(3)

Appendix G: Household Characteristics and Demographics

GROUP A: DUKE CUSTOMERS (N=202)

In what type of building do you live?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single-family home, detached construction	157	77.7	77.7	77.7
	Single family home, factory manufactured/modular	15	7.4	7.4	85.1
	Single family, mobile home	13	6.4	6.4	91.6
	Row House (shared or common exterior wall with another house	2	1.0	1.0	92.6
	Apartment (4 + families) - traditional structure	8	4.0	4.0	96.5
	Condominium - traditional structure	4	2.0	2.0	98.5
	Other	1	.5	.5	99.0
	Don't Know	2	1.0	1.0	100.0
	Total	202	100.0	100.0	

What year was your residence built?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1959 and before	31	15.3	15.3	15.3
	1960 - 1979	42	20.8	20.8	36.1
	1980 - 1989	28	13.9	13.9	50.0
	1990 - 1997	23	11.4	11.4	61.4
	1998 - 2000	13	6.4	6.4	67.8
	2001 - 2007	36	17.8	17.8	85.6
	2008 - present	14	6.9	6.9	92.6
	Don't Know	15	7.4	7.4	100.0
	Total	202	100.0	100.0	

How many rooms are in your home (excluding bathrooms, but including finished basements)?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 3	16	7.9	7.9	7.9
	4	17	8.4	8.4	16.3
	5	35	17.3	17.3	33.7

	6	36	17.8	17.8	51.5
	7	32	15.8	15.8	67.3
	8	27	13.4	13.4	80.7
	9	14	6.9	6.9	87.6
	10+	25	12.4	12.4	100.0
	Total	202	100.0	100.0	

Which of the following best describes your home's heating system?					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**None**	4	2.0	2.0	2.0
	Central forced air furnace	85	42.1	42.1	44.1
	Electric Baseboard	7	3.5	3.5	47.5
	Heat Pump	71	35.1	35.1	82.7
	Geothermal Heat Pump	3	1.5	1.5	84.2
	Other (please specify):	5	2.5	2.5	86.6
	hot water/steam/boiler/radiator	3	1.5	1.5	88.1
	wood burning	4	2.0	2.0	90.1
	gas/gas pack	9	4.5	4.5	94.6
	kerosene	1	.5	.5	95.0
	propane	2	1.0	1.0	96.0
	oil	4	2.0	2.0	98.0
	electric wall/ceiling	3	1.5	1.5	99.5
	Don't know	1	.5	.5	100.0
	Total	202	100.0	100.0	

Do you use one or more of the following to cool your home? (Select all that apply)					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Heat pump for cooling**	46	22.8	22.8	22.8
	Central air conditioning	134	66.3	66.3	89.1
	Through the wall or window air conditioning unit	16	7.9	7.9	97.0
	Geothermal Heat pump	2	1.0	1.0	98.0
	Other (please specify):	1	.5	.5	98.5
	fans	3	1.5	1.5	100.0
	Total	202	100.0	100.0	

How many window-unit or "through the wall" air conditioner(s) do you use?					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**

Valid	None	175	86.6	86.6	86.6
	1	13	6.4	6.4	93.1
	2	5	2.5	2.5	95.5
	3	6	3.0	3.0	98.5
	4	3	1.5	1.5	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each system: Primary Heating System Fuel

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Electricity	111	55.0	55.0	55.0
	Natural Gas	69	34.2	34.2	89.1
	Oil	7	3.5	3.5	92.6
	Propane	7	3.5	3.5	96.0
	Other	7	3.5	3.5	99.5
	None / Do Not Have	1	.5	.5	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each system: Secondary Heating System Fuel

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Electricity	64	31.7	31.7	31.7
	Natural Gas	24	11.9	11.9	43.6
	Oil	1	.5	.5	44.1
	Propane	9	4.5	4.5	48.5
	Other	8	4.0	4.0	52.5
	None / Do Not Have	96	47.5	47.5	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each system: Cooling System

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Electricity	195	96.5	96.5	96.5
	Natural Gas	4	2.0	2.0	98.5
	Other	1	.5	.5	99.0
	None / Do Not Have	2	1.0	1.0	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each system: Water Heater

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Electricity	142	70.3	70.3	70.3
	Natural Gas	58	28.7	28.7	99.0
	Other	2	1.0	1.0	100.0
	Total	202	100.0	100.0	

Please estimate the age of each of the following systems in your home: Heating System

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 4 years	50	24.8	24.8	24.8
	5 - 9 years	73	36.1	36.1	60.9
	10 - 14 years	34	16.8	16.8	77.7
	15 - 19 years	26	12.9	12.9	90.6
	20+ years	16	7.9	7.9	98.5
	Do not have	3	1.5	1.5	100.0
	Total	202	100.0	100.0	

Please estimate the age of each of the following systems in your home: Cooling System

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 4 years	58	28.7	28.7	28.7
	5 - 9 years	76	37.6	37.6	66.3
	10 - 14 years	32	15.8	15.8	82.2
	15 - 19 years	22	10.9	10.9	93.1
	20+ years	8	4.0	4.0	97.0
	Do not have	6	3.0	3.0	100.0
	Total	202	100.0	100.0	

Please estimate the age of each of the following systems in your home: Water Heater

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 4 years	62	30.7	30.7	30.7
	5 - 9 years	76	37.6	37.6	68.3
	10 - 14 years	40	19.8	19.8	88.1
	15 - 19 years	15	7.4	7.4	95.5
	20+ years	6	3.0	3.0	98.5
	Do not have	3	1.5	1.5	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Electricity Indoor Cooktop					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	18	8.9	8.9	8.9
	Checked	184	91.1	91.1	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Electricity Indoor Oven					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	18	8.9	8.9	8.9
	Checked	184	91.1	91.1	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Electricity Clothes Dryer					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	19	9.4	9.4	9.4
	Checked	183	90.6	90.6	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Natural Gas Indoor Cooktop					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	187	92.6	92.6	92.6
	Checked	15	7.4	7.4	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Natural Gas Indoor Oven					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	189	93.6	93.6	93.6
	Checked	13	6.4	6.4	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Natural Gas Clothes Dryer					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	190	94.1	94.1	94.1
	Checked	12	5.9	5.9	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Oil Indoor Cooktop					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	202	100.0	100.0	100.0

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Oil Indoor Oven					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	202	100.0	100.0	100.0

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Oil Clothes Dryer					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	201	99.5	99.5	99.5
	Checked	1	.5	.5	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Propane Indoor Cooktop					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	201	99.5	99.5	99.5
	Checked	1	.5	.5	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Propane Indoor Oven					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	200	99.0	99.0	99.0
	Checked	2	1.0	1.0	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Propane Clothes Dryer					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Unchecked**	201	99.5	99.5	99.5
	Checked	1	.5	.5	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Other Indoor Cooktop					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**

Valid	Unchecked	202	100.0	100.0	100.0

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Other Indoor Oven					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unchecked	202	100.0	100.0	100.0

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Other Clothes Dryer					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unchecked	200	99.0	99.0	99.0
	Checked	2	1.0	1.0	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Do Not Have Indoor Cooktop					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unchecked	198	98.0	98.0	98.0
	Checked	4	2.0	2.0	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Do Not Have Indoor Oven					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unchecked	200	99.0	99.0	99.0
	Checked	2	1.0	1.0	100.0
	Total	202	100.0	100.0	

Please select the fuel used for each appliance: (Select all fuels that apply per appliance) Do Not Have Clothes Dryer					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unchecked	196	97.0	97.0	97.0
	Checked	6	3.0	3.0	100.0
	Total	202	100.0	100.0	

About how many square feet of living space are in your home? (Do not include garages or other unheated areas) Note: A 10-foot by 12 foot room is 120 square feet					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	500 - 999	13	6.4	6.4	6.4
	1000 - 1499	49	24.3	24.3	30.7

	1500 - 1999	49	24.3	24.3	55.0
	2000 - 2499	31	15.3	15.3	70.3
	2500 - 2999	21	10.4	10.4	80.7
	3000 - 3499	18	8.9	8.9	89.6
	3500 - 3999	3	1.5	1.5	91.1
	4000 or more	2	1.0	1.0	92.1
	Don't Know	16	7.9	7.9	100.0
	Total	202	100.0	100.0	

Do you own or rent your home?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Own	158	78.2	78.2	78.2
	Rent	44	21.8	21.8	100.0
	Total	202	100.0	100.0	

How many levels are in your home (not including your basement)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	One	132	65.3	65.3	65.3
	Two	68	33.7	33.7	99.0
	Three	2	1.0	1.0	100.0
	Total	202	100.0	100.0	

Does your home have a heated or unheated basement?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Heated	19	9.4	9.4	9.4
	Unheated	19	9.4	9.4	18.8
	No basement	164	81.2	81.2	100.0
	Total	202	100.0	100.0	

Does your home have an attic?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	142	70.3	70.3	70.3
	No	60	29.7	29.7	100.0
	Total	202	100.0	100.0	

Are your central air/heat ducts located in the attic?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	70	34.7	34.7	34.7
	No	99	49.0	49.0	83.7
	Not Applicable	33	16.3	16.3	100.0
	Total	202	100.0	100.0	

Does your house have cold drafts in the winter?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	78	38.6	38.6	38.6
	No	124	61.4	61.4	100.0
	Total	202	100.0	100.0	

Does your house have sweaty windows in the winter?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	58	28.7	28.7	28.7
	No	144	71.3	71.3	100.0
	Total	202	100.0	100.0	

Do you notice uneven temperatures between the rooms in your home?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	131	64.9	64.9	64.9
	No	71	35.1	35.1	100.0
	Total	202	100.0	100.0	

Does your heating system keep your home comfortable in winter?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	179	88.6	88.6	88.6
	No	22	10.9	10.9	99.5
	Do not have	1	.5	.5	100.0
	Total	202	100.0	100.0	

Does your cooling system keep your home comfortable in summer?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	177	87.6	87.6	87.6
	No	25	12.4	12.4	100.0

	Total	202	100.0	100.0	

Do you have a programmable thermostat?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	112	55.4	55.4	55.4
	No	90	44.6	44.6	100.0
	Total	202	100.0	100.0	

What temperature is your thermostat set to on a typical summer weekday afternoon ?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 69 o	9	4.5	4.5	4.5
	69 o - 72 o	58	28.7	28.7	33.2
	73 o - 78 o	109	54.0	54.0	87.1
	Greater than 78 o	19	9.4	9.4	96.5
	Off	1	.5	.5	97.0
	Don't Know	1	.5	.5	97.5
	Do not have	5	2.5	2.5	100.0
	Total	202	100.0	100.0	

What temperature is your thermostat set to on a typical winter weekday afternoon ?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 67 o	13	6.4	6.4	6.4
	67 o - 70 o	72	35.6	35.6	42.1
	71 o - 73 o	64	31.7	31.7	73.8
	74 o - 77 o	46	22.8	22.8	96.5
	Greater than 77 o	3	1.5	1.5	98.0
	Off	1	.5	.5	98.5
	Do not have	3	1.5	1.5	100.0
	Total	202	100.0	100.0	

Do you have a swimming pool or spa?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	31	15.3	15.3	15.3
	No	171	84.7	84.7	100.0
	Total	202	100.0	100.0	

Would a two-degree increase in the summer afternoon temperature in your home affect your comfort?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	45	22.3	22.3	22.3
	Slightly	103	51.0	51.0	73.3
	Moderately	42	20.8	20.8	94.1
	Greatly	12	5.9	5.9	100.0
	Total	202	100.0	100.0	

How many people live in this home?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	3.0	3.0	3.0
	2	23	11.4	11.4	14.4
	3	39	19.3	19.3	33.7
	4	78	38.6	38.6	72.3
	5	41	20.3	20.3	92.6
	6	8	4.0	4.0	96.5
	7	6	3.0	3.0	99.5
	8 or more	1	.5	.5	100.0
	Total	202	100.0	100.0	

How many persons are usually home on a weekday afternoon?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	20	9.9	9.9	9.9
	1	29	14.4	14.4	24.3
	2	41	20.3	20.3	44.6
	3	49	24.3	24.3	68.8
	4	44	21.8	21.8	90.6
	5	13	6.4	6.4	97.0
	6	3	1.5	1.5	98.5
	7	3	1.5	1.5	100.0
	Total	202	100.0	100.0	

Are you planning on making any large purchases to improve energy efficiency in the next 3 years ?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	51	25.2	25.2	25.2
	No	70	34.7	34.7	59.9

	Nor sure	81	40.1	40.1	100.0
	Total	202	100.0	100.0	

What is your age group?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 34	39	19.3	19.3	19.3
	35 - 49	103	51.0	51.0	70.3
	50 - 59	34	16.8	16.8	87.1
	60 - 64	6	3.0	3.0	90.1
	65 - 74	12	5.9	5.9	96.0
	Over 74	2	1.0	1.0	97.0
	Prefer not to answer	6	3.0	3.0	100.0
	Total	202	100.0	100.0	

Please select your total annual household income:					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under $15,000	10	5.0	5.0	5.0
	$15,000 - $29,999	27	13.4	13.4	18.3
	$30,000 - $49,999	35	17.3	17.3	35.6
	$50,000 - $74,999	32	15.8	15.8	51.5
	$75,000 - $100,000	31	15.3	15.3	66.8
	Over $100,000	17	8.4	8.4	75.2
	Prefer not to answer	50	24.8	24.8	100.0
	Total	202	100.0	100.0	

SCHOOL COUNTY					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		12	5.9	5.9	5.9
	Alamance	12	5.9	5.9	11.9
	Alexander	1	.5	.5	12.4
	Anderson	11	5.4	5.4	17.8
	Cabarrus	6	3.0	3.0	20.8
	Caldwell	2	1.0	1.0	21.8
	Caswell	1	.5	.5	22.3
	Catawba	1	.5	.5	22.8
	Cherokee	3	1.5	1.5	24.3

	Chester	2	1.0	1.0	25.2
	Cleveland	1	.5	.5	25.7
	Davidson	2	1.0	1.0	26.7
	Durham	4	2.0	2.0	28.7
	Forsyth	2	1.0	1.0	29.7
	Gaston	4	2.0	2.0	31.7
	Greenville	24	11.9	11.9	43.6
	Greenwood	6	3.0	3.0	46.5
	Guilford	10	5.0	5.0	51.5
	Henderson	1	.5	.5	52.0
	Iredell	2	1.0	1.0	53.0
	Lancaster	10	5.0	5.0	57.9
	Laurens	1	.5	.5	58.4
	Lincoln	5	2.5	2.5	60.9
	Macon	1	.5	.5	61.4
	Mcdowell	1	.5	.5	61.9
	Mecklenburg	17	8.4	8.4	70.3
	Oconee	2	1.0	1.0	71.3
	Orange	4	2.0	2.0	73.3
	Pickens	4	2.0	2.0	75.2
	Rockingham	2	1.0	1.0	76.2
	Rowan	4	2.0	2.0	78.2
	Rutherford	2	1.0	1.0	79.2
	Spartanburg	19	9.4	9.4	88.6
	Stanly	2	1.0	1.0	89.6
	Stokes	2	1.0	1.0	90.6
	Surry	3	1.5	1.5	92.1
	Transylvania	1	.5	.5	92.6
	Union	1	.5	.5	93.1
	Wilkes	1	.5	.5	93.6
	York	13	6.4	6.4	100.0
	Total	202	100.0	100.0	

SCHOOL DISTRICT NAME					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		16	7.9	7.9	7.9
	Abundant Life Christian School	1	.5	.5	8.4

	Alamance-Burlington Sch Dist	11	5.4	5.4	13.9
	Alexander Co School District	1	.5	.5	14.4
	Anderson School District 1	3	1.5	1.5	15.8
	Anderson School District 3	2	1.0	1.0	16.8
	Anderson School District 5	7	3.5	3.5	20.3
	Brevard Academy	1	.5	.5	20.8
	Burlington Christian Academy	1	.5	.5	21.3
	Cabarrus Co School District	3	1.5	1.5	22.8
	Cabarrus County Schools	3	1.5	1.5	24.3
	Caldwell Co School District	2	1.0	1.0	25.2
	Caswell Co School District	1	.5	.5	25.7
	Catawba Co School District	1	.5	.5	26.2
	Chapel Hill-Carrboro City Schools	1	.5	.5	26.7
	Chapel Hill-Carrboro City SD	2	1.0	1.0	27.7
	Charlotte-Mecklenburg Sch Dist	11	5.4	5.4	33.2
	Cherokee Co School District 1	3	1.5	1.5	34.7
	Chester Co School District	2	1.0	1.0	35.6
	Cleveland Co School District	1	.5	.5	36.1
	Clover School District 2	1	.5	.5	36.6
	Davidson Co School Dist	1	.5	.5	37.1
	Diocese of Charleston Ed Off	3	1.5	1.5	38.6
	Diocese of Charlotte Ed Office	2	1.0	1.0	39.6
	District Five Schools of Spartanburg County	1	.5	.5	40.1
	Durham Public Schools	2	1.0	1.0	41.1
	Fort Mill School District 4	6	3.0	3.0	44.1
	Gaston County Schools	2	1.0	1.0	45.0
	Greenville Co School District	18	8.9	8.9	54.0
	Greenwood Christian School	1	.5	.5	54.5
	Greenwood School District 50	3	1.5	1.5	55.9
	Greenwood School District 52	2	1.0	1.0	56.9
	Guilford Co School District	8	4.0	4.0	60.9
	Henderson Co Public Schools	1	.5	.5	61.4
	Iredell-Statesville Sch Dist	1	.5	.5	61.9
	Lancaster Co School District	7	3.5	3.5	65.3
	Lancaster County School District	3	1.5	1.5	66.8
	Laurens Co School District 55	1	.5	.5	67.3
	Legacy Charter School - 5-10	1	.5	.5	67.8
	Lincoln Co School District	5	2.5	2.5	70.3

	Macon Co School District	1	.5	.5	70.8
	McDowell County Schools	1	.5	.5	71.3
	Montessori School of Anderson	2	1.0	1.0	72.3
	Mt Airy City School District	1	.5	.5	72.8
	North Carolina Dept of Ed	7	3.5	3.5	76.2
	North Hills Christian School	1	.5	.5	76.7
	Oconee Co School District	2	1.0	1.0	77.7
	Pickens Co School District	2	1.0	1.0	78.7
	Rock Hill School Dist 3	5	2.5	2.5	81.2
	Rockingham Co School District	2	1.0	1.0	82.2
	Rowan-Salisbury School Dist	3	1.5	1.5	83.7
	Rutherford Co School District	1	.5	.5	84.2
	Spartanburg School District 1	1	.5	.5	84.7
	Spartanburg School District 2	3	1.5	1.5	86.1
	Spartanburg School District 3	2	1.0	1.0	87.1
	Spartanburg School District 4	3	1.5	1.5	88.6
	Spartanburg School District 5	5	2.5	2.5	91.1
	Spartanburg School District 6	2	1.0	1.0	92.1
	Spartanburg School District 7	2	1.0	1.0	93.1
	Stanly Co School District	2	1.0	1.0	94.1
	Stokes Co School District	2	1.0	1.0	95.0
	Surry Co School District	1	.5	.5	95.5
	Thomasville City School Dist	1	.5	.5	96.0
	Trinity School	1	.5	.5	96.5
	Union Co Public Schools	1	.5	.5	97.0
	United Faith Christian Academy	1	.5	.5	97.5
	Vandalia Christian School	1	.5	.5	98.0
	Wilkes Co School District	1	.5	.5	98.5
	Winston-Salem Forsyth Co SD	2	1.0	1.0	99.5
	York School District 1	1	.5	.5	100.0
	Total	202	100.0	100.0	

SCHOOL NAME					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Abner Creek Academy	1	.5	.5	.5
	Abundant Life Christian School	1	.5	.5	1.0
	Albemarle Road Elem School	1	.5	.5	1.5

	Alexander Wilson Elem School	1	.5	.5	2.0
	Allenbrook Elementary School	2	1.0	1.0	3.0
	B Everett Jordan Elem School	1	.5	.5	3.5
	B H Tharrington Primary School	1	.5	.5	4.0
	Bell's Crossing Elem School	1	.5	.5	4.5
	Blacksburg Primary School	1	.5	.5	5.0
	Bluford Elementary School	1	.5	.5	5.4
	Boger Elementary School	1	.5	.5	5.9
	Boiling Springs Interm School	1	.5	.5	6.4
	Brawley Middle School	1	.5	.5	6.9
	Brevard Academy	1	.5	.5	7.4
	Brightwood Elementary School	1	.5	.5	7.9
	Brooks Global Studies Mag Sch	1	.5	.5	8.4
	Bryson Elementary School	2	1.0	1.0	9.4
	Buford Elementary School	3	1.5	1.5	10.9
	Burlington Christian Academy	1	.5	.5	11.4
	Cannons Elementary School	1	.5	.5	11.9
	Carrboro Elementary School	2	1.0	1.0	12.9
	Catawba Springs Elementary Sch	1	.5	.5	13.4
	Central Elementary School	1	.5	.5	13.9
	Central Presbytrian School	1	.5	.5	14.4
	Chandler Creek Elem School	2	1.0	1.0	15.3
	Charles H Tuttle ES	1	.5	.5	15.8
	Chastain Road Elementary Sch	1	.5	.5	16.3
	Chester Park Sch of The Arts	1	.5	.5	16.8
	Clear Creek Elementary School	1	.5	.5	17.3
	Cleveland Elementary School	1	.5	.5	17.8
	Collettsville Elem School	1	.5	.5	18.3
	Community School of Davidson	1	.5	.5	18.8
	Concord Elementary School	2	1.0	1.0	19.8
	Concrete Primary School	2	1.0	1.0	20.8
	Cotswold Elementary School	1	.5	.5	21.3
	Cowpens Middle School	1	.5	.5	21.8
	Creekside Elementary School	1	.5	.5	22.3
	Croft Community School	1	.5	.5	22.8
	Crowders Creek Elementary Sch	1	.5	.5	23.3
	Douglass Elementary School	1	.5	.5	23.8
	Downtown School	1	.5	.5	24.3

	Draytonville Elementary School	1	.5	.5	24.8
	Dutchman Creek Middle School	1	.5	.5	25.2
	Easley Elementary School	1	.5	.5	25.7
	East Rutherford Middle School	1	.5	.5	26.2
	Ebenezer Avenue Elem School	1	.5	.5	26.7
	Elon Elementary School	2	1.0	1.0	27.7
	Erwin Elementary School	2	1.0	1.0	28.7
	Ethan Shive Elementary	2	1.0	1.0	29.7
	Flat Rock Middle School	1	.5	.5	30.2
	Forest Heights Elem School	1	.5	.5	30.7
	Fountain Inn Elementary School	2	1.0	1.0	31.7
	Franklin Elementary School	1	.5	.5	32.2
	Ft Mill Elementary School	2	1.0	1.0	33.2
	Gamewell Middle School	1	.5	.5	33.7
	Graham Middle School	1	.5	.5	34.2
	Granard Middle School	1	.5	.5	34.7
	Great Falls Elementary School	1	.5	.5	35.1
	Greenwood Christian School	1	.5	.5	35.6
	Greer Middle School	1	.5	.5	36.1
	Hasty Elementary School	1	.5	.5	36.6
	Heath Springs Elem School	1	.5	.5	37.1
	Hickory Grove-Sharon Elem Sch	1	.5	.5	37.6
	Highland Elementary School	2	1.0	1.0	38.6
	Highland Mill Montessori ES	1	.5	.5	39.1
	Hillcrest Elementary School	2	1.0	1.0	40.1
	Hillcrest Middle School	1	.5	.5	40.6
	Holly Springs Motlow Elem Sch	1	.5	.5	41.1
	Home School	1	.5	.5	41.6
	homeschool	1	.5	.5	42.1
	homeschooled	1	.5	.5	42.6
	Hughes Academy	2	1.0	1.0	43.6
	Huntsville Elementary School	1	.5	.5	44.1
	Immaculata Catholic School	1	.5	.5	44.6
	Indian Land Elementary School	3	1.5	1.5	46.0
	Iva Elementary School	2	1.0	1.0	47.0
	J N Fries Middle School	1	.5	.5	47.5
	Jamestown Elementary School	1	.5	.5	48.0
	Jefferson Elementary School	1	.5	.5	48.5

	Joseph W Grier Academy	3	1.5	1.5	50.0
	King Elementary School	2	1.0	1.0	51.0
	Lake Forest Elementary School	1	.5	.5	51.5
	Lake Norman Charter School	2	1.0	1.0	52.5
	Lakeshore Elementary School	1	.5	.5	53.0
	Laurens Middle School	1	.5	.5	53.5
	Legacy Charter School - 5-10	1	.5	.5	54.0
	Mary Scroggs Elementary School	1	.5	.5	54.5
	Mathews Elementary School	1	.5	.5	55.0
	Mauldin Middle School	1	.5	.5	55.4
	McCarthy-Teszler School	1	.5	.5	55.9
	McLees Elementary School	3	1.5	1.5	57.4
	Meadowview Middle School	1	.5	.5	57.9
	Midway Elementary School	2	1.0	1.0	58.9
	Millennium Charter Academy	1	.5	.5	59.4
	Montessori School of Anderson	2	1.0	1.0	60.4
	Moravian Falls Elem School	1	.5	.5	60.9
	Mountain Island Charter School	1	.5	.5	61.4
	Mt Holly Elementary School	2	1.0	1.0	62.4
	Mtn Discovery	1	.5	.5	62.9
	n/a	2	1.0	1.0	63.9
	Ninety Six Primary School	2	1.0	1.0	64.9
	North Belmont Elem School	1	.5	.5	65.3
	North Elementary School	2	1.0	1.0	66.3
	North Hills Christian School	1	.5	.5	66.8
	Northern Elementary School	1	.5	.5	67.3
	Northern Middle School	1	.5	.5	67.8
	Northwest Cabarrus Middle Sch	1	.5	.5	68.3
	Northwest Guilford	1	.5	.5	68.8
	Northwest Middle School	1	.5	.5	69.3
	Oakdale Elementary School	1	.5	.5	69.8
	Oakland Elementary School	2	1.0	1.0	70.8
	Old Fort Elem School	1	.5	.5	71.3
	Old Pointe Elementary School	1	.5	.5	71.8
	Orange Charter School	1	.5	.5	72.3
	Our Lady of Grace School	1	.5	.5	72.8
	Our Lady of The Rosary Rc Sch	3	1.5	1.5	74.3
	Patriots Elementary School	1	.5	.5	74.8

	Pinewood Elementary School	1	.5	.5	75.2
	Polo Elementary School	1	.5	.5	75.7
	Pumpkin Center Inter School	1	.5	.5	76.2
	Pumpkin Center Primary School	2	1.0	1.0	77.2
	Reidville Elementary School	1	.5	.5	77.7
	River Ridge Elementary School	4	2.0	2.0	79.7
	Riverview Elementary School	3	1.5	1.5	81.2
	Roebuck Elementary School	1	.5	.5	81.7
	Royal Oaks Elementary School	2	1.0	1.0	82.7
	Socrates Academy	1	.5	.5	83.2
	South Graham Elementary School	2	1.0	1.0	84.2
	South Macon Elementary School	1	.5	.5	84.7
	South Stanly Middle School	2	1.0	1.0	85.6
	Southeast Middle School	1	.5	.5	86.1
	Southern Elementary School	1	.5	.5	86.6
	Springfield Elementary School	2	1.0	1.0	87.6
	St James Elementary School	1	.5	.5	88.1
	St Patrick's School	1	.5	.5	88.6
	Stokesdale Elementary School	1	.5	.5	89.1
	Sugar Creek Elementary School	1	.5	.5	89.6
	Summit Drive Elementary School	1	.5	.5	90.1
	Sun Valley Middle School	1	.5	.5	90.6
	Tamassee-Salem Middle High Sch	2	1.0	1.0	91.6
	Tanglewood Middle School	2	1.0	1.0	92.6
	Taylors Elementary School	1	.5	.5	93.1
	Thomas E Kerns Elementary Sch	1	.5	.5	93.6
	Thomasville Primary School	1	.5	.5	94.1
	Trinity School	1	.5	.5	94.6
	Tuckaseegee Elementary School	1	.5	.5	95.0
	United Faith Christian Academy	1	.5	.5	95.5
	Vandalia Christian School	1	.5	.5	96.0
	Voyager Academy	1	.5	.5	96.5
	West Alexander Middle School	1	.5	.5	97.0
	Winterfield Elementary School	1	.5	.5	97.5
	Woodland Heights Elem School	1	.5	.5	98.0
	Woodruff Elementary School	1	.5	.5	98.5
	Woodruff Primary School	2	1.0	1.0	99.5
	Wren Middle School	1	.5	.5	100.0

	Total	202	100.0	100.0	

SCHOOL TYPE					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		12	5.9	5.9	5.9
	Private	13	6.4	6.4	12.4
	Public	177	87.6	87.6	100.0
	Total	202	100.0	100.0	

GRADE BAND					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	27	13.4	13.4	13.4
	2	23	11.4	11.4	24.8
	3	37	18.3	18.3	43.1
	4	12	5.9	5.9	49.0
	5	13	6.4	6.4	55.4
	6	9	4.5	4.5	59.9
	7	6	3.0	3.0	62.9
	8	8	4.0	4.0	66.8
	K	45	22.3	22.3	89.1
	N/A	22	10.9	10.9	100.0
	Total	202	100.0	100.0	

Household CITY					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ANDERSON	11	5.4	5.4	5.4
	BROWN SUMMIT	1	.5	.5	5.9
	BURLINGTON	7	3.5	3.5	9.4
	CAMPOBELLO	2	1.0	1.0	10.4
	CARRBORO	1	.5	.5	10.9
	CATAWBA	1	.5	.5	11.4
	CENTRAL	1	.5	.5	11.9
	CHAPEL HILL	2	1.0	1.0	12.9
	CHARLOTTE	13	6.4	6.4	19.3
	CHESTER	1	.5	.5	19.8
	CLOVER	1	.5	.5	20.3

	COLFAX	1	.5	.5	20.8
	CONCORD	4	2.0	2.0	22.8
	CONFEDERATE LN.	1	.5	.5	23.3
	COWPENS	1	.5	.5	23.8
	DENVER	1	.5	.5	24.3
	DURHAM	4	2.0	2.0	26.2
	EASLEY	1	.5	.5	26.7
	EDEN	1	.5	.5	27.2
	ELLENBORO	1	.5	.5	27.7
	FORT MILL	10	5.0	5.0	32.7
	FOUNTAIN INN	2	1.0	1.0	33.7
	GAFFNEY	2	1.0	1.0	34.7
	GASTONIA	2	1.0	1.0	35.6
	GIBSONVILLE	1	.5	.5	36.1
	GOLD HILL	1	.5	.5	36.6
	GRAHAM	4	2.0	2.0	38.6
	GRAY COURT	1	.5	.5	39.1
	GREAT FALLS	1	.5	.5	39.6
	GREENSBORO	8	4.0	4.0	43.6
	GREENVILLE	14	6.9	6.9	50.5
	GREENWOOD	4	2.0	2.0	52.5
	GREER	3	1.5	1.5	54.0
	HENDERSONVILLE	1	.5	.5	54.5
	HIGH POINT	1	.5	.5	55.0
	HILLSBOROUGH	1	.5	.5	55.4
	HUNERSVILLE	1	.5	.5	55.9
	HUNTERSVILLE	1	.5	.5	56.4
	INDIAN TRAIL	1	.5	.5	56.9
	INIDAN LAND	1	.5	.5	57.4
	INMAN	2	1.0	1.0	58.4
	IVA	1	.5	.5	58.9
	JAMESTOWN	1	.5	.5	59.4
	KANNAPOLIS	2	1.0	1.0	60.4
	KING	2	1.0	1.0	61.4
	LAKE WYLIE	1	.5	.5	61.9
	LANCASTER	7	3.5	3.5	65.3
	LENOIR	3	1.5	1.5	66.8
	LIBERTY	1	.5	.5	67.3

	LINCOLNTON	2	1.0	1.0	68.3
	LYMAN	1	.5	.5	68.8
	MADISON	1	.5	.5	69.3
	MAIDEN	2	1.0	1.0	70.3
	MATTHEWS	1	.5	.5	70.8
	MAULDIN	1	.5	.5	71.3
	MONROE	1	.5	.5	71.8
	MOORE	2	1.0	1.0	72.8
	MOORESVILLE	2	1.0	1.0	73.8
	MORAVIAN FALLS	1	.5	.5	74.3
	MOUNT AIRY	4	2.0	2.0	76.2
	MOUNT HOLLY	1	.5	.5	76.7
	MT. HOLLY	1	.5	.5	77.2
	NINETY SIX	1	.5	.5	77.7
	NORWOOD	2	1.0	1.0	78.7
	OLD FORT	1	.5	.5	79.2
	OTTO	1	.5	.5	79.7
	PELZER	1	.5	.5	80.2
	PICKENS	1	.5	.5	80.7
	PIEDMONT	1	.5	.5	81.2
	PISGAH FOREST	1	.5	.5	81.7
	RANDLEMAN	1	.5	.5	82.2
	ROCK HILL	2	1.0	1.0	83.2
	RUFFIN	1	.5	.5	83.7
	SALEM	1	.5	.5	84.2
	SALISBURY	3	1.5	1.5	85.6
	SHARON	1	.5	.5	86.1
	SIMPSONVILLE	6	3.0	3.0	89.1
	SPARTANBURG	7	3.5	3.5	92.6
	SPINDALE	1	.5	.5	93.1
	STANLEY	1	.5	.5	93.6
	STARR	1	.5	.5	94.1
	STOKESDALE	1	.5	.5	94.6
	TAYLORS	1	.5	.5	95.0
	THOMASVILLE	1	.5	.5	95.5
	WAXHAW	1	.5	.5	96.0
	WHITTIER	1	.5	.5	96.5
	WILLIAMSTON	1	.5	.5	97.0

	WINSTON-SALEM	3	1.5	1.5	98.5
	WINSTONSALEM	1	.5	.5	99.0
	WOODRUFF	2	1.0	1.0	100.0
	Total	202	100.0	100.0	

Household STATE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NC	102	50.5	50.5	50.5
	SC	100	49.5	49.5	100.0
	Total	202	100.0	100.0	

GROUP B: NON-DUKE CUSTOMERS (N=177)

SCHOOL COUNTY					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		8	4.5	4.5	4.5
	Abbeville	2	1.1	1.1	5.6
	Alamance	2	1.1	1.1	6.8
	Alexander	2	1.1	1.1	7.9
	Anderson	1	.6	.6	8.5
	Burke	2	1.1	1.1	9.6
	Cabarrus	4	2.3	2.3	11.9
	Caldwell	3	1.7	1.7	13.6
	Caswell	2	1.1	1.1	14.7
	Catawba	2	1.1	1.1	15.8
	Cherokee	2	1.1	1.1	16.9
	Chester	3	1.7	1.7	18.6
	Clermont	1	.6	.6	19.2
	Cleveland	1	.6	.6	19.8
	Davidson	2	1.1	1.1	20.9
	Durham	3	1.7	1.7	22.6
	Forsyth	3	1.7	1.7	24.3
	Gaston	8	4.5	4.5	28.8
	Greenville	16	9.0	9.0	37.9
	Greenwood	2	1.1	1.1	39.0
	Guilford	8	4.5	4.5	43.5
	Hamilton	1	.6	.6	44.1
	Henderson	2	1.1	1.1	45.2
	Iredell	2	1.1	1.1	46.3
	Lancaster	3	1.7	1.7	48.0
	Laurens	2	1.1	1.1	49.2
	Lincoln	7	4.0	4.0	53.1
	Mecklenburg	14	7.9	7.9	61.0
	Oconee	3	1.7	1.7	62.7
	Orange	4	2.3	2.3	65.0
	Pickens	2	1.1	1.1	66.1
	Polk	1	.6	.6	66.7

	Rockingham	1	.6	.6	67.2
	Rowan	1	.6	.6	67.8
	Spartanburg	8	4.5	4.5	72.3
	Stanly	1	.6	.6	72.9
	Stokes	1	.6	.6	73.4
	Surry	5	2.8	2.8	76.3
	Union	9	5.1	5.1	81.4
	Wilkes	3	1.7	1.7	83.1
	York	30	16.9	16.9	100.0
	Total	177	100.0	100.0	

SCHOOL DISTRICT NAME

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		14	7.9	7.9	7.9
	Abbeville Co School District	2	1.1	1.1	9.0
	Alamance-Burlington Sch Dist	2	1.1	1.1	10.2
	Alexander County Schools	1	.6	.6	10.7
	Anderson School District 5	1	.6	.6	11.3
	Burke Co School District	1	.6	.6	11.9
	Cabarrus Co School District	2	1.1	1.1	13.0
	Cabarrus County Schools	1	.6	.6	13.6
	Caldwell Co School District	3	1.7	1.7	15.3
	Caswell Co School District	2	1.1	1.1	16.4
	Catawba Co School District	2	1.1	1.1	17.5
	Central Academy at Lake Park	1	.6	.6	18.1
	Chapel Hill-Carrboro City Schools	1	.6	.6	18.6
	Chapel Hill-Carrboro City SD	1	.6	.6	19.2
	Charlotte-Mecklenburg Sch Dist	9	5.1	5.1	24.3
	Cherokee Co School District 1	1	.6	.6	24.9
	Chester Co School District	3	1.7	1.7	26.6
	Cincinnati City Sch District	1	.6	.6	27.1
	Cleveland Co School District	1	.6	.6	27.7
	Clover School District 2	4	2.3	2.3	29.9
	Davidson Co School Dist	2	1.1	1.1	31.1
	Diocese of Charleston Ed Off	2	1.1	1.1	32.2
	Diocese of Charlotte Ed Office	1	.6	.6	32.8
	First Assembly Christian Sch	1	.6	.6	33.3

	First Assembly CHRN School	1	.6	.6	33.9
	Fort Mill School District 4	3	1.7	1.7	35.6
	Gaston Co School District	1	.6	.6	36.2
	Gaston County Schools	4	2.3	2.3	38.4
	Greenville Co School District	14	7.9	7.9	46.3
	Greenwood School District 50	2	1.1	1.1	47.5
	Guilford Co School District	6	3.4	3.4	50.8
	Henderson Co Public Schools	1	.6	.6	51.4
	Immaculata School	1	.6	.6	52.0
	Lancaster Co School District	1	.6	.6	52.5
	Lancaster County School District	2	1.1	1.1	53.7
	Laurens Co School District 55	2	1.1	1.1	54.8
	Lexington City School District	1	.6	.6	55.4
	Lincoln Co School District	4	2.3	2.3	57.6
	Morganton Day School	1	.6	.6	58.2
	North Carolina Dept of Ed	15	8.5	8.5	66.7
	Oconee Christian Academy	1	.6	.6	67.2
	Oconee Co School District	2	1.1	1.1	68.4
	Orange Co School District	1	.6	.6	68.9
	Orange County Schools	1	.6	.6	69.5
	Pickens Co School District	2	1.1	1.1	70.6
	Polk County Schools	1	.6	.6	71.2
	Rock Hill School Dist 3	17	9.6	9.6	80.8
	Rockingham Co School District	1	.6	.6	81.4
	Rowan-Salisbury School System	1	.6	.6	81.9
	Spartanburg School District 2	2	1.1	1.1	83.1
	Spartanburg School District 3	1	.6	.6	83.6
	Spartanburg School District 4	1	.6	.6	84.2
	Spartanburg School District 6	4	2.3	2.3	86.4
	Stanly Co School District	1	.6	.6	87.0
	Statesville Montessori School	1	.6	.6	87.6
	Stokes Co School District	1	.6	.6	88.1
	Surry Co School District	1	.6	.6	88.7
	Union Co Public Schools	6	3.4	3.4	92.1
	Union Co School District	1	.6	.6	92.7
	Vandalia Christian School	1	.6	.6	93.2
	West Clermont Local Sch Dist	1	.6	.6	93.8
	Westminster Catawba CHRN Sch	1	.6	.6	94.4

	Wilkes Co School District	3	1.7	1.7	96.0
	Winston-Salem Forsyth Co SD	2	1.1	1.1	97.2
	York School District 1	5	2.8	2.8	100.0
	Total	177	100.0	100.0	

SCHOOL NAME

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Academy For Teaching & Lrng	1	.6	.6	.6
	Anderson Mill Elementary Sch	1	.6	.6	1.1
	Antioch Elementary School	2	1.1	1.1	2.3
	Bell's Crossing Elem School	3	1.7	1.7	4.0
	Belmont Central Elem School	1	.6	.6	4.5
	Bethany Elementary School	1	.6	.6	5.1
	Bethel Elementary School	1	.6	.6	5.6
	Blacksburg Primary School	1	.6	.6	6.2
	Blue Ridge Elementary School	2	1.1	1.1	7.3
	Boger Elementary School	1	.6	.6	7.9
	Boiling Springs Interm School	1	.6	.6	8.5
	Boomer-Ferguson Elem School	1	.6	.6	9.0
	Bostian Elementary School	1	.6	.6	9.6
	Brewer Middle School	1	.6	.6	10.2
	Bridges School	1	.6	.6	10.7
	Brook Glenn Elementary School	1	.6	.6	11.3
	Carrboro Elementary School	1	.6	.6	11.9
	Catawba Elementary School	1	.6	.6	12.4
	Chandler Creek Elem School	2	1.1	1.1	13.6
	Charles W Stanford Mid School	1	.6	.6	14.1
	Chastain Road Elementary Sch	1	.6	.6	14.7
	Cherryville Elementary School	1	.6	.6	15.3
	Chester Park Sch of Inquiry	2	1.1	1.1	16.4
	Claremont Elementary School	1	.6	.6	16.9
	Clear Creek Elementary School	1	.6	.6	17.5
	Clover High School	1	.6	.6	18.1
	Community School of Davidson	3	1.7	1.7	19.8
	Cooley Springs-Fingerville Sch	1	.6	.6	20.3
	Cowpens Middle School	1	.6	.6	20.9
	Crowders Creek Elementary Sch	2	1.1	1.1	22.0

	Diamond Hill Elementary School	1	.6	.6	22.6
	Dutchman Creek Middle School	2	1.1	1.1	23.7
	East Wilkes Middle School	1	.6	.6	24.3
	Ebenezer Avenue Elem School	1	.6	.6	24.9
	Edward Sadler Jr Elem Sch	1	.6	.6	25.4
	Finley Road Elementary School	2	1.1	1.1	26.6
	First Assembly Christian Sch	1	.6	.6	27.1
	First Assembly CHRN School	1	.6	.6	27.7
	Forest Heights Elem School	1	.6	.6	28.2
	Foster Park Elementary School	1	.6	.6	28.8
	Frank P Graham Elem School	1	.6	.6	29.4
	Friedberg Elementary School	1	.6	.6	29.9
	Gable Middle School	1	.6	.6	30.5
	Gold Hill Elementary School	1	.6	.6	31.1
	Gray Court Owings Middle Sch	1	.6	.6	31.6
	Hickory Grove-Sharon Elem Sch	3	1.7	1.7	33.3
	Holt Elementary School	1	.6	.6	33.9
	Hudson Elementary School	2	1.1	1.1	35.0
	Hughes Academy	2	1.1	1.1	36.2
	Hunter Street Elem School	1	.6	.6	36.7
	Huntersville Elementary School	5	2.8	2.8	39.5
	Huntingtowne Farms Elem School	1	.6	.6	40.1
	Immaculata Catholic School	1	.6	.6	40.7
	Immaculata School	1	.6	.6	41.2
	Immaculate Heart of Mary Sch	1	.6	.6	41.8
	Independence Elementary School	1	.6	.6	42.4
	Indian Land Elementary School	2	1.1	1.1	43.5
	J N Fries Middle School	1	.6	.6	44.1
	Jefferson Elementary School	2	1.1	1.1	45.2
	Kershaw Elementary School	1	.6	.6	45.8
	Lake Park Christian Academy	1	.6	.6	46.3
	Lakeshore Elementary School	1	.6	.6	46.9
	Laurens Middle School	1	.6	.6	47.5
	Lawsonville Elementary School	1	.6	.6	48.0
	Learning Center	1	.6	.6	48.6
	Lesslie Elementary School	1	.6	.6	49.2
	Lexington Middle School	1	.6	.6	49.7
	Lincoln Charter Sch-Lincolnton	3	1.7	1.7	51.4

	Lindley Elementary School	1	.6	.6	52.0
	Merwin Elementary School	1	.6	.6	52.5
	Midway Elementary School	1	.6	.6	53.1
	Millennium Charter Academy	3	1.7	1.7	54.8
	Millis Road Elementary School	1	.6	.6	55.4
	Morganton Day School	1	.6	.6	55.9
	Mountain Island Charter School	1	.6	.6	56.5
	Mountain View Elem School	2	1.1	1.1	57.6
	N/A	1	.6	.6	58.2
	North Avondale Montessori Sch	1	.6	.6	58.8
	North Belmont Elem School	1	.6	.6	59.3
	North Elementary School	2	1.1	1.1	60.5
	Northern Middle School	1	.6	.6	61.0
	Northwest Cabarrus Middle Sch	1	.6	.6	61.6
	Oak Hill Elementary School	1	.6	.6	62.1
	Oak View Elementary School	1	.6	.6	62.7
	Oakboro Elementary School	1	.6	.6	63.3
	Oakdale Elementary School	2	1.1	1.1	64.4
	Oakridge Middle School	1	.6	.6	65.0
	Oakview Elementary School	1	.6	.6	65.5
	Oconee Christian Academy	1	.6	.6	66.1
	Old Pointe Elementary School	3	1.7	1.7	67.8
	Old Town Elementary School	1	.6	.6	68.4
	Our Lady of The Rosary Rc Sch	1	.6	.6	68.9
	Palmetto Primary	1	.6	.6	69.5
	Pathways Elementary School	1	.6	.6	70.1
	Pickens Elementary School	1	.6	.6	70.6
	Pickett Elementary School	1	.6	.6	71.2
	Pleasant Knoll Elementary Sch	2	1.1	1.1	72.3
	Polo Ridge Elementary School	1	.6	.6	72.9
	Poplin Elementary School	1	.6	.6	73.4
	Pumpkin Center Primary School	2	1.1	1.1	74.6
	randolph middle school	1	.6	.6	75.1
	Ridge Road Middle School	1	.6	.6	75.7
	River Oaks Academy	1	.6	.6	76.3
	Rock Springs Elementary School	1	.6	.6	76.8
	Roebuck Elementary School	1	.6	.6	77.4
	Saluda Trail Middle School	1	.6	.6	78.0

	Shelby high school	1	.6	.6	78.5
	Socrates Academy	2	1.1	1.1	79.7
	South Graham Elementary School	1	.6	.6	80.2
	Southwest Elementary School	1	.6	.6	80.8
	Southwood Elementary School	1	.6	.6	81.4
	Springfield Elementary School	2	1.1	1.1	82.5
	St James Elementary School	1	.6	.6	83.1
	St Mary's Catholic School	1	.6	.6	83.6
	Stanley Middle School	1	.6	.6	84.2
	Statesville Montessori School	1	.6	.6	84.7
	Stokesdale Elementary School	1	.6	.6	85.3
	Stony Point Elementary School	1	.6	.6	85.9
	Sullivan Middle School	1	.6	.6	86.4
	Sun Valley Middle School	2	1.1	1.1	87.6
	Sunset Park Elementary School	3	1.7	1.7	89.3
	Taylors Elementary School	1	.6	.6	89.8
	Taylorsville Elementary School	1	.6	.6	90.4
	Thomas E Kerns Elementary Sch	1	.6	.6	91.0
	tl hanna Elementary School	1	.6	.6	91.5
	Tryon Elementary School	1	.6	.6	92.1
	Union Hill Elementary School	1	.6	.6	92.7
	Valmead Elementary School	1	.6	.6	93.2
	Vandalia Christian School	1	.6	.6	93.8
	Voyager Academy	1	.6	.6	94.4
	Westcliffe Elementary School	1	.6	.6	94.9
	Western Union Elem School	1	.6	.6	95.5
	Westfield Elementary School	1	.6	.6	96.0
	Westminster Catawba CHRN Sch	1	.6	.6	96.6
	Westwood Elementary School	1	.6	.6	97.2
	WG Pearson Elementary School	1	.6	.6	97.7
	Wilkesboro Elementary School	1	.6	.6	98.3
	Woodland Heights Elem School	1	.6	.6	98.9
	Woodlawn Middle School	1	.6	.6	99.4
	Woodruff Elementary School	1	.6	.6	100.0
	Total	177	100.0	100.0	

SCHOOL TYPE					
		Frequency	Percent	Valid Percent	Cumulative Percent

Valid		8	4.5	4.5	4.5
	Private	10	5.6	5.6	10.2
	Public	159	89.8	89.8	100.0
	Total	177	100.0	100.0	

GRADE BAND					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	22	12.4	12.4	12.4
	2	23	13.0	13.0	25.4
	3	20	11.3	11.3	36.7
	4	11	6.2	6.2	42.9
	5	25	14.1	14.1	57.1
	6	15	8.5	8.5	65.5
	7	4	2.3	2.3	67.8
	8	3	1.7	1.7	69.5
	K	23	13.0	13.0	82.5
	N/A	31	17.5	17.5	100.0
	Total	177	100.0	100.0	

Household CITY					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ABBEVILLE	2	1.1	1.1	1.1
	ANDERSON	3	1.7	1.7	2.8
	ARARAT	1	.6	.6	3.4
	BLACKSBURG	1	.6	.6	4.0
	BOILING SPRINGS	1	.6	.6	4.5
	BOOMER	1	.6	.6	5.1
	CARLISLE	1	.6	.6	5.6
	CARRBORO	1	.6	.6	6.2
	CHAPEL HILL	1	.6	.6	6.8
	CHARLOTTE	5	2.8	2.8	9.6
	CHERRYVILLE	1	.6	.6	10.2
	CHESNEE	1	.6	.6	10.7
	CHESTER	1	.6	.6	11.3
	CLAYTON	1	.6	.6	11.9
	CLOVER	2	1.1	1.1	13.0

CONCORD	3	1.7	1.7	14.7
CORNELIUS	2	1.1	1.1	15.8
DALLAS	2	1.1	1.1	16.9
DANBURY	1	.6	.6	17.5
DAVIDSON	1	.6	.6	18.1
DEEP GAP	1	.6	.6	18.6
DENVER	2	1.1	1.1	19.8
DURHAM	3	1.7	1.7	21.5
EASLEY	1	.6	.6	22.0
FLETCHER	1	.6	.6	22.6
FLORENCE	1	.6	.6	23.2
FORT MILL	6	3.4	3.4	26.6
FOUNTAIN INN	1	.6	.6	27.1
GASTONIA	5	2.8	2.8	29.9
GRAHAM	1	.6	.6	30.5
GRAY COURT	1	.6	.6	31.1
GREENSBORO	1	.6	.6	31.6
GREENVILLE	4	2.3	2.3	33.9
GREENWOOD	2	1.1	1.1	35.0
GREER	5	2.8	2.8	37.9
HAYS	1	.6	.6	38.4
HIGH POINT	6	3.4	3.4	41.8
HILLSBOROUGH	3	1.7	1.7	43.5
HUDSON	2	1.1	1.1	44.6
HUNTERSVILLE	7	4.0	4.0	48.6
INDIAN TRAIL	3	1.7	1.7	50.3
IRON STATION	2	1.1	1.1	51.4
KANNAPOLIS	1	.6	.6	52.0
KERSHAW	1	.6	.6	52.5
LAGRANGE	1	.6	.6	53.1
LAKE WYLIE	1	.6	.6	53.7
LANCASTER	1	.6	.6	54.2
LENOIR	1	.6	.6	54.8
LEXINGTING	1	.6	.6	55.4
LEXINGTON	3	1.7	1.7	57.1
LEXINTON	1	.6	.6	57.6
LIBERTY	3	1.7	1.7	59.3
LINCOLNTON	4	2.3	2.3	61.6

	MATTHEWS	2	1.1	1.1	62.7
	MIDLAND	1	.6	.6	63.3
	MONROE	2	1.1	1.1	64.4
	MORGANTON	1	.6	.6	65.0
	MOUNT AIRY	2	1.1	1.1	66.1
	MURPHY	1	.6	.6	66.7
	NORTH WILKESBORO	1	.6	.6	67.2
	OAKBORO	1	.6	.6	67.8
	OXFORD	1	.6	.6	68.4
	PACOLET	1	.6	.6	68.9
	PELHAM	1	.6	.6	69.5
	PILOT MOUNTAIN	1	.6	.6	70.1
	PROVIDENCE	1	.6	.6	70.6
	RALEIGH	1	.6	.6	71.2
	ROCK HILL	16	9.0	9.0	80.2
	ROCK HILLS	1	.6	.6	80.8
	ROEBUCK	2	1.1	1.1	81.9
	SAINT HELENA ISLAND	1	.6	.6	82.5
	SALISBURY	1	.6	.6	83.1
	SENECA	2	1.1	1.1	84.2
	SHARON	1	.6	.6	84.7
	SHELBY	2	1.1	1.1	85.9
	SIMPSONVILLE	3	1.7	1.7	87.6
	SMYRNA	2	1.1	1.1	88.7
	SPARTANBURG	2	1.1	1.1	89.8
	STANLEY	1	.6	.6	90.4
	STATESVILLE	2	1.1	1.1	91.5
	STOKESDALE	1	.6	.6	92.1
	STONY POINT	1	.6	.6	92.7
	TAYLORS	1	.6	.6	93.2
	TAYLORSS	1	.6	.6	93.8
	TAYLORSVILLE	1	.6	.6	94.4
	THOMASVILLE	1	.6	.6	94.9
	TRINITY	1	.6	.6	95.5
	UNION	1	.6	.6	96.0
	WAXHAW	1	.6	.6	96.6
	WILLIAMSTON	1	.6	.6	97.2
	WINSTON-SALEM	2	1.1	1.1	98.3

	YORK	3	1.7	1.7	100.0
	Total	177	100.0	100.0	

Household STATE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NC	100	56.5	56.5	56.5
	SC	77	43.5	43.5	100.0
	Total	177	100.0	100.0	

Impact Evaluation and Review of the 2011 PowerShare® Program in the Carolinas System

Final Report

Prepared for
Duke Energy
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Table of Contents

Executive Summary

Introduction and Purpose of Study

This document presents the evaluation report for Duke Energy's PowerShare® Program as it was administered in the Carolinas System. For our use in this report, the PowerShare name is an umbrella term that contains multiple programs including PowerShare Mandatory, PowerShare Generator, PowerShare CallOption, and PowerShare Voluntary. Note that Duke Energy does not claim any capacity credits from the PowerShare Voluntary program and therefore no capacity values are calculated for this program.

For this evaluation, Duke Energy performed the calculations and conducted the impact analysis, and Integral Analytics (a TecMarket Works Subcontractor) conducted the review of the methodology and results.

Summary of the Evaluation

The impact analysis of the PowerShare program was conducted by Duke Energy. The basic approach for determining the impacts, capabilities, and profit and loss (i.e., P&L, the MW values used for revenue recovery under Save-A-Watt, SAW) involves combining actual weather data with hourly load data from all enrolled customers, collected for the previous month(s), as appropriate. A regression model is developed using the combined data to provide an estimate of what the load would have been for the customer, absent an event. This is compared to the actual customer load to determine the impacts from the event.

Evaluation Objectives

The purpose of this evaluation was two-fold. The first objective is to summarize the actual kW and expected peak normal kW impacts determined by Duke Energy for 2011. The second objective is to determine if the approach used by Duke Energy in estimating these impacts (where actual metered data is not used as it is for the Generator program), as well as the capacity values, are consistent with commonly accepted evaluation principles.

Recommendations

Overall, based on our review, Duke Energy's impact evaluation is a very complete and innovative approach, and it should result in accurate estimates of Event impacts (i.e., settlement with customers, M&V results for an event, capability values, and P&L values).
In general, the model specifications in all the processes includes the key determinates of energy usage, so there is little likelihood of any bias in the results from omitted variables. One particularly noteworthy feature is that Duke Energy uses an extensive history to estimate the model, rather than relying on only a handful of days as is common in many utilities which use less rigorous approaches. In addition, using a multivariate regression model in the Capabilities, P&L, and M&V processes is generally preferred over approaches that are based on average loads from a pre-event period.

In addition, the technical approach used by Duke Energy in developing settlement calculations for the customer day-ahead Pro forma load (PFL) and the M&V event impacts are very well thought out and developed. The use of multiple methods and determining the Best of Breed (BoB) in the PFL is noteworthy in that it assures that the most accurate approach will be used in developing the PFL – a step which, to the best of our knowledge, is not used by any other entity.

The one concern we have is that there are multiple processes that essentially measure the same thing. For example, the PFL and M&V processes both measure the impacts for a specific event day (i.e., the effect of the event on load shapes). Likewise, the P&L and Capability processes are essentially both measuring the peak normalized load reduction capability of participants. This appears to be inefficient, as well as confusing.

In addition, for some programs under the PowerShare umbrella, there appears to be no direct link between the customer payments (based on the day-ahead PFL) and the overall program impacts (based on the M&V and Capability process). Since the day-ahead PFL is based on the BoB approach for PowerShare CallOption, Mandatory, and Voluntary, while the other processes are based on regression models, it may be that there is a marked difference between the two estimates of load impacts. Therefore, it is our recommendation that Duke Energy investigate a mechanism that will produce all the required reports for customers, internal use, and regulatory requirements, using a single, unified process for the PFLs and the other reports. An example might be to store the day ahead PFLs associated with an event for developing the Capability and M&V processes for appropriate programs.

Relatedly, it is not clear why different processes must be involved. While there appears to be a specific purpose for each process, there may be efficiencies captured by consolidating the processes. While it is obvious that a distinction be made between actual weather and peak normal weather, it is not clear why that requires two distinct processes. It seems possible to combine the Capability and M&V process into one process, where the regression models are estimated once, and for the weather sensitive customers, estimates of both actual and weather normal impacts are estimated from the same model (just using different weather values). In addition, the difference between the Capability and P&L process is that the P&L includes customers who have enrolled after the summer. Duke Energy clearly wants to capture these post-summer enrollments and start collecting revenues for them during the current year. However, it is our opinion that P&L process may overstate the actual *capability* of the program, if for example you are talking about the *capability* of the program during the summer of 2011, since post-summer enrollments were not enrolled during the summer event period. Therefore, our recommendation is that the impacts should be based on the Capability calculations, and Duke Energy should review the need for each process to see if they are truly required. In terms of P&L process results, the use of these results may be appropriate in the revenue recovery process but that is best addressed by Duke Energy and the state regulatory entities.

Description of Programs

PowerShare is a demand response program designed to reduce non-residential customers' energy use during periods of high energy prices or during periods when high energy usage would cause energy supplies across the transmission and distribution system to drop to near-critical levels. In both these situations, the PowerShare program allows Duke Energy to purchase capacity from their customers by paying their commercial and industrial customers to reduce their energy demand, thus increasing the available energy supply. There are four offerings within the PowerShare program: Mandatory, Voluntary, Generator, and CallOption. Participants in the Mandatory program are typically enrolled in the Voluntary program. The fourth offering, CallOption, was approved for South Carolina in early 2010, but was not approved for North Carolina until March of 2011. Due to a desire to coordinate offerings across the Carolinas System, Duke Energy made the decision not to market CallOption in South Carolina while they awaited approval from the North Carolina regulators. With CallOption approved in both states, Duke Energy plans to market CallOption in the Carolinas System starting in 2012. The following program descriptions were obtained from Duke Energy.

- PowerShare® is a non-residential curtailment program consisting of four options: an emergency only option for curtailable load (PowerShare® Mandatory), an emergency only option for load curtailment using on-site generators (PowerShare® Generator), an economic based voluntary option (PowerShare® Voluntary), and a combined emergency and economic option that allows for increased notification time of events (PowerShare® CallOption).
    - PowerShare® Mandatory: Participants in this emergency only option will receive capacity credits monthly based on the amount of load they agree to curtail during utility-initiated emergency events. Participants also receive energy credits for the load curtailed during events. Customers enrolled may also be enrolled in PowerShare® Voluntary and eligible to earn additional credits.
    - PowerShare® Generator: Participants in this emergency only option will receive capacity credits monthly based on the amount of load they agree to curtail (i.e., transfer to their on-site generator) during utility-initiated emergency events and their performance during monthly test hours. Participants also receive energy credits for the load curtailed during events.
    - PowerShare® Voluntary: Enrolled customers will be notified of pending emergency or economic events and can log on to a Web site to view a posted energy price for that particular event. Customers will then have the option to participate in the event and will be paid the posted energy credit for load curtailed.
    - PowerShare® CallOption: This DSM program offers a participating customer the ability to receive credits when the customer agrees, at the Company's request, to reduce and maintain its load by a minimum of 100 kW during Emergency and/or Economic Events. Credits are paid for the load available for curtailment, and charges are applicable when the customer fails to reduce load in accordance with the participation option it has selected. Participants are obligated to curtail load during emergency events. CallOption offers four participation options to customers: PS 0/5, PS 5/5, PS 10/5 and PS 15/5. All options include a limit of five Emergency Events and set a limit for Economic Events to 0, 5, 10 and 15 respectively.

In the Carolinas System, Duke Energy has customers participating in legacy demand response programs, not described above, that were in place prior to Duke Energy's merger with Cinergy in 2006. A program manager reports that across PowerShare and the legacy C&I programs, Duke Energy currently manages over 500 MW of capacity in the Carolinas System.

Overview of the Evaluation Approach

The impact analysis for the PowerShare programs was conducted by Duke Energy staff and evaluated by Integral Analytics staff. The results presented in this report include a review by Integral Analytics of the impact evaluation methodology and results.

The evaluation of the PowerShare program must meet a diverse set of goals. Specifically, after each event, the level of load reduction must be calculated for each participant. If the participant is on a firm reduction agreement the determination is made if they reduced load from wherever their load was to their contracted firm reduction level. If the customer is on a fixed reduction agreement, the evaluation calculates the difference between the baseline and the actual load during the control period to see if the agreed amount of reduction was achieved.

In the Carolinas System, customers may sign up for the programs throughout the calendar year. This complicates the impact analysis, having the number of participants in the programs potentially changing each month.

Credits or penalties for events, using PFLs, are calculated within the Energy Profiler Online (EPO) system for PowerShare and recorded on the customer's utility bill. In addition, the results of the various evaluations are used to develop reports for the system operator, load availability projections, summer curtailment projections for state level planning, and event load reduction analysis.

A further complication is that a control event can be called at any time, for either an emergency power or economic condition depending on the program. Therefore, the evaluation must operate under the assumption that each day is a potential control analysis day. The control season runs all year for emergency events; however, economic events tend to be limited to the summer season although there are programs available that allow economic event activity throughout the year. Regardless of the date, the evaluation needs to be able to assess the load records of all participants so that Duke Energy can calculate the amount of load reduction that is achieved at any time.

These requirements have resulted in an extensive evaluation procedure. This evaluation procedure consists of the following tasks:

Table 1. PowerShare Evaluation Procedures

Process	Purpose	Frequency
Day-ahead PFLs	Settlement with customers and emergency event load reduction estimates	Every weekday
Monthly Capabilities	Internal reporting	Monthly
Profit and Loss (P&L)	Regulatory filings for revenue recovery	Monthly as needed with year-end true-up
M&V	Reporting actual impacts of events to regulatory bodies.	Monthly if an event occurred in the prior month

Other processes which are done on an as-needed or requested basis include event day analysis and generator tests.

A high-level overview of each process in Table 1 is given below. Note that all processes are not necessarily required for all programs under the PowerShare umbrella.

Day-Ahead PFLs

This process, as the name implies, creates the day-ahead pro forma (i.e., estimated load assuming no control events) load shapes (PFL) specific to each customer.

The estimation of the PFL involves using 12 weeks (84 days) of historical load and weather data (eliminating NERC holidays, event days, generator test days (for generator customers only) and any days identified as quiet periods from the analysis) to produce hourly predicted load shapes for the next thirty days based upon forecasted weather for each region.

The estimation of the PFL involves using five different estimation approaches:

- Hourly regression,
- PJM average method,
- MISO average method,
- Last two days average, and a
- Hybrid method.

A summary of each approach is presented below.

Hourly Regression

In this method, hourly energy is regressed on a set of Fourier variables, weather variables and monthly dummies (if appropriate). An autoregressive (AR) process is fit to the error terms. This AR process has lags at 1, 24 and 25. The same model is re-fit except that weather variables are excluded. Then an F-test is performed to see if weather is a significant explanatory factor and the appropriate model results are used for further calculations.

PJM Method

This method is based on the method PJM uses to calculate CBLs for settlement. It calculates an average load shape based on the high 4 of 5 days selected by the method. Those 5 days are selected from a 45 day window of days. Only weekdays are considered. The initial set of days is the most recent 5 days in the window. If the average usage on any day in the 5 days is less than 25% of the overall average for the 5 days, that day is dropped and a replacement selected. This loop is repeated until there are 5 days, none of whose average usage is less than 25% of the average usage. The 4 days with the highest usage are selected from this group and the average load shape is calculated using those 4 days.

MISO Method

The MISO method is similar to the PJM method. The differences are the MISO method uses 10 days, there are no exclusions for low usage and all 10 days are used to calculate the load shape.

Last Two Days Method
For this method, the load shape is calculated based upon the most recent past two days hourly load shapes.

Hybrid Method
This method first performs a regression of the daily energy usage for a customer. The explanatory variables are binary variables for day of the week, a daily weather variable, monthly dummies (if appropriate) and interactions between the weather variables and binary variables. The model is fit using an AR(7) process. As with the hourly regression, the model is re-fit without the weather variables and an F-test performed to determine the appropriate model. Once the predicted daily energy has been determined it is spread over the hours of the day using the load shape from the PJM method after that load shape has been normalized by the total energy under the shape.

Best of Breed (BoB)
For each customer, the "best" method is chosen to produce the final day-ahead baseline estimates. This is done by comparing the predicted load from each method to the actual load for the five days that went into the PJM method at an hourly, daily, and total level. Specifically:

- For the hourly value, the absolute value of each hourly difference between the predicted and actual load is summed across all five days.
- For the daily value, the difference for each hour is summed for each day, then the absolute value is summed across the five days.
- For the total, the difference in each hour for all five days is calculated for all five days, then summed and the absolute value is taken.

The best method is chosen based on each methods relative performance of these differences. If a method is the best for at least two values, then the PFL from that method is used. Otherwise, the PFL from the method which produced the lowest hourly variance is used.

Capability, P&L, and M&V

The steps involved in the calculation of the monthly reports of Capability, P&L, and M&V are all similar, and therefore will be discussed as a group. Note that this process described below is not used for the PowerShare Generator program since that program requires metered generators and monthly test events. Therefore, values are derived from the metered generator data. In addition, for PowerShare Voluntary, the Capability and P&L processes are not performed since they are not relevant to the program. For PowerShare Mandatory and CallOption and for the M&V process for PowerShare Voluntary, hourly load data from all enrolled customers is collected for the previous month(s). Data is treated similarly but with a few exceptions such as the modeling of quiet periods, days when participants have reduced load due to a maintenance shutdown for example, in the M&V and Capability process but not modeled in the P&L process. However, all three processes include quiet periods.

This data is combined with the actual weather for that month(s). A regression model is developed using the combined data similar to the hourly regression model discussed in the day-ahead PFL calculations discussed above. Specifically, the regression equation relates the customer's hourly electricity load to:

- A Fourier transform of hour of the day
- A Fourier transform of hour of the week
- A Fourier transform of hour of the month
- Temperature Humidity Index.
- Binary variables for holidays and quiet periods, if appropriate
- Interactions between the Fourier transforms and the other variables

An F-test is calculated for each customer to determine if weather is a significant explanatory variable (unless weather is explicitly excluded). If so, then the estimated parameters are used to create predicted loads using peak normal weather conditions for the Capability and P&L processes, while the M&V process uses actual weather. Thus, the PFLs from the Capability and P&L processes represent weather normal loads, while the PFLs from the M&V process are representative of the actual load the customer would have had, absent an event.

Table 2. Differences across Capabilities, P&L, and M&V processes

Process	Days Eliminated	Weather Data
Capabilities	Event and Generator Test	Peak Normal
P&L	Event	Peak Normal
M&V	Event and Generator Test	Actual Weather

Evaluation Findings

Load Impact Results

Based on the evaluation performed by Duke Energy staff following the procedures discussed above, the resulting PowerShare impacts during 2011 are produced from the M&V process and should be viewed as the actual load reduction impacts received on event days in 2011.

Table 3. PowerShare Program M&V Impacts, 2011 Carolinas System

Date	Hour Ending	EDT /EST	PS CallOption (MW)	PS Mandatory (MW)	PS Generator (MW)	PS Voluntary (MW)	PowerShare Total (MW)
6/1/2011	13	EST	0.0	340.1	16.8	0.0	356.9
6/1/2011	14	EST	0.0	341.5	17.5	0.2	359.2
6/1/2011	15	EST	0.0	336.2	17.4	0.4	354.0
6/1/2011	16	EST	0.0	329.5	15.7	0.5	345.7
6/1/2011	17	EST	0.0	320.5	15.1	0.3	335.9
6/1/2011	18	EST	0.0	0.0	0.0	3.6	3.6
6/1/2011	19	EST	0.0	0.0	0.0	3.4	3.4
6/1/2011	20	EST	0.0	0.0	0.0	3.0	3.0

6/2/2011	14	EST	0.0	0.0	0.0	17.0	17.0
6/2/2011	15	EST	0.0	0.0	0.0	17.0	17.0
6/2/2011	16	EST	0.0	0.0	0.0	16.5	16.5
6/2/2011	17	EST	0.0	0.0	0.0	15.7	15.7
6/2/2011	18	EST	0.0	0.0	0.0	14.7	14.7
6/2/2011	19	EST	0.0	0.0	0.0	15.5	15.5
7/12/2011	13	EST	0.0	342.1	12.5	0.0	354.6
7/12/2011	14	EST	0.0	341.3	12.5	0.0	353.8
7/12/2011	15	EST	0.0	338.7	12.6	0.0	351.3
7/12/2011	16	EST	0.0	332.1	12.2	0.0	344.3
7/20/2011	13	EST	0.0	0.0	0.0	2.0	2.0
7/20/2011	14	EST	0.0	0.0	0.0	2.0	2.0
7/20/2011	15	EST	0.0	0.0	0.0	1.8	1.8
7/20/2011	16	EST	0.0	0.0	0.0	1.6	1.6
7/20/2011	17	EST	0.0	0.0	0.0	1.6	1.6
7/20/2011	18	EST	0.0	0.0	0.0	1.7	1.7
7/21/2011	13	EST	0.0	0.0	0.0	2.0	2.0
7/21/2011	14	EST	0.0	0.0	0.0	2.0	2.0
7/21/2011	15	EST	0.0	0.0	0.0	1.9	1.9
7/21/2011	16	EST	0.0	0.0	0.0	1.8	1.8
7/21/2011	17	EST	0.0	0.0	0.0	1.9	1.9
7/21/2011	18	EST	0.0	0.0	0.0	1.9	1.9
7/22/2011	11	EST	0.0	0.0	0.0	3.5	3.5
7/22/2011	12	EST	0.0	0.0	0.0	3.5	3.5
7/22/2011	13	EST	0.0	0.0	0.0	3.6	3.6
7/22/2011	14	EST	0.0	0.0	0.0	3.7	3.7
7/22/2011	15	EST	0.0	0.0	0.0	3.5	3.5
8/3/2011	14	EST	0.0	0.0	0.0	2.1	2.1
8/3/2011	15	EST	0.0	0.0	0.0	2.1	2.1
8/3/2011	16	EST	0.0	0.0	0.0	2.1	2.1
8/3/2011	17	EST	0.0	0.0	0.0	2.1	2.1
8/3/2011	18	EST	0.0	0.0	0.0	2.1	2.1

Based on the evaluation performed by Duke Energy staff following the procedures discussed above and on peak normal weather, the resulting PowerShare P&L impacts during 2011 are produced from the P&L process and should be viewed as the average of 12 monthly values that represent the 2011 summer capability of participants enrolled in the program during each month throughout the year. These values are presented in Table 4. [1]

[1] The purpose of this review was on the methods used to determine load impacts, not the accounting methods and results. Therefore, the P&L results are included here for completeness only. Neither TecMarket Works nor Integral Analytics can attest to the veracity of these results.

Table 4. PowerShare P&L and Summer Capability Program Values, 2011 Carolinas System

Program	Year-end Number of Participants[1]	P&L Program Impacts (MW)[2]	Summer Capability (MW)
PowerShare Mandatory	150	307.0	316.0
PowerShare Generator	9	14.0	14.3
PowerShare CallOption	0	0.1[3]	0.0
Total	159	321.1	330.3

[1]*Note: Participants are year-end values.*
[2]*MWs are an average across the entire year.*
[3]*There was 1 participant from 1/11 through 5/11.*

Review of Approach

Overall, the technical approach used by Duke Energy in developing the customer PFL and the event impacts are very well thought out and developed. The use of multiple methods and determining the Best of Breed (BoB) in the PFL is noteworthy in that it assures that the most accurate approach will be used in developing the PFL – a step which, to the best of our knowledge, is not used by any other entity.

In general, the model specifications in all the processes includes the key determinates of energy usage, so there is little likelihood of any bias in the results from omitted variables. One particularly noteworthy feature is that they use an extensive history to estimate the model, rather than relying on only a handful of days as is common in many utilities which use less rigorous approaches. In addition, using a multivariate regression model in the Capabilities, P&L, and M&V processes is generally preferred over approaches that are based on average loads from a pre-event period.

The one concern we have is that there are multiple processes that essentially measure the same thing. For example, the PFL and M&V processes both measure the impacts for a specific event day (i.e., the effect of the event on load shapes). Likewise, the P&L and Capability processes are essentially both measuring the peak normalized load reduction capability of participants. This appears to be inefficient, as well as confusing, as it is not clear what the actual estimate of impacts is for the program without considerable explanation. Of note, Duke Energy describes the P&L value as follows:

- The PowerShare programs allow the company to reduce load at any point during the year during an emergency. Because of that, the Company recognizes revenue ratably over a 12 month period based on the current summer capability for that month. (Said another way, the Company multiplies its current kW summer capability times the avoided cost of capacity per kW / 12.) The Company accordingly reports its 12-month average summer capability in regulatory true up proceedings for the PowerShare program.

In addition, for some programs under the PowerShare umbrella, there appears to be no direct link between the customer payments (based on the day-ahead PFL) and the overall program impacts (based on the M&V and Capability process). Since the day-ahead PFL is based on the BoB approach for PowerShare CallOption, Mandatory, and Voluntary, while the other processes are based on regression models, it may be that there is a marked difference between the two estimates of load impacts.

Therefore, it is our recommendation that Duke Energy investigates a mechanism that will produce all the required reports for customers, internal use, and regulatory requirements, using a single, unified process for the PFLs and the other reports. An example might be to store the day ahead PFLs associated with an event for developing the Capability and M&V processes for appropriate programs.

Relatedly, it is not clear why different processes must be involved. While there appears to be a specific purpose for each process, there may be efficiencies captured by consolidating the processes. While it is obvious that a distinction be made between actual weather and peak normal weather, it is not clear why that requires two distinct processes. It seems possible to combine the Capability and M&V process into one process, where the regression models are estimated once, and for the weather sensitive customers, estimates of both actual and weather normal impacts are estimated from the same model (just using different weather values). In addition, a difference between the Capability and P&L process is that the P&L includes customers who have enrolled after the summer or potentially participated during the beginning of the year but terminated their participation prior to the summer. Duke Energy clearly wants to capture these post-summer enrollments and start collecting revenues for them during the current year. However, it is our opinion that the P&L process may overstate or understate the actual capability of the program, if for example you are talking about the capability of the program during the summer of 2011. Therefore, our recommendation is that the impacts should be based on the Capability calculations, and Duke Energy should review the need for each process to see if they are truly required. In terms of P&L process results, the use of these results may be appropriate in the revenue recovery process but that is best addressed by Duke Energy and the state regulatory entities.

Overall, based on our review, Duke Energy's impact evaluation is a very complete and innovative approach, and it should result in accurate estimates of event impacts.

Impact Evaluation and Review of the 2011 Power Manager® Program in the Carolinas System

Final Report

Prepared for
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Table of Contents

Executive Summary

Summary of Findings

The approach used by Duke Energy for estimating the effect of the Power Manager program is very reasonable and defensible. One particularly noteworthy feature is that they use an extensive history to estimate the model, rather than relying on only a handful of days as is common in many utilities which use less rigorous approaches (i.e., approaches that compare average usages from a pre-event period rather than conducting a multivariate regression model, as Duke Energy is doing).

Overall, based on our review, Duke Energy's impact evaluation is a very complete and innovative approach, and should result in accurate estimates of event impacts and the summer load reduction capacity under peak normal weather conditions, as summarized in Table 11 on page 14.

Recommendation

- The behavior of some Cannon switches to deviate substantially from the shed times expected for the Target Cycle method is worrisome since it increases the uncertainty of the program impacts. While this is beyond the control of Duke Energy, we encourage Duke Energy to continue to work with Cooper Power Systems (Cannon) staff to determine the cause and extent of this issue.
    - See section titled "PM Load Control Strategies", specifically "Table 5. Percentage of Cannon Switches for Each Shed Pattern" on page 10.

Introduction and Purpose of Study

This document presents the evaluation report for Duke Energy's Power Manager® Program as it was administered in North and South Carolina.

The evaluation was conducted by the TecMarket Works evaluation team. Duke Energy conducted the impact analysis, and Integral Analytics (a TecMarket Works subcontractor) conducted the review of the methodology and results.

Summary Overview

This document presents a review of the impact evaluation for the Power Manager (PM) program conducted by Duke Energy as it was administered in North and South Carolina.

Summary of the Evaluation

Power Manager is a voluntary residential load control program. Participants receive billing credits during the billing months of July through October in exchange for allowing Duke Energy Carolinas the right to cycle their central air conditioning systems and, additionally, to interrupt the central air conditioning when the Company has capacity needs.

The impact evaluation conducted by Duke Energy developed an air conditioner (AC) duty cycle model based on information from a sample of PM participants in the Carolinas System. This duty cycle model was then used to simulate the expected natural duty cycle under two different conditions: 1) during the PM event days, and 2) under peak normal weather conditions. The results of these simulations were used to produce estimates of the potential load reduction. These estimates were then de-rated by the results of various operability studies (see Appendices A and B) to give estimates of the realized load reductions.

Evaluation Objectives

The purpose of this evaluation is two-fold. The first objective is to summarize the actual kW and expected peak normal kW impacts determined by Duke Energy for 2011. The second objective is to determine if the approach used by Duke Energy in estimating these impacts is consistent with commonly accepted evaluation principles.

Description of Program

Power Manager (PM) is a voluntary residential program, available to homeowners with central air conditioning (AC). There are two types of events that may be implemented for PM. First, Economic Events can be implemented on days where energy demand and/or energy costs are expected to be high, but there is not necessarily significant concern about system reliability. For such an event, Duke Energy has permission from Power Manager participants to cycle their air conditioning off for a period of time. Second, Emergency Events can be implemented by Duke Energy's system operations center (SOC) when emergency conditions occur. For such an event, participants' air conditioning would be turned off for the duration of the Power Manager emergency event.

There are two requirements that must be met for a customer to be eligible to participate in Power Manager. First, they need to own and live in their single family home. Second, they need to have a functional central air conditioner with an outside compressor that can be controlled. When customers enroll, Duke Energy installs a switch that allows the AC unit to be cycled off and on in response to signals sent over Duke Energy's paging system.

The target load reduction in the Carolinas System is 1.3kW per device. Events may be called on non-holiday weekdays during the months of June through September.

Within Duke Energy Carolinas portfolio, Power Manager is currently the only residential demand response program[1]. The Power Manager program plays a key role in capacity planning; every year, the Retail Energy Desk provides an estimate as to how much capacity the program can provide during the summer season, and this information is taken into account by the capacity planners.

Program Participation

Program	Participation (Switch) Count for 2011
Power Manager Carolinas System	EOM Sept. 2011 – 192,357

[1] Not including pilot programs.

Methodology

Overview of the Evaluation Approach

The impact evaluation for the PM program was conducted by Duke Energy staff. The results presented in this report include a review by Integral Analytics of the impact evaluation methodology and results.

The impact evaluation developed an AC duty cycle model for each AC unit based on information from a sample of PM participants in the Carolinas System. This duty cycle was then used to simulate the expected natural duty cycle for load control technologies under two different conditions: 1) during the PM event days, and 2) under peak normal weather conditions. The results of these simulations were used to produce estimates of the potential load reduction. These estimates were then de-rated by the results of various operability studies to give estimates of the realized load reductions. See Appendices A and B. Table 1 below summarizes the resulting estimated actual and the peak normal weather load impacts at the switch level for customers in the Carolinas System:

Table 1. Carolinas System Load Impacts per Switch Adjusted for Line Losses

Control Strategy	2011 Impacts	Peak Normal Weather Impacts
Target Cycle (TC) 1.3 and Fixed Cycle	0.64	0.69
Full Cycle	0.95	1.19

The approach used by Duke Energy staff is nearly identical to the approach used in the prior evaluations reviewed by the TecMarket team. Noteworthy additions include:

- The discovery that many Cannon switches deviate substantially from the shed times expected for the Target Cycle method, shedding more like an "inverted" pattern. This results in a significant difference between the expected Target Cycle shed and the actual shed. The reported estimated impacts incorporate this inverted shed.
- It appears that the peak normal impacts now include an adjustment for line losses. This is a commendable approach and is rarely done in other evaluations.

This general approach is well established in the industry and the actual analysis was very thorough and well thought out. The resulting impact estimates are reasonable and accurate. A potential alternative approach for future impact evaluations is to use the data from the EM&V[2] and the operability sample to directly estimate impacts via statistical models. This approach could use a time-series, cross-sectional analysis where the dependent variable is the actual AC load (or run-time), and the independent variables include weather conditions, time of day, day of week, and the PM control event. In essence, this would produce an overall duty-cycle model, and

[2] Evaluation, Measurement and Verification

the coefficient on the PM control event variable(s) would estimate the actual load impacts during those events. This approach is very similar to the approach used by Duke Energy, but it reduces the need to model event days separately. It is not certain that the results would necessarily be more accurate, however it is a more efficient use of the data. In addition, the statistical significance of the estimated impacts are directly calculated.

Evaluation Findings

Validation of AC Duty Cycle Data

Hourly AC run-time data collected from Cannon devices is compared to corresponding premise interval kWh to verify that the hourly AC run-time data accurately reflect the operations of the attached AC unit. The validation process is accomplished through a sequence of computer programs that: 1) convert the hourly AC run-time data into hourly duty cycle; 2) display time series plots of premise kWh and duty cycle with control over time resolution enabling visual comparison of plot detail; and 3) calculate cross-correlation between hourly kWh and hourly duty cycle and display cross-plots of kWh versus duty cycle. Each run-time data file collected for an AC in the 2011 EM&V sample is reviewed in this fashion, and the AC duty cycle is added to the model database when hourly premise kWh provides adequate confirmation.

For 4 ACs in the Southeast sample, Duke Energy could not obtain the 2011 data needed to apply validation procedures due to being unable to retrieve scan data. In the validation process, run-time data was rejected for 9 ACs in the sample. These cases appear to be due to sensitivity issues, where the AC is reported to have no run-time or to be always running. The remaining sample is statistically significant and provides better insight into AC usage profiles. Overall, hourly duty cycle data was added to the model database for 165 ACs from the sample. The final sample size for the Carolinas System is still adequate to produce estimates at 20% relative precision at 90% confidence level. Table 2 summarizes the 2011 EM&V sample.

Table 2. EM&V Sample

	North Carolina	South Carolina
Households (some with multiple ACs)	104	39
Total AC Units	178	
Missing data	4	
Invalid Data	9	
Final AC Sample	165 AC units	

AC Duty Cycle Models

Impact estimates during PM load control periods are based upon models developed for the natural duty cycle of EM&V AC units. These models are developed from 2011 duty cycle data described above, and similar duty cycle data from the two prior summers (2009, 2010) for AC units that are holdovers from previous EM&V samples. Weekends and holidays are not used in the models, and hours during load control and for the remainder of the day are not used. Duke Energy staff was able to develop duty cycle models for AC units at 136 households in the EM&V sample.

Natural duty cycle models are specified and estimated individually for the AC units to better capture the unique dependence of duty cycle on the temperature and humidity characteristics of the location of each AC unit. A limited dependent variable model specification is adopted for the hourly duty cycle, the independent variable in the models. Candidate specifications for dependent variables in the models include temperature averaged over the prior 2-hour, 4-hour, and 6-hour intervals, and a weighted temperature average with declining weights over the previous six hours. Candidate specifications also include similar sets of averages based on temperature-humidity index (THI) and heat index (16-element polynomial). Models are estimated with the SAS procedure QLIM[3]. The dependent variable specification selected for an AC unit is based on fit diagnostics from hourly model fits over the typical load control hours, 2:00–6:00 PM. For the selected model, distinct parameters are estimated in each hour of interest, resulting in a set of hourly natural duty cycle fits for each EM&V AC.

PM Load Control Strategies

The PM program employs two generic types of load control devices which require somewhat different treatment for load impact evaluation. The newer switch type (Cannon LCR 4700) operates with an adaptive control strategy called Target Cycle (TC). For each hour of load control, the Target Cycle switch calculates a unique shed time (or percentage) based on characteristics of the attached AC unit in order to achieve a fixed (i.e., target) kW load reduction. The older switch type (Comverge) uses traditional fixed cycling control, where all devices on the same program shed the same amount of time during the control period.

Cannon devices in NC and SC are configured with a load reduction target of 1.3 kW (TC 1.3) constrained by the maximum shed time of 22.5 minutes per 30-minute control period, and Comverge fixed cycling devices limit the AC run-time to 5 minutes of each 15-minute control period (Fixed Cycling (FC) 67%). Another control strategy is full shed of the AC. The AC is completely turned off during the control periods for a full shed. This strategy is only commonly employed in the Southeast for emergency load shed events. Table 3 summarizes PM load control technology and strategy used.

Table 3. PM Load Control Devices and Strategies

		Strategy	
	Period	NC / SC	
Device	(min)	Cycling	Full Shed
Cannon	30	TC 1.3	FC 100%
Comverge	15	FC 67%	FC 100%

The Target Cycle control strategy puts more functionality in the switch itself. Rated amps of the attached AC unit is entered into the switch at installation, and used to determine connected load for the unit. The switch also records hourly duty cycle of the attached AC unit and builds a profile (historical profile) of the expected hourly duty cycle under weather conditions typical for load control. The historical profile can be scaled (globally) by adjusters included in the commands sent to switches for load control. The connected load and adjusted historical profile

[3]QLIM qualitative and limited dependent variable model.

are used to calculate hourly cycling percentages for the attached AC unit to achieve the appropriate load reduction target.

Factors that determine Target Cycle shed percentages for EM&V AC units during control periods are known, except for contents of hourly historical profile registers on those days. Values in these registers change frequently during the summer as they are updated with the AC hourly run-time on "saved" days, which are selected with weather conditions sufficiently close to a typical load control day. Hourly run-time profiles on 2011 control days for EM&V AC units are determined from the contents at the start of the 2011 control season (when available), and the unit run-time on 2011 saved days.

The expected Target Cycle shed times are calculated with switch register values for the amp parameter, the hourly historical profile, and the load reduction target. Various factors contribute to small deviations between the switch shed minutes recorded hourly in the switch data log during PM load control hours and the expected Target Cycle. These factors include limited precision of switch processor arithmetic, and occasional hours with proper shed in only one of two 30-minute shed periods. Note that in the shed analysis, hours with zero shed time are incorporated into the operability shed factor and do not contribute to the shed adjustment results. By analysis of Cannon switch shed times during 2011 PM load control hours for Target Cycle switches from the operability samples in NC/SC, average shed deviation was estimated. These results given in Table 4 are used to adjust Target Cycle shed percentages in the load impact simulation model.

Table 4. Target Cycle shed adjustment

State	Program	Shed deviation (min /hr)	Shed deviation (%)
NC / SC	TC 1.3 kW	-0.99	-1.66

Analysis of Cannon switch shed times during 2011 PM load control hours for operability samples in NC/SC has identified many Cannon switches that deviate substantially from the shed times expected for the Target Cycle method. Instead, these switches appear to shed more like an "inverted" pattern, relative to the pattern expected, defined as follows:

$$Inverted\ shed\ \% = 100 - 0.5 * Target\ Cycle\ shed\ \%$$

Table 5 gives the estimates of the proportion of Cannon switches that shed according to the inverted pattern. These proportions are used to determine the overall shed per switch attributable to Cannon switches. These results are used to adjust shed percentages for the inverted pattern in the load impact simulation model.

Table 5. Percentage of Cannon Switches for Each Shed Pattern

State	Target KW	Target Cycle shed	Inverted shed
NC/SC	1.3	60.5%	39.5%

The more recently installed Cannon LCR 4700 switches with higher serial numbers shed according to the inverted pattern. This issue is currently being researched by Cooper Power Systems (Cannon) staff.

The inverted pattern is characterized in terms of the Target Cycle shed time, and it is reasonable to expect similar deviations for these switches. By analysis of Cannon switch shed times during 2011 PM load control hours for switches following the inverted shed pattern from the operability samples in NC/SC, we have estimated average shed deviation for the inverted pattern for different program types. Results are given in Table 6. These results are used to adjust shed percentages for the inverted pattern in the load impact simulation model.

Table 6. Shed adjustment for the inverted pattern

State	Program	Shed deviation (min /hr)	Shed deviation (%)
NC / SC	1.3 kW	-1.25	-2.09

AC Connected Load

Connected load is the average power demand (kW) of a running AC unit over a full cycle. It determines the load reduction (kWh) achieved when AC run-time is reduced. Connected load is specified for EM&V AC units through the basic engineering formulas:

*Apparent Power (kVA) = (Compressor Amps + Fan Amps) * 230 Volts / 1000*

*Connected Load (kW) = Power Factor * Apparent Power*

Rated amps for the compressor (FLA) and fan (RLA) are typically listed on the AC faceplate.

Power factor in this formula is actually different for different AC units, and even varies somewhat for different cycles of the same unit, increasing at high temperature and humidity. Duke Energy has analyzed synchronous AC run-time and premise interval kWh collected for the EM&V samples to determine an appropriate overall power factor within each sample. The result is a 0.8 power factor for the EM&V sample. This power factor value is used to calculate connected loads for the impact evaluation.

Simulation Method for PM Impact Evaluation

Simulation with EM&V natural duty cycle models is used to determine average load reduction per household within high and low EM&V strata during each hour of load control and for each PM cycling strategy. These strata results are combined with the population weights given in Table 7 below to estimate average load reduction per household in the PM population. The potential load impacts estimated in this manner represent the load reduction which would be achieved if all switches controlled as expected. Impact results for PM load control in the Southeast are obtained by simulation with the EM&V sample.

Table 7. EM&V Sample Stratification

	Sample allocation		Population weight	
	High	Low	High	Low

NC & SC	74	69	37.3%	62.7%

The simulation procedure is very similar for the three basic PM control strategies: Target Cycle, Fixed Cycling, and Full Shed. In a fixed cycling or full shed (100% cycling) simulation, the same specified shed percentage is applied to all ACs to evaluate load impact for a particular program option. Program shed percentages are shown in Table 3. In a Target Cycle simulation, during a specified hour (and day) of load control, a customized shed percentage is calculated for each AC unit from information specific to that unit. The appropriate adjustment is applied to this shed percentage. The resulting unit-specific shed percentages remain fixed in all simulated realizations for that load reduction target and load control hour.

Load reduction corresponding to the inverted shed pattern is also calculated in a Target Cycle simulation. A unit-specific shed percentage for the inverted pattern is determined from the relationship to the Target Cycle shed percentage given in the section "PM Load Control Strategies" and the appropriate adjustment from Table 6. The same set of simulated duty cycles for an AC are used to evaluate load reduction with both the Target Cycle shed percentage and the inverted pattern shed percentage calculated for that AC.

A single realization in the simulation is generated by a random draw for each of the EM&V natural duty cycle model fits, which are evaluated at the temperature and humidity of the control hour (and day). This gives a set of simulated natural duty cycles appropriate for the control hour. Load reduction for each EM&V AC is calculated as follows:

Duty cycle reduction = MAX[Duty cycle - (1 – Shed percentage), 0]

*Load reduction = Connected load * Duty cycle reduction*

For households with multiple ACs, realized load reduction is aggregated to the household level by summing load reduction from all household ACs. These realized load reductions are averaged within the strata to produce single realizations of average load reduction per household within both high and low strata. These two sample averages constitute the result from one pass through the simulation corresponding to one draw of model residuals.

Two thousand passes through the simulation are performed to adequately capture the variation in average load reduction within strata that is consistent with our duty cycle models and EM&V sample sizes. The results accumulate into distributions of sample averages for both high and low strata. The grand means of these distributions are the most significant output from a simulation run. They are the estimates of average load reduction per household in the high and low strata for the specified control hour and cycling strategy. The spread of these distributions (e.g., variance) characterizes the uncertainty in the load reduction estimates, and is very much affected by the EM&V sample sizes.

Load Impact Results

The load impacts described in this section are computed with population estimates of load reduction per switch, rather than load reduction per household. Simulation results are converted to load reduction per switch using the factor of 1.178 switches per household. Population estimates of load reduction per household are divided by this factor to get corresponding population estimates of load reduction per switch.

The appropriate de-rating factors for each switch technology are determined by separate operability studies. See Appendix A and B.

The de-rating factor appropriate for Cannon devices (94.5%) is used to calculate de-rated impacts. Table 8 shows de-rating factors used for the 2011 impact evaluation in the Carolinas System. The factors for Comverge were determined by operability studies conducted in 2010. Cannon factors were determined by operability studies conducted in 2011.

Table 8. De-rating Factors for Impact Evaluation

Switch Type	NC / SC
Cannon	0.945
Comverge	0.399

PM economic events were activated in NC and SC on 7 days during the summer of 2011. Both Cannon and Comverge devices were controlled on all days. PM offers a single program in NC and SC, with fixed cycling at 67% for Comverge switches and a Target Cycle load reduction target of 1.3 kW for Cannon switches.

Table 9 gives hourly impact results for each control day. The last column of Table 9 gives total PM impact after losses in the Southeast for NC and SC for both types of switches. The highest hourly impact for cycling events in the Southeast was 117 MW in hour 17 (4:00 – 5:00 pm EDT) on July 21.

Table 9. PM Impact Results for NC and SC Including Line Loss Adjustment

Event Date	Hour	PM Impact (MW)		Southeast Total
		NC	SC	
6/21/2011	16	68.7	28.5	97.2
	17	73.4	30.6	104.0
7/11/2011	16	67.3	27.8	95.1
	17	72.5	30.0	102.5
	18	74.8	31.0	105.8
7/13/2011	16	74.8	31.1	105.9
	17	72.6	30.2	102.8
	18	68.2	28.3	96.5
7/20/2011	16	74.4	30.6	105.0
	17	77.8	2.1	109.9
7/21/2011	16	79.3	32.9	112.2
	17	82.7	34.3	117.0

7/29/2011	16	76.8	31.6	108.4
	17	79.6	32.8	112.4
8/2/2011	17	81.0	33.1	114.1
	18	82.6	33.8	116.4
8/25/2011	16	136.5	46.8	183.3

Please note that a full shed test event was activated on August 25 from 3:00 to 4:00 pm in NC and SC and the total impact was 183.3 MW.

Table 10 gives estimated load reduction per switch under peak normal weather conditions for different PM load control technologies. **Table 11 shows the summer monthly load reduction capability adjusted for line losses under peak normal weather conditions for each control strategy.** Table 12 shows the peak normal weather conditions used to calculate the results in Table 10. The system peak in the Southeast is assumed to occur in the hour 4:00 – 5:00 pm EDT (identified as hour 17 in this report).

Table 10. Shed kW/switch with Peak Normal Weather

Control Strategy	Potential Impact NC/SC	De-rated Impact NC/SC
Cannon TC 1.3 kW	1.18	1.12
Cannon Full Shed	2.22	2.10
Comverge Fixed Cycle 67%	1.29	0.51
Comverge Full Shed	2.22	0.89

Table 11. Carolinas System Monthly Peak Normal Weather Load Reduction Capability De-rated Impact by Control Strategy Adjusted for Line Losses

State	Control Strategy	June	July	August	September	Average MW
Carolinas	Cycling	110.9	112.9	113.7	115	113.1
Carolinas	Full Shed	224.2	226.7	227.6	229.2	226.9

Table 12. Peak Normal Weather

Hour	NC / SC	
	Temp	Dewpt
11	89.0	69.0
12	91.0	69.0
13	92.0	68.0
14	94.0	68.0
15	93.0	69.0
16	95.0	67.0
17	95.0	66.0
18	95.0	67.0

The value in Table 11 of 226.9 MWs shows the average capability of the Power Manager program across the summer months in 2011. Duke Energy has made us aware that there is another value, called a P&L value, calculated from monthly capability values in each state. This is the value proposed by Duke Energy to be used for revenue recovery. This value for 2011 is 226.7 MW. It is our opinion that the P&L value calculation should reflect the *capability* of the program. For this report, we believe a brief explanation of the P&L value is satisfactory since the final decision on what value to use for revenue recovery is a topic best left to discussion between Duke Energy and the state regulatory entities.

A. Monthly Capability – These values represent the average load reduction capability of program participants during a particular month under peak normal weather conditions. These values would only include participants who were enrolled for the specific month in question. Note that if a single seasonal number is desired, there are different ways to combine the monthly values into a single value for the appropriate peaking season. Duke Energy Carolinas is a summer peaking utility suggesting that a combination of the summer monthly values is the most appropriate.
B. P&L Value (Revenue Recovery Value) – Duke Energy has described multiple ways that this value has been calculated over the past several years. Currently, the process can be summarized as follows.
   1. Using the processes described above and the program participants for a particular month, calculate the monthly capability of those participants using summer peak normal weather. For Power Manager, these values, for the summer months, are the same values as provided above in Table 11 after they are adjusted for line losses.
   2. The monthly values receive adjustments for line losses and other Carolinas System specific criteria best described as accounting adjustments.
   3. The revised monthly values are averaged across the months during which the program is available for curtailment. For the Power Manager program, this would include only the 4 summer monthly values and therefore the P&L result is very similar to the summer capability value.

Appendix A: 2011 Operability Study for North Carolina and South Carolina Cannon LCR4700

In May of 2011, a random sample of 150 households was selected from the population of Power Manager participants in the Southeast with Cannon LCR4700 load control devices. The sample was designed to target at relative 5% precision at 90% confidence level. The scan data were collected for all Cannon devices at sample households in July and October. Fifteen devices were dropped from the study: one due to access problems, four that had terminated participation in Power Manager, and ten that cannot retrieve the data from the devices. Our final study size includes 165 load control devices from 142 households, which is still adequate to meet the statistical criteria stated above.

Device operability is separated into two components, the setup and shed factors. The setup factor measures proper installation and configuration of devices prior to a load control event, while the shed factor measures performance during a load control event for devices with correct setup. The de-rating factor for impact evaluation is the product of the setup and shed factors. Table 1 below summarizes study observations pertaining to the setup factor. From this data, the setup factor estimate is 94.85%.

Table 13. Setup factor (0.9489) for Cannon LCR4700

Factor	Count	Description
0	6	Nonfunctional LCR
1/7	2	LCR disconnected from AC after the first event
2/7	1	LCR disconnected from AC after the second event
1	156	Correct setup

Three devices were found to be disconnected at the end of the control season, but device data logs showed control during one or two events at the start of the season. The setup factors for these devices were calculated as the ratio of event controlled (1 or 2) to total events (7) during the summer and the results were shown in the second and third rows of Table 13.

Cannon devices were instructed to execute a Target Cycle. With Target Cycle, each device calculates a unique shed time for each hour of load control based on the Amps parameter for the attached AC unit (entered into the device at installation) and the expected hourly run-time of the attached AC unit stored in the historical profile registers. Expected run-time is accumulated in the historical profile by saving run-time of the attached AC unit on days with weather conditions similar to load control days.

Table 2 shows the list of events which occurred during the summer of 2011 for Cannon switches. The data collection included both device scan data and device data logs. Device data logs contain hourly shed minutes and hourly run-time for the attached AC unit. We obtained shed minutes during each hour of load control from device data logs and this information was used to assess shed performance of devices.

Table 14. SE PM events for Cannon devices

Event Date	Event Duration (EDT)

6/21/2011	2:30 – 5:00 pm
7/11/2011	2:30 – 6:00 pm
7/13/2011	2:30 – 6:00 pm
7/20/2011	2:30 – 5:00 pm
7/21/2011	2:30 – 5:00 pm
7/29/2011	2:30 – 5:00 pm
8/2/2011	3:30 – 6:00 pm

The shed factor measures correct response by properly configured devices to paging signals sent immediately prior to and during a load control event. In the current study, 159 devices were properly configured to shed. The shed factor was calculated by dividing the total non-zero shed hours by total event hours for each device. Table 15 below summarizes the results pertaining to the shed factor. From this data, the shed factor estimate is 99.56%.

Table 15. Shed factor (0.9956)

Factor	Count
8/13	1
10/13	1
12/13	1
1	156

Our study result for the overall de-rating factor is 94.5%, the product of setup (94.89%) and shed factors (99.56%).

To gauge the uncertainty in this point estimate, an interval estimate for the de-rating factor has been derived with the simulation method. The results in Table 13 and Table 15 define multinomial probability distributions for the setup and shed factors respectively. For simulation, we model the multinomial distribution in Table 3 as a mixed distribution with discrete probability 153/156 at the value 1, and the remaining probability (3/156) uniformly distributed over the interval (7/13, 1). We have incorporated this distribution, the multinomial distribution defined by Table 1, and the study sample size into a Monte Carlo simulation to determine a 90% confidence interval around our point estimate of the de-rating factor. Our result is [91.6%, 97.0%].

Appendix B: 2010 Operability Study for Comverge Load Control Devices

In April of 2010, a random sample consisting of 183 households in North Carolina and 117 households in South Carolina was selected from the population of Power Manager participants with Comverge load control devices in North Carolina and South Carolina. Initial data collection was scheduled for all sample devices in July and early August. For some devices a second data collection was needed to resolve operability status, and this was performed early in October. 7 households were dropped from the study over the summer: 2 due to access problems, 1 due to inability to locate the residence, and 4 due to Cannon switch replacement. Our final study size includes 293 households with 328 Comverge devices.

Device operability is separated into two components, the setup and shed factors. The setup factor measures proper installation and configuration of devices prior to a load control event, while the shed factor measures performance during a load control event for devices with correct setup. The de-rating factor for impact evaluation is the product of the setup and shed factors. Table 16 summarizes study observations pertaining to the setup factor. From this data, the setup factor estimate is 61.3%.

Table 16. Setup factor (0.613) for Comverge

Factor	Count	Description
0	76	LCR disconnected from A/C
0	6	LCR not communicating
0	45	No device present
1	201	Correct setup

The shed factor for Comverge load control devices is based on relay activation counts read from the device by a technician using a Portable Counter Display (PCD) unit and recorded by the technician on an inspection sheet. For the first data collection, the shed factor is determined by comparing the recorded activations counts to the number of 15-minute load control periods prior to the date and time of data collection. Commands were issued to clear activation counters prior to the first control of the season. Comverge load control devices were shed in South Carolina only on June 14, in North Carolina only on June 15, and in both states on June 23, July 7, July 8, July 22, and July 23. Table 17 gives the relay activation counts corresponding to the load control periods on these days, and the expected contents of device activation counters after the load control periods on these days. The first data collection in South Carolina was performed between July 28 and August 5, and the expected number of activation counts is 68 for all South Carolina devices, as shown in Table 17. The first data collection in North Carolina was performed between July 7 and July 27. Table 17 shows that the expected activation counts for a North Carolina device is 28, 40, 52, 60, or 72 depending upon the date and time of scan data collection.

Table 17. Comverge relay activation counts from 2010 load control

Event Date	Activation counts - NC		Activation counts - SC	
	Increment	Total	Increment	Total
June 14 (3:00-5:00 pm)	0	0	8	8
June 15 (1:00-4:00 pm	12	12	0	8
June 23 (2:00-6:00 pm)	16	28	16	24
July 7 (3:00-6:00 pm)	12	40	12	36
July 8 (2:00-5:00 pm)	12	52	12	48
July 22 (3:00-5:00 pm)	8	60	8	56
July 23 (3:00-6:00 pm)	12	72	12	68
August 5 (2:00-5:00 pm)	12	84	12	80

Setup and shed factors were determined for 234 devices from the first data collection. A second data collection was specified for the remaining sample devices, except for those dropped from the study. The reasons for requiring a second data collection include:

1) Device setup correct, and activation counts greater than zero but different than expected.
2) Device setup correct, but PCD readings could not be obtained
3) Device setup correct, but the wrong PCD reading was recorded
4) Device was missed in the first collection.

Subsequent to the first data collection, Comverge switches were shed on August 5 from 2:00 pm to 5:00 pm. Table 17 shows the expected increment (12) in activation counts from this control period, and the expected total activation counts for PCD readings in the October data collection. The shed factor for switches with valid PCD readings from both data collections (July/August and October) is determined by comparing the change in activation counts between these collections to the expected change over the time period between the collection dates, which can be determined from Table 17. For switches without a valid PCD reading of activation counts in the first data collection, the shed factor is determined by comparing activation counts from the second reading to expected counts for the entire control season, which is given in the last row of Table 17. For 8 devices with valid PCD readings in the first data collection (but different activation counts than expected), the activation counts recorded in the October data collection were less than the values recorded in the first collection. Shed factors for these devices are determined from the activation counts recorded in the first data collection. For 6 other devices with valid PCD readings in the first data collection (but different activation counts than expected), the wrong PCD reading was recorded in the October data collection. Shed factors for these devices are also determined from the activation counts recorded in the first collection.

The shed factor measures correct response by properly configured devices to paging signals sent immediately prior to and during a load control event. Table 16 shows 201 devices in the study were properly configured and connected to get load reduction during 2010 control periods. Table 18 summarizes the results of our analysis of relay activation counts collected from these devices. Shed factors are assigned to each device according to the ratio of activation counts read from the device to the expected activation counts. A shed factor of one is assigned when this ratio exceeds 90%, a shed factor of zero is assigned when the ratio falls below 10%, and the shed factor is set equal to the ratio when it falls between 10% and 90%. Table 18 shows that the 25 devices with intermediate shed factor are quite evenly spread between 0.1 and 0.9; the mean value for this group is 51.9%. The overall mean for the shed factor is 65.1%.

Table 18. Shed factor (0.651) for Comverge

Factor (x)	Count
1	118
0.8<= x <0.9	4
0.7<= x <0.8	5
0.6<= x <0.7	1
0.5<= x <0.6	3
0.4<= x <0.5	2
0.3<= x <0.4	3
0.2<= x <0.3	4
0.1<= x <0.2	3
0	58

Our result for the de-rating factor for Comverge load control devices in North Carolina and South Carolina is 39.9%, the product of the setup (61.3%) and shed factors (65.1%).

To gauge the uncertainty in this point estimate, an interval estimate for the de-rating factor has been derived by the simulation method. The setup factor described in Table 16 defines a binomial probability distribution. Our results for the shed factor described in Table 18 do not correspond to a simple discrete distribution, and so we shall model the shed factor with a mixed probability density having discrete weights at zero and one, and a continuous, uniform density between 0.1 and 0.9. Note that shed factor results below 0.1 and above 0.9 are incorporated into the probability weights for zero and one, respectively. Table 19 specifies the parameters of the mixed distribution adopted for the shed factor.

Table 19. Mixed distribution of shed factor used for simulation

Factor	Probability
1	0.587065
Uniformly spread between 0.1 and 0.9	0.128148
0	0.284787

The probabilities for zero and one in Table 19 agree closely with the corresponding results in Table 18, and the intermediate probability (0.128148) is chosen to give the same mean value as in Table 18 (65.1%). The mixed distribution in Table 19 reasonably captures the variability of shed factor results shown in Table 18. Our simulation employed the probability distributions in Table 16 and Table 19 along with the study sample size to determine a 90% confidence interval around the point estimate for the de-rating factor. Our result is [35.6%, 44.2%].

Process and Impact Evaluation of the Residential Smart $aver Energy Efficiency Products (CFLs) Program in the Carolina System

Final Report

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

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TABLE OF CONTENTS

Executive Summary

Key Findings and Recommendations

This section presents the key findings and recommendations identified through this evaluation. Table 1 presents the estimated overall ex post energy impacts from the engineering analysis.

Table 1. Estimated Overall Impacts

	Gross Savings	Net Savings
Annual Savings Per Bulb Distributed		
kWh	33.6	30.6
kW	0.0056	0.0051

The impacts in this table were calculated using engineering algorithms from Appendix G: Impact Algorithms. These estimates also take into account a participant's tendency to over report operating hours and the length of daylight at the time of the year the survey results were collected. These two factors, and the reasons for their inclusion, are explained in their respective sections: Self-Reporting Bias, and Daylength Adjustment. The net-to-gross ratio used to calculate net savings is 91.09%. Freeridership and spillover, the two components of the net-to-gross ratio, are calculated in their respective sections: Freeridership and Spillover. Market effects energy savings are not included in this program evaluation report and if present, are above and beyond those savings reported.

Significant Process Evaluation Findings

From the Management Interviews

- Overall, this program was highly successful in meeting its goals and is not experiencing any significant problems. A member of Duke Energy's program management summarized it as "working wonderfully." The IVR and online platforms have performed well and exceeded all goals for increasing CFL participation.
- Duke Energy wants to grow the portfolio to include specialty bulbs in their promotional offer. TecMarket Works agrees with this expansion of program offerings.
- Consumer education is an area for potentially enhancing CFL acceptance and adoption.

From the Participant Surveys

- Overall program and CFL satisfaction levels are very high, and overall Duke Energy satisfaction is high.
- The direct mail CFL program in the Carolina system is doing an excellent job of targeting participants with little or no prior CFL use. Prior to the program CFL saturation was low within the direct mail CFL participant population.

- The desire to "save on utility costs" was the most influential factor in their decision to obtain CFLs via the program. "Desire to save energy" placed second.
- For those participants that used the online CFL order tracking system, the mean satisfaction rating is very high.
- While the two highest rated factors influencing bulb purchasing were energy savings and cost savings, factors often perceived as barriers to CFL adoption such as aesthetics, mercury content, and availability of dimmable bulbs were among the lowest rated factors having little effect on adoption and use.
- Outdoor floodlights and dimmable CFLs appear to be the best candidate for a specialty CFL discount program targeting all current CFL participants.

From the Non-Participant Surveys

- Overall satisfaction with Duke Energy across all non-participants surveyed averaged 8.5 out of 10. A high score.
- The most popular reason for not participating in the program was because customers did not find the offer compelling enough to take action.
- Despite not participating in the program, nearly two thirds of the non-participants surveyed indicated that learning of Duke Energy's CFL program had increased their awareness about how to save energy by using CFLs. This suggests that the program is having an energy savings transformative effect on non-participants.
- The desire to save on utility costs and the desire to be environmentally responsible tied as the most influential factors on CFL purchases by non-participants.

Significant Impact Evaluation Findings

- Average wattage of a replaced incandescent is 64.5 watts.
    - See Impact Analysis on page 62.
- A first year installation rate of 67.2% was reported, with an ISR of 80.0%.
    - See In Service Rate (ISR) Calculation on page 64.
- Living/family room, master bedroom, and kitchen, in that order, are the three most popular room types for bulb replacements; together they make up 63% of all bulb installations.
    - See Figure 11 on page 63.
- Surveyed participants report slightly increased operating hours when switching from an incandescent to a CFL having a very small effect on energy savings.
    - See Table 55 on page 65.

Introduction and Purpose of Study

Summary Overview

This document presents the evaluation report for Duke Energy's Residential Smart $aver Energy Efficiency CFLs Program as it was administered in the Carolina System. The evaluation was conducted by TecMarket Works, Matthew Joyce, and BuildingMetrics, Inc.

Summary of the Evaluation

The findings presented in this report were calculated using survey data from participants in the CFL campaigns as presented in Table 2 below.

Table 2. Evaluation Date Ranges

Evaluation Component	Sample Pull: Start Date of Participation	Sample Pull: End Date of EMV Sample	Dates of Analysis
Participant Surveys	July 1st 2010	April 28th 2011	Surveys conducted from 12/14/11 through 4/4/12
Engineering Estimates	July 1st 2010	April 28th 2011	N/A

TecMarket Works conducted a phone survey with a random sample of 149 participants and 67 non-participants from the Carolina System between December 14th, 2011 and April 4th 2012. Surveyed participants fall into one of two income categories based on the Experian identifier that used Federal Poverty Guidelines[1] (and further confirmed[2] by the surveys' demographic questions) provided by Duke Energy indicating the customer was a low income customer. Survey sampling targeted half low income customers[3], and half "standard" income participants.[4] This allows Duke Energy to understand if the transition for low income customers to IVR/Web was successful.

[1] U.S. Department of Health & Human Services 2012 HHS Poverty Guidelines.

[2] Confirmation process determined that 79.2% were correctly identified as Low Income and Standard Income. In view that conditions may change from year to year, this was determined acceptable for the purposes of classification for this report.

[3] Low Income customers are defined as living at or below 200% of the Federal Poverty Level. However, there is no difference in the number of customers identified as low income when low income is defined as living at or below 175% of the Federal Poverty Level.

[4] In the past, Duke Energy Ohio has also offered the Agency Assistance Kit to low-income customers. In partnership with various local assistance agencies, qualifying customers could complete a survey to receive 12 compact fluorescent light bulbs. For their assistance in helping customers complete the survey, agencies received monetary compensation for each survey completed. The Residential CFL program now provides this service to all customers in the Carolina System through the automated IVR/Web platform.

Low Income customers are estimated[5] to be 42% of the population in North Carolina and 43% in South Carolina. These values were weighted by the populations of each state, as presented in Table 3 below, to arrive at an overall weighted value of 42.3% of the Carolinas' population being classified as Low Income customers.

Table 3. Distribution of Low Income Population

State	State Population	Percent Low Income Customers
North Carolina	9,656,401	42%
South Carolina	4,679,230	43%
Total	**14,335,634**	
Weighted Mean[6]		**42.3%**

Surveyed participants were asked how many CFLs that were currently installed in light fixtures were ordered through Duke Energy's CFL direct mail program. Additional, more specific information was collected for a maximum of three bulbs. This information included the location of the installed CFL, the type and wattage of the bulb that it replaced, and the average hours per day that it is in use. The decision to limit the number of CFLs about which to collect detailed information to three was made in the interest of time and evaluation cost, as the surveys are lengthy. The information gathered about the three CFLs is sufficient and provides statistically significant data. A separate sample of participants were sent e-mails or letters inviting them to take part in the survey online via Duke Energy's website, through which an additional 215 responses were collected from October 31st to November 25th, 2011. The compilation of the data from all 364 survey participants is presented in Table 54.

To assess barriers to, and interest in, program participation, TecMarket Works conducted phone surveys with a random sample of 67 non-participants, 33 low income and 34 standard customers, from the Carolina System between February 14th, and April 2nd, 2012.

An impact analysis was performed for all CFLs by room type and can be seen in Table 56. However, it should be noted that individual room type samples are of insignificant size to achieve statistical relevance and are presented as anecdotal evidence. The impacts are based on an engineering analysis of the impacts associated with the self-reported installs identified through the participant surveys. The customer-reported hours of use were adjusted downward for the self-reporting bias, identified in a previous CFL study[7] that included a reconciliation between customer reported and lighting logger data, and also to reflect yearly averages using the daylength algorithm developed via a larger logger study conducted in California[8] that documented the monthly change in lighting usage due to seasonal variances in day length. These two factors, and the reasons for their inclusion, are explained in their respective sections: Self-Reporting Bias, and Daylength Adjustment.

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[5] http://www.statehealthfacts.org/comparebar.jsp?ind=877&cat=1

[6] NC population of 9,656,401 = 67.4% of Carolina System population. Weighted mean = (67.4%*42%) + (32.6%*43%) = 42.3%.

[7] TecMarket Works and Building Metrics. "Ohio Residential Smart Saver CFL Program". June 29th, 2010. Pg. 35.

[8] The Cadmus Group. "Upstream Lighting Program Evaluation Report. Prepared for CPUC". November 16th, 2009. Pg. 16.

This report is structured to provide program impact estimations per bulb distributed as well as overall program savings based on an extrapolation of these results to the full participant population, which includes participants from July 1st 2010 through April 28th 2011 (n=743,804 customers).

Description of Program

Duke Energy residential customers have the ability to 'opt-in' and order CFLs by responding to a direct mail campaign (campaign ID = 664), or by calling the IVR toll free number, or by logging into their account information in OLS (Online Services) (IVR and OLS campaign ID = 701). Customers are eligible for up to 15 CFLs (depending on past program participation).

The program was designed to provide on-demand ordering while checking eligibility with program updates in the CFL tracker, Duke Energy's online order tracking system. The platform provided customers access to check the status of their CFL order from beginning to end (delivery to home).

Program Participation

Table 4. Program Participation

Program	Campaign ID	Participation (Customer) Count From: July 1st, 2010 To: April 28th, 2011
Residential Smart $aver CFL	664	296,589
Residential Smart $aver CFL	701	447,215
Residential Smart $aver CFL	**TOTAL**	**743,804**

Methodology

Overview of the Evaluation Approach

This process evaluation had four components: management interviews, participant surveys, non-participant surveys, and an impact analysis based on engineering algorithms.

Study Methodology

Management Interviews

TecMarket Works conducted interviews with Duke Energy's Product Manager and with the Client Manager at Niagara Conservation, the vendor contracted to provide order tracking and bulb fulfillment from program inception until April of 2012.

Participant Surveys

This survey focused on customers who, according to program tracking records, responded to the CFL program marketing efforts by Duke Energy to receive free CFLs. The survey was conducted by phone by TecMarket Works staff from a randomly generated sample from a list of 144,726 customers who requested the CFLs, and 364 survey respondents completed the survey by phone or online. Phone surveys were conducted with 149 participants, and online surveys were answered by 215 people. The survey instrument can be found in Appendix B: Participant Survey Instrument.

Non-Participant Surveys

This survey focused on customers who recalled the promotion for the free CFLs but did not respond to the offer from Duke Energy. The survey was conducted by phone by TecMarket Works' staff from a randomly generated sample of 721,304 customers, with 67 survey respondents responding to all of the survey questions. These surveys were conducted by telephone. The survey instrument can be found in Appendix C: Non-Participant Survey.

Impact Analysis

Engineering algorithms taken from the Draft Ohio Technical Resource Manual (TRM) were used to estimate savings. These unit energy savings values were applied to customers in the engineering analysis sample.

Number of Completes and Sample Disposition for Each Data Collection Effort

Management Interviews

Two out of two management representatives were contacted in 2012 for a 100% response rate.

Participant Surveys

From the sample list of 144,726 customers[9], 783 participants were called between December 14th and February 18th 2012, and a total of 149 usable telephone surveys were completed yielding a

[9] This does not represent all participants, only those that called the toll-free number to participate in the program.

response rate of 19.0% (149 out of 783). Surveys were completed by an additional 215 participants through an online survey.

Non-Participant Surveys

From a sample list of 721,304 customers, 1,457 non-participants were called between February 13th, 2012 and April 4th 2012, and a total of 67 usable telephone surveys were completed yielding a response rate of 4.6% (67 out of 1,457).

Impact Analysis

A total of 149 participants answered the phone survey and 215 participants answered the online survey. The surveys asked the same questions and were combined for a total of 364 completed surveys.

Expected and achieved precision

Participant Surveys

The survey sample methodology for the telephone survey had an expected precision of 90% +/- 4.6% and an achieved precision of 90% +/- 4.3%.

Non-Participant Surveys

The survey sample methodology had an expected precision of 90% +/- 10.6% and an achieved precision of 90% +/- 10.0%.

Impact Analysis

Engineering estimates rely on participant survey responses. Sampling procedures for the participant survey had an expected precision of ± 4.6% at 90% confidence and an achieved precision of 4.3%.

Description of baseline assumptions, methods and data sources

Baseline assumptions were determined through phone surveys with customers providing self-reported values of baseline lamp watts and operating hours. Robust data concerning HVAC system fuel and type was available from Duke Energy's Home Profile Database (appliance saturation survey type data) in the Carolinas. Interaction factors derived from this data were used in favor of deemed values from secondary sources as they recognize only Duke Energy customers and, therefore, more accurately represent the participant population. A breakdown of these factors by system and fuel type can be seen in Appendix G: Impact Algorithms.

Description of measures and selection of methods by measure(s) or market(s)

The program distributed CFLs exclusively. The Draft Ohio TRM's impact algorithms were enhanced with primary data, specifically appropriate waste heat factors were used that are indicative of climate characteristics similar to those observed in North Carolina and its various climates and used to calculate energy savings. All customers are in the residential market.

Threats to validity, sources of bias and how those were addressed

CFL installations and hours of operation were self-reported by the surveyed participants. There is a potential for social desirability bias[10] but the customer has no vested interest in their reported measure adoptions, therefore this bias is expected to be minimal. There is a potential for bias in the engineering algorithms, which was minimized through the use of building energy simulation models, which are considered to be state of the art for building shell and HVAC system analysis.

[10] Social desirability bias occurs when a respondent gives a false answer due to perceived social pressure to "do the right thing."

Management Interviews

Description of the Program

The Residential Smart $aver Energy Efficiency Products (CFL) Program began in 2010 and is designed to provide qualifying Duke Energy residential customers with up to 15 CFLs that are mailed directly to the customers' homes.

Initially the program offered customers six CFLs via coupon or a business reply card. The program then expanded by increasing both the incentive size and the range of message channels. The 2011 incentive offered customers up to a maximum of 15 CFLs at one time, shipped directly to their home, and utilized a wide variety of channels, including low cost/no cost options such as toll-free interactive voice recognition (IVR) and online ordering platforms.

The 2011 program was originally test-piloted in August 2010, and was initially limited only to customers who are Duke Energy employees. The IVR number subsequently went viral as individuals posted it on web blogs, Facebook, Twitter, and other online social media (which also drove occasional television and radio reporting). This rapidly engaged the participation of Duke Energy's general public customers in September-December 2010 despite little targeted marketing of the program by Duke Energy during that time.

As the IVR went viral in the fall of 2010, the range of channels for the program expanded further. The online service account (OLS) that customers utilize for billing added a pop-up asking the customer if he/she wants free CFLs. Customers were eligible for up to 15 CFLs (minus the number redeemed from previous Duke Energy promotional campaigns), and could elect to accept fewer than the maximum if they preferred. Customers received the pop-up box only once in order to avoid annoying customers with repeated pop-ups. However, for those who chose "no thanks", the next time that they logged back in, they received a small promotional message (that can be clicked to pursue CFL offer) in the OLS advertising area.

Additional electronic channels included: a program website that enables customers to directly request CFLs, utility website promotions, Duke Energy state website promotions, Facebook advertising targeted by specific zip code areas, and email messages (for customers who previously opted in to receive email promotions). Other channels were also used to help drive traffic to the IVR and other electronic platforms. These other channels included: direct mail (customized with account number to make responding easier), bill insert promotions, marketing in some Spanish journals and magazines, and press releases. Duke used a unique URL for each message type and utilized Google Analytics to track each URL.

This program enabled customers to order on-demand and have the CFLs shipped directly to their home, and to track their order throughout the ordering/shipping process. Customers were told to allow either 4-6 weeks or 6-8 weeks for delivery, although most orders were actually delivered within 1-2 weeks.

Goals of the Program

Duke Energy's pre-launch Communication Plan for this program described the goal of this campaign as "to expand participation in the [CFL] program…[by marketing to each segment] where and how they prefer, and provide an easy way to order and receive bulbs." In other words, the overall goal was to increase CFL participation through new IVR and online ordering platforms with direct shipping to customers. Specific objectives included engaging customers who had not been previous coupon redeemers, reaching more total customers, and establishing cost-effective promotion platforms. Additionally, specific types of messages and channels were identified for particular target audiences, as outlined in Table 5.

Table 5. 2011 CFL Communication Plan Targets

Target Audience	Key Message	Channel
Budget Conscious Homeowners	Free Save money Get attention with CFL game because this segment includes a lot of online gamers	State landing page promos OLS promos Advantages of CFLs via CFL game Social media YouTube videos Blogger outreach
Sustaining Seniors	Free No risk Save money Overcome safety objections	Earned media State landing page promos OLS promos Bill message Envelope message Low income printed piece Postcard
Mainstream Families	Green message Save money	State landing page promos OLS promos Online CFL game Envelope messages Vehicle signage Blogger outreach Social Media YouTube videos
Financially Secure Traditionalists	Green message Save money	State landing page promos OLS promos Bill messages Envelope messages Postcard Vehicle signage
Financially Secure Homeowners	Green message Save money	State landing page promos OLS promos Bill messages Envelope messages Postcard Vehicle signage Searchability
Young Mobile Achievers	unspecified	Social media YouTube videos CFL game Searchability

Fulfillment

Niagara Conservation of Cedar Knolls, NJ was chosen to serve as Duke Energy's fulfillment contractor, providing a customer- and order-tracking database, bulb order processing and handling, shipping (via FedEx), and a call center for customer assistance with ordering difficulties, shipping issues, broken bulbs, and questions regarding the use of the CFLs. Niagara served in this capacity from program inception until April of 2012.

In its arrangement with Niagara, Duke Energy agreed to an initial purchase of 8 million CFLs in May of 2010 for the first round. These bulbs were to be used to fulfill customer requests from all Duke Energy CFL programs. In March of 2011, a second round of nine million bulbs was purchased. A third round of five million CFLs was placed in January of 2012.

Under the original arrangement, business reply card orders were sent to Duke Energy for processing and in turn forwarded to Niagara in batches for fulfillment within nine business days. In its early days, this process was occasionally slowed by Duke Energy's inability to quickly scan and process the BRCs[11]. Partly as a result, when the IVR and online ordering systems were incorporated, the process was streamlined and all new orders were sent directly to Niagara. The nine business day processing requirement remained in the service level agreement.

Bulb requests were compiled daily and sent to Niagara in electronic form for processing beginning the next day. Typical volume ranged from 2,000 to 20,000 customer bulb requests per day, and Niagara was required to be staffed to ensure sufficient labor for compiling the efficiency kits, which consisted of a branded cardboard box loaded with the appropriate number of CFLs, Duke Energy's marketing copy, additional collateral, and packing materials. Prior to fulfillment, all customer bulb requests were checked against the CFL tracker database to ensure customer eligibility based on the previous number of bulbs received through other Duke Energy program efforts.

Under normal operations, Duke Energy coordinated well with Niagara to ensure that the fulfillment vendor was informed in advance of new marketing efforts that were likely to increase bulb order volumes. Within normal volumes, customer orders were processed in a timely fashion. However, in late 2011, due to several factors, Niagara fell behind in bulb processing and ran out of CFLs due to supply issues from bulb manufacturers in China. As a result, no bulb orders were filled for several weeks.

Unexpectedly high numbers of CFL requests were a precipitating factor. During the week of September 4, 2011 alone, over 80,000 customers requested more than 1 million bulbs. Continued high demand during subsequent weeks added another million bulbs. This surge in demand was spurred in part by a direct mail campaign that achieved surprisingly high response rates and the viral nature of the reaction by the customers. Niagara representatives claim that they were caught off guard because they were not notified by Duke Energy in advance about the new marketing effort. Without sufficient staff to process the orders, fulfillment and shipping delays ensued. Despite the delays, customer satisfaction did not seem to be impacted since customer expectations were set for a six week delivery schedule.

[11] However, participant surveys indicate that customers were satisfied with the delivery time of the CFLs.

Customer and Order Tracking

Niagara Conservation was also the vendor responsible for developing and maintaining the database for tracking and coordinating all CFL program activity, including: the number of bulbs requested by customer, specific Duke Energy CFL program generating each request, marketing vehicle generating the request, customer address, order method, dates of order and shipment, and shipping information concerning delivery, returns, and reasons for returns. The CFL tracker system is online accessible, making order information and program reports available on demand.

The initial database developed in 2009-2010 was less ambitious than that described above, but as the program grew during 2010 Duke Energy program managers recognized the importance of collecting and managing additional fields of data. Moreover, as the program grew it also became apparent that a more robust computer system was needed to effectively handle the rapidly expanding numbers of customers being added to the database. Niagara was charged with providing the additional capabilities. After a planning phase, work on the enhanced database began in the spring of 2011 and was completed in September of 2011. While the new system has proven to be robust and effective, the timeline for its development was longer than desired.

Results and Evaluation

Overall, this program was highly successful in meeting its goals. A member of Duke Energy's program management summarized it as "working wonderfully". TecMarket Works agrees with this assessment. The IVR and online platforms have performed well and exceeded all goals for increasing CFL participation. Once established, these platforms have functioned very effectively at low/no cost. These platforms synchronize well with inventory management, and provide real-time tracking information to the customer about his/her order, and to Duke Energy regarding program performance (i.e. order files and program reports can be accessed nightly).

When the pilot first went viral, IVR was the primary mode of participation. As the OLS channel was established it drew the greatest number of participants. Nonetheless, IVR and web-based platforms, in conjunction with the other channels promoting them, have also attracted considerable participation. Together these efforts created a powerful demand for the Duke Energy CFLs.

In summary, the program has been highly successful overall and while it did experience some growing pains due to its rapid expansion, it is now running well and not experiencing any problems. Some potential areas for further improvement/expansion have been identified. For instance, Duke Energy will explore additional creative marketing ideas, perhaps adding new channels such as newspaper inserts, billboard advertisements, and possibly increased radio advertising. However, given the expansive range of channels already utilized by the current campaign, the potential impact of such additions is unclear.

Duke Energy also wants to grow the portfolio to include specialty bulbs in their promotional offer. They are currently developing a program that they intend to launch in late 2012 or early 2013. That program will offer a discount toward the purchase of CFL specialty bulbs rather than a free bulb incentive because of the higher cost of specialty CFLs. The exact discount will likely vary by type of specialty bulb, but those details are yet to be determined.

Consumer education is another area for potentially enhancing CFL acceptance and adoption. This includes explaining the new labeling, i.e., helping consumers understand the transition from wattage to lumens. Other education possibilities may include clarifying the savings benefits to the customers, as well as the overall environmental value of transitioning to CFLs. Education may also address common misconceptions about CFLs that deter adoption. Examples of common misconceptions include: no instant on, not meeting lifetime claims, not fitting some fixtures, stark color of the light, and safety issues such as risks of mercury contamination or fire.

Participant Surveys

This survey focused on customers who, according to program tracking records, completed the short survey to receive free CFLs. The survey was conducted with 215 participants online and with 149 participants via phone by TecMarket Works' staff. Of these 364 total surveys, 364 were completed with some usable responses, but some questions do not have responses so the total number of respondents for a given question may be fewer than 364.

Program Awareness

All of the customers responding to the survey (n=364) recall receiving the direct mail CFLs provided by Duke Energy. Of the 364 survey respondents, 188 were identified as living in low-income households and 176 were identified as not living in low-income (labeled as standard herein) households.

Participants were also asked to rate the influence, on a 1-to-10 scale, that various factors had on their decisions to obtain CFLs through the Duke Energy CFL program. According to those surveyed, the desire to "save on utility costs" was rated as a 9.3, making it the most influential factor in their decision to obtain CFLs via the program. "Desire to save energy" placed second with a mean influence score of 9.0. "Desire to be environmentally responsible" rounded out the top three most influential factors with a mean influence score of 8.5. The remainder of the scores for each factor is noted in Table 6.

Table 6. Factors Influencing Program Participation

	Weighted Mean Influence Score Total Population N=362
Your desire to save on utility costs	9.3
Your desire to save energy	9.0
Your desire to be environmentally responsible.	8.5
Friends or family by word of mouth	5.8
The brand of CFLs offered by the program	5.5
Duke Energy advertising on TV, Radio, or newspaper	4.9
Advertising on Duke Energy's Web site	4.1
Other non-Duke Energy advertising	3.6
Friends or family by email	3.2
Duke Energy advertising on social media sites such as Facebook	2.4
Friends or family by social media such as Facebook	2.3
Someone you don't know personally or a group that you follow on Facebook or Twitter	2.0

Figure 1 below compares influence ratings by income group. With an average score of 9.3, low income participants rated "Desire to save on utility costs" one tenth of a point higher than standard income participants did (9.2). Two tenths of a point difference was all that separated their ratings for "Desire to save energy," which they scored 9.1 and 8.9 respectively. None of the factors showed a mean influence rating with more than two tenths of a point difference between income groups. These differences are not statically significant.

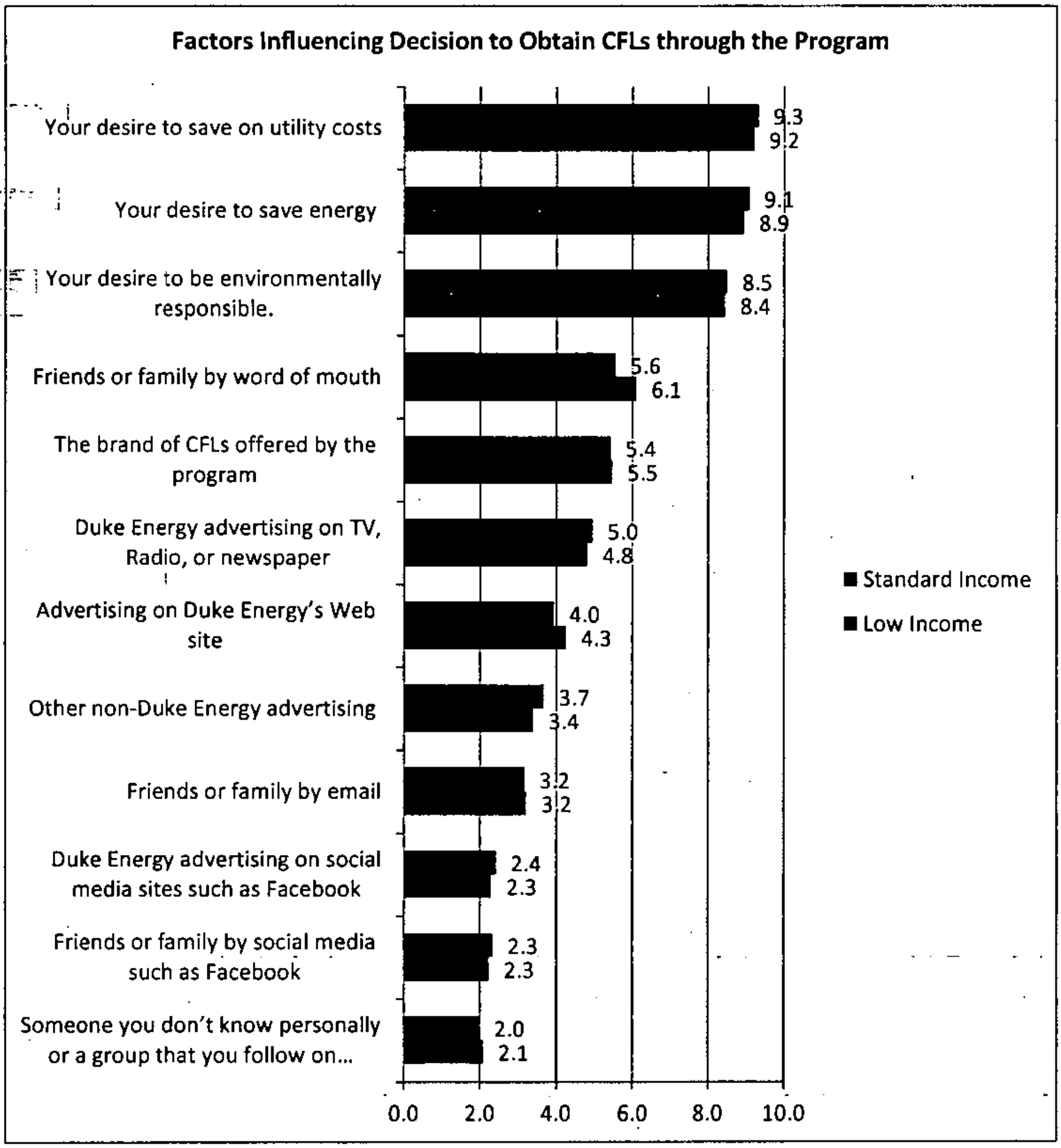


Figure 1. Mean Influence Score of Factors Influencing Decision to Obtain CFLs through the Program

Participants were asked to rate, on a 1-to-10 scale, the influence several categories of advertising on their awareness of the Duke Energy CFL direct mail program. These categories included:

- Duke Energy advertising on TV, radio or in a newspaper
- Duke Energy Web Site advertising
- Duke Energy social media advertising
- In-store advertising
- Other advertising
- Friends and family by word of mouth

- Friends and family by email
- Friends and family by social media
- A public person or group followed on Twitter or Facebook

According to participants, and regardless of income level, Duke Energy's print advertising was the most influential component that created awareness of the CFL program. Word of mouth from friends and family and the Duke Energy Web Site were also cited as having some influence on awareness. The results are shown in Table 7.

Table 7. Factors Influencing Awareness of CFL Direct Mail Program

Category	Low Income participants (N=178)		Standard Participants (N=171)		All survey respondents (N=349)	
	N	%	N	%	N	Weighted %
Advertisement in my bill	47	26.4%	51	29.8%	98	28.3%
Brochure in the mail	43	24.2%	47	27.5%	90	26.1%
Friends/Family	35	19.7%	26	15.2%	61	17.1%
Duke Energy Web Site	34	19.1%	23	13.5%	57	15.9%
Paperless Billing Email	4	2.3%	8	4.7%	12	3.7%
Other Email	4	2.3%	4	2.3%	8	2.3%
Email from family/friend	3	1.7%	3	1.8%	6	1.8%
Other: Unspecified	4	1.9%	2	1.2%	6	1.5%
Television	3	1.7%	2	1.2%	5	1.4%
Email from Duke Energy Employee	0	-	3	1.8%	3	1.0%
Social Media	0	-	1	0.6%	1	0.3%
Other Web Site	0	-	1	0.6%	1	0.3%
Community Action or Local Assistance Agency	0	-	1	0.6%	1	0.3%

Order Completion Success Rate

TecMarket Works asked all participants (n=364) which of the following five statements best described the level of success they had in completing their CFL order:

- Successful at placing order on first attempt
- Had to make more than one attempt using the same method
- Had to make more than one attempt using different methods
- Don't remember
- Other

Almost all participants (weighted mean of 98.2%) were successful at placing their order on the first attempt. Those participants who indicated that they had made more than one attempt using different methods (n=5) were asked which methods they had used. All five respondents made one attempt via the toll-free number. Three participants made another attempt via mail-in cards, one made another attempt via the Web, and one participant made an attempt through a Duke Energy employee.

The participant who answered "other" to the order completion question attempted an order online but never received any CFLs from the direct mail program.

Reasons for Participation

Phone survey participants were asked an open-ended question to give all the reasons that made them decide to take advantage of the CFL offer from Duke Energy. Web survey participants were asked to either choose the reason or reasons for participation from a list, or to enter a reason that was not provided.

All answers were codified into the following categories:

- Needed light bulbs
- To save energy
- To save money
- Because it was free
- To try CFLs
- It was environmentally correct
- Convenience
- CFL last longer than standard bulbs
- Other

The distribution of answers is shown in Table 8 in order of most to least frequently mentioned reasons. The desire to save money and energy were by far the most cited reasons for participating in the CFL direct mail program.

Table 8. Reasons for Participation in the CFL Direct Mail Program

Category	Low Income participants (N=188)		Standard Participants (N=176)		All survey respondents (N=364)	
	N	%	N	%	N	Weighted %
To save energy	90	48.1%	96	54.5%	188	51.8%
To save money	86	46.0%	88	50.0%	175	48.3%
Because it was free	69	36.9%	71	40.3%	141	38.8%
CFLs last longer	49	26.2%	47	26.7%	97	26.5%
To try CFL	53	28.3%	44	25.0%	98	26.4%
Convenience	41	21.9%	40	22.7%	82	22.4%
It was environmentally correct	36	19.3%	43	24.4%	80	22.2%
Needed light bulbs	25	13.4%	19	10.8%	44	11.9%
Other	16	8.6%	24	13.6%	40	11.5%

Note: Participants were allowed multiple responses

Participants Promoting the Program

TecMarket Works surveyed 364 program participants to determine if they had told anyone about the CFL program and, if so, how many people they told and how they told them. As shown in Table 9, 85% reported telling others about the program. Not surprisingly, this percentage corresponded closely within the low income group (89%), as well as with the standard income group (82%).

Table 9. Participants who Told Others About the Program

Did you tell others about the CFL program?	Total Population		Low Income		Standard	
	N	Weighted %	N	%	N	%
Yes	308	85%	164	89%	144	82%
No	56	15%	21	11%	31	18%
Don't Know	0	0	0	0	0	0

When asked with whom they had spoken, 65% of all respondents (235) indicated that they had spoken with one or more family members about the program. Family members were also the most frequently mentioned audience group among low income participants (70%) and standard income participants (60%). For all three of these income categories friends ranked as the second most common audience, while co-workers ranked third. However, participants in all three income categories told fewer than half as many co-workers about the program as they did family members or friends. Table 10 illustrates a comparison of these groups and their respective number of conversations.

Table 10. Type and Number of People Told About the CFL Program

Did you tell others about the CFL program?	Low Income		Standard Income		Total Population	
	# of Participants	# of People Told	# of Participants	# of People Told	# of Participants	# of People Told
Family	129	308	106	342	235	559
Friends	107	340	106	251	213	862
Co-Workers	45	109	61	169	106	278
Neighbors	49	147	35	79	84	226
Other	11	70	7	0	18	70

Note: Survey participants were allowed multiple responses

As seen in Table 11, among all income categories, word of mouth was the most prevalent means of communication with email coming in second and various forms of social media, such as Facebook, Twitter and website forums coming in a distant last.

Table 11. Methods of Communication About the Program

	Word of mouth	Email	Facebook	Twitter	Web site forum	Other
Total Population	297	37	7	1	3	3

Low Income	159	16	1	0	2	2
Standard	138	21	6	1	1	1

Perception of Reasons for the Program

TecMarket Works asked participants to state the reason or reasons why they believe that Duke Energy is providing free CFLs to its customers. All answers given are summarized below.

Table 12. Reasons Customers Believe Duke Energy Provides Free CFLs

Reason	Percent of Participants (N=175)		Percent of Low-Income Participants (N=184)		All Surveyed Participants (n=364)	
	N	%	N	%	N	Weighted %
Duke Energy wants to save energy for environmental reasons	58	33.1%	59	32.1%	117	32.7%
Duke Energy wants to save energy/reduce electrical demand	51	29.1%	57	31.0%	108	29.9%
Duke Energy wants to save their customers money	40	22.9%	46	25.0%	86	23.8%
Duke Energy wants to look good	21	12.0%	21	11.4%	42	11.7%
To help customers use more or "get used to" CFLs	12	6.9%	7	3.8%	19	5.6%
To raise awareness of energy efficiency	5	2.9%	5	2.7%	10	2.8%
The government is forcing Duke Energy to do it	5	2.9%	4	2.2%	9	2.6%
Duke Energy is trying to educate people	1	0.6%	5	2.7%	6	1.5%
To avoid building new power plants	2	1.1%	2	1.1%	4	1.1%
Kick-back from GE	-	-	2	1.1%	2	0.5%
To make it easier to raise rates	1	0.6%	-	-	1	0.3%

Prior CFL Use

All survey respondents were asked how long they had been using CFLs before receiving CFLs from the Duke Energy direct mail program. Responses included:

- Never purchased until now
- 1 year or less
- 1-2 years
- 2-3 year
- 3-4 years
- 4 or more years

As seen in Table 13 below, 22.5% of all direct mail CFL program participants in the Carolina system indicate that they have purchased CFLs in the past two years or less and 57.4% of all participants indicate that this is their first purchase of CFLs. A minority of participants, or just over 42% (42.6%) of all participants, say that they have ever purchased a CFL. This data suggests that CFL saturation was low within the direct mail CFL participant population prior to the use of the Duke Energy CFL program. It also indicates that the direct mail CFL program in the Carolina system is doing an excellent job of targeting participants with little or no prior CFL use.

Table 13. Time Since First Purchase of CFLs

	Never purchased until now	1 year or less	1-2 Years	2-3 Years	3-4 Years	4 or more years
Low Income Participants, n=187	58.3%	11.8%	9.6%	10.7%	1.6%	8.0%
Standard Participants, n=176	56.8%	10.8%	12.5%	8.5%	5.1%	6.3%
All Survey Respondents, Weighted Percent n=363	57.4%	11.2%	11.3%	9.4%	3.6%	7.0%

Eligible Number of CFLs vs. Number CFLs Ordered

Five of the surveyed low income participants (3.0%) and 4 of the surveyed standard participants (2.3%) reported that they did not order all of the CFLs that they were eligible to receive through the direct mail CFL program (weighted mean of 2.6%). Four respondents gave reasons why they did not order all the bulbs they were eligible to receive. Three respondents indicated that they did not need the full amount of CFLs at the time of ordering and one respondent indicated that he or she was disappointed that the CFLs offered were not manufactured in the United States (note: no CFLs of this type are manufactured in the United States).

Program CFL Self-Reported Installation

TecMarket Works asked all participant survey respondents how many CFLs were currently installed that had been obtained through the CFL Direct Mail program. Three-hundred fifty (350) of 364 participants reported that 2,671 program CFLs were currently installed for a weighted mean of 7.4 installed CFLs per all surveyed participants. One-hundred seventy-seven (177) low income participants installed an average of 7.1 CFLs, and 173 standard participants installed an average of 7.6 CFLs.

Program CFL Removal

Of the 350 participants who had installed program CFLs, 71 respondents (weighted mean of 19.9%[12]) indicated that they had subsequently removed at least one program CFL from a working socket. Sixty-one (61) respondents gave specific reasons for their removal of program CFLs: 56 respondents removed program CFLs that had burned out, 4 respondents removed program CFLs for aesthetic reasons, and 1 respondent removed a CFL that was too slow to start.

CFL Order Tracking System

[12] 17.7% of Low Income; 21.6% of Standard.

TecMarket Works asked all survey respondents that ordered their CFLs online if they were aware of the direct mail program's online order tracking tool which allows participants the option to check their CFL order status. A weighted mean of 32.6% of these respondents indicated that they were aware of the order tracking tool. Six of the 33 low-income respondents (18%) that were aware of the tool used it to track their order. Seven of the 32 standard participants (29.9%) aware of the tracking tool used it. The respondents who reported using the system were asked to rate their satisfaction with the system on a 1-to-10 point scale with 1 indicating Very Unsatisfied and 10 indicating Very Satisfied. The mean weighted satisfaction rating for the online tracking tool is 9.2 and no respondents gave a satisfaction score of less than 8.

The online order tracking system has a low awareness rate and a very low participation rate. While the mean satisfaction rating for the tracking system is very high among users, the low participation rate of those ordering their bulbs online, even among those aware of the tool, indicates that a large majority of respondents do not currently find it to be a useful part of the CFL direct mail program in the Carolina system.

Likelihood of Future CFL Behaviors

TecMarket Works asked survey respondents to rate their likelihood, on a 1-to-10 scale, of continuing to use CFLs, of replacing any bulb with a CFL, and of telling friends or family about the CFL program. The results are stratified by income group and shown in Figure 2.

Table 14. Mean Ratings of Likelihood of Three Behaviors Across All Participants

	N	Weighted Mean Rating
Likelihood to continue to use CFLs	362	9.0
Likelihood to replace bulb with CFL	363	8.9
Likelihood to tell friends/family	364	8.9

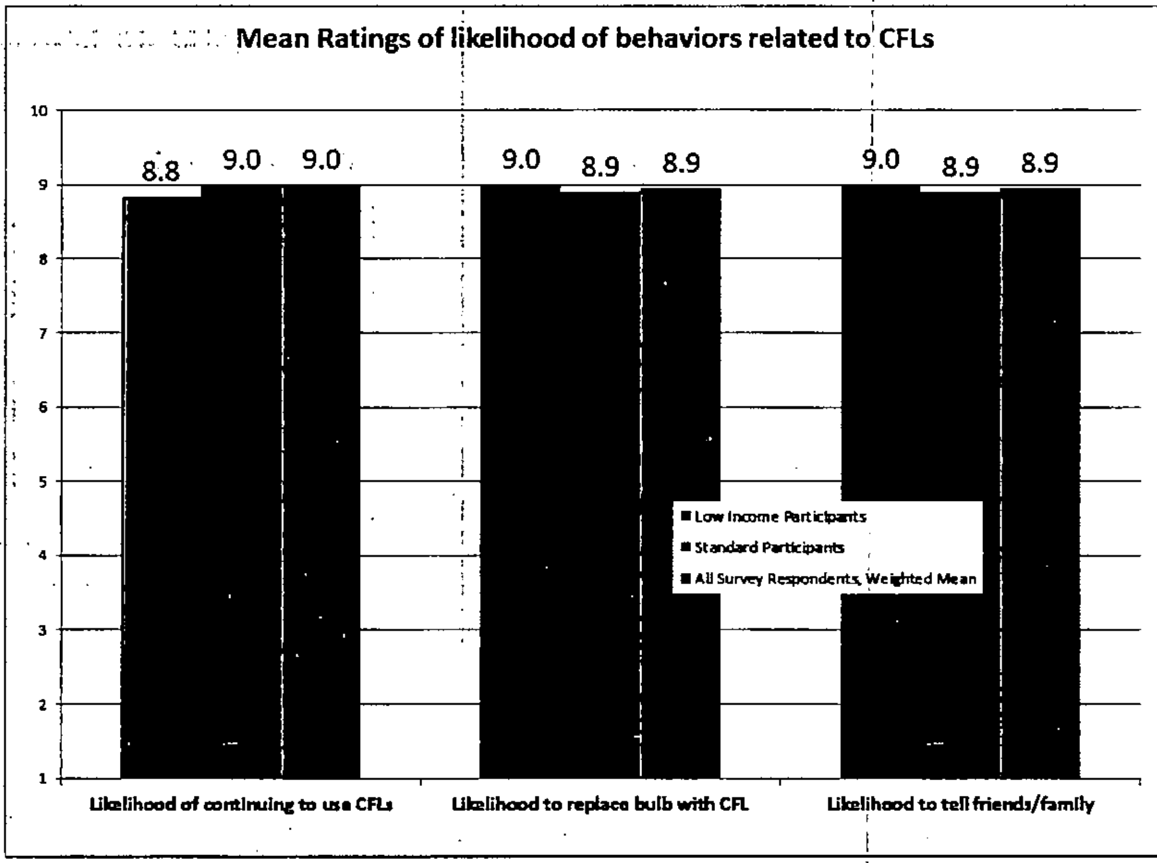


Figure 2. Mean Ratings of Likelihood of Future Behaviors Regarding CFLs by Respondents

Survey respondents were also asked to estimate the number of bulbs in their house that were not CFLs, and how many of those bulbs are used for more than two hours per day. The results are shown in Table 15.

Table 15. Estimated Number of Sockets Available in Homes

	Low Income Participants (n=187)	Standard Participants (n=177)	All survey respondents, Weighted Value (n=364)
Average number of bulbs in house not CFLs	9.43	11.1	10.39
Average number used more than 2 hours per day	3.55	4.12	3.88

Future CFL Purchases

TecMarket Works asked survey respondents to consider their future CFL purchases and identify how many CFLs they would expect to purchase in the next year if CFLs were offered at a certain price compared to a standard (incandescent) bulb. The prices offered were:

- The same price as a standard bulb
- $1 more than a standard bulb
- $2 more than a standard bulb
- $3 more than a standard bulb

Table 16 shows the number of CFLs that survey respondents would purchase as the bulbs increase in price. As expected, the general trend is toward purchasing fewer CFLs as they become more expensive. Table 17 presents the data by percentage of surveyed participants indicating the number of CFLs they would purchase under various pricing scenarios.

Table 16. Number of CFLs Purchased at Different Price Points by Income Group (n=347)

Income Group	Number of CFLs	Standard Incandescent Price	$1 More	$2 More	$3 More
Low Income	None	12	24	55	89
	1 to 3	16	28	49	42
	4 to 6	68	68	54	39
	7 to 9	27	22	10	2
	10 to 12	41	29	8	5
	13 or more	14	7	2	1
Standard	None	17	31	66	78
	1 to 3	18	28	30	47
	4 to 6	62	66	44	26
	7 to 9	22	22	15	10
	10 to 12	35	13	6	3
	13 or more	15	6	3	2
Population Total	None	29	55	121	167
	1 to 3	34	56	79	89
	4 to 6	130	134	98	65
	7 to 9	49	44	25	12
	10 to 12	76	42	14	8
	13 or more	29	13	5	3

Table 17. Percent of Customers that would Purchase CFLs at Different Price Points by Income Group (n=347)

Income Group	Number of CFLs	Standard Incandescent Price	$1 More	$2 More	$3 More

Low Income	None	6.7%	13.5%	30.9%	50.0%
	1 to 3	9.0%	15.7%	27.5%	23.6%
	4 to 6	38.2%	38.2%	30.3%	21.9%
	7 to 9	15.2%	12.4%	5.6%	1.1%
	10 to 12	23.0%	16.3%	4.5%	2.8%
	13 or more	7.9%	3.9%	1.1%	0.6%
Standard	None	10.1%	18.7%	40.2%	47.0%
	1 to 3	10.7%	16.9%	18.3%	28.3%
	4 to 6	36.7%	39.8%	26.8%	15.7%
	7 to 9	13.0%	13.3%	9.1%	6.0%
	10 to 12	20.7%	7.8%	3.7%	1.8%
	13 or more	8.9%	3.6%	1.8%	1.2%
Population Total, Weighted Percent	None	8.7%	16.5%	36.3%	48.3%
	1 to 3	9.9%	16.4%	22.2%	26.3%
	4 to 6	37.3%	39.1%	28.3%	18.3%
	7 to 9	13.9%	12.9%	7.7%	4.0%
	10 to 12	21.7%	11.4%	4.0%	2.2%
	13 or more	8.4%	3.7%	1.5%	0.9%

Light Bulb Characteristics

Surveyed participants were asked to rate the importance of specific bulb characteristics when making their bulb purchasing decisions. The results of these importance ratings are shown in Table 18. Responses were provided on a one to ten scale, where one is not at all important and ten is very important.

Table 18. Importance of Bulb Characteristics When Purchasing Bulbs

Bulb Characteristic	N	Low Income	Standard	Population, Weighted Average
Cost savings on your utility bill	364	9.5	9.4	9.4
Energy Savings	363	9.4	9.3	9.3
Selection of wattage and light output levels available	364	9.0	8.9	8.9
Availability of the bulb in stores you normally shop	360	8.6	8.7	8.7
Purchase price of the bulb	361	8.8	8.6	8.7
Availability of utility programs or services that offer	361	8.3	8.2	8.2
Ease of bulb disposal	359	8.4	8.4	8.4
Speed at which the bulb comes up to full lighting level	363	7.6	7.4	7.5
Recommendations from the utility company	364	7.7	7.4	7.5
Mercury content of the bulb	351	7.6	7.2	7.4
Recommendations from family and friends	363	7.3	6.8	7.0
Ability to dim the lighting level	362	6.2	6.4	6.3
Attractiveness or appearance of the bulb	364	6.3	6.3	6.3

Interestingly, the "Selection of wattage and light output levels available" (8.9 average) and the "Availability of the bulb in stores you normally shop" (8.7 average) were rated higher than or just as high as the "Purchase price of the bulb" (8.7 average). The two highest rated factors were "Energy savings" (9.3 average) and "Cost savings on your utility bill" (9.4 average). Factors often perceived as barriers to CFL adoption, such as aesthetics (6.3 average), mercury content (7.4 average), and availability of dimmable bulbs (6.3 average), were among the lowest rated categories. A graphical representation in ascending order of importance can be seen in Figure 3.

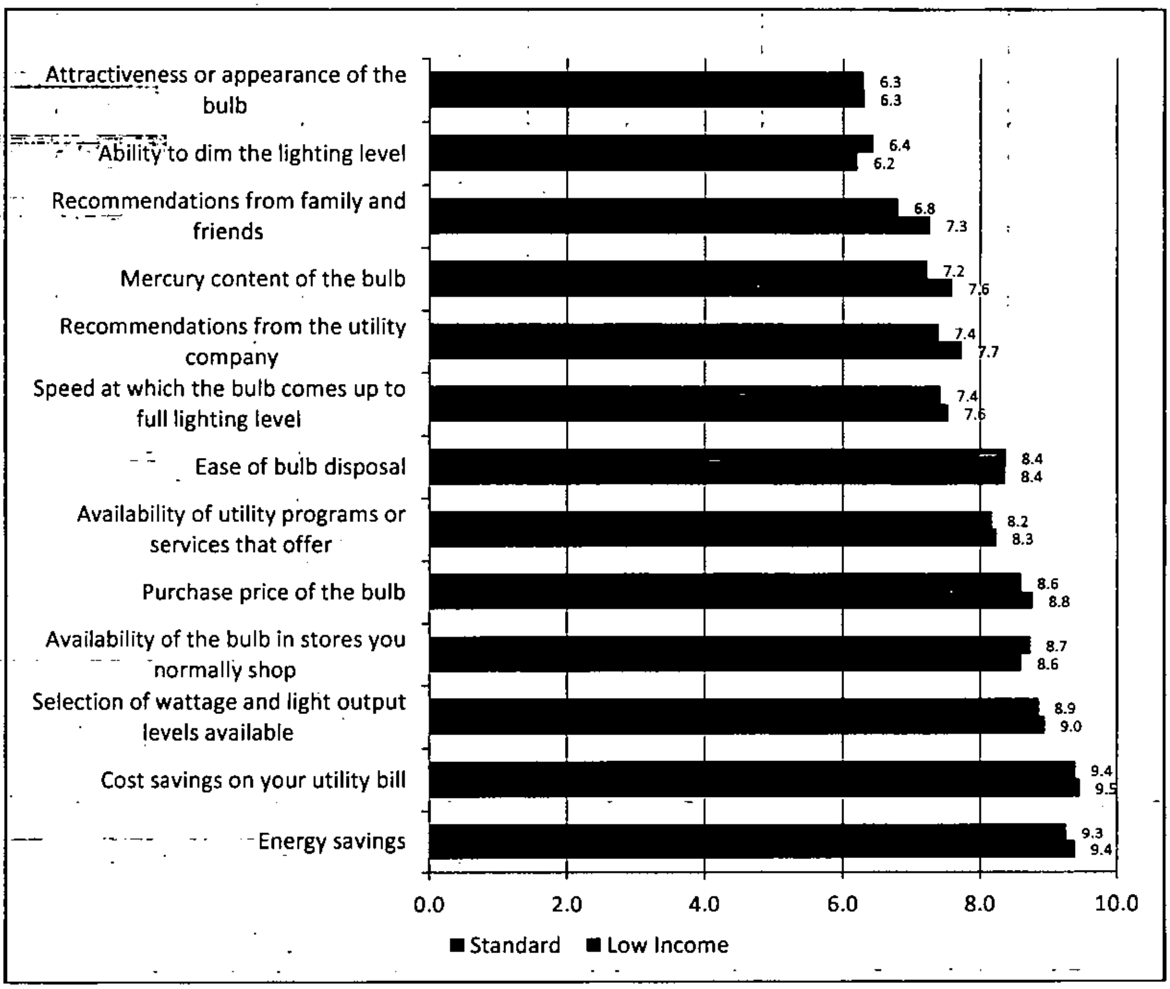


Figure 3. Importance of Bulb Characteristics by Income Group

Figure 4 shows a graphical comparison of the importance of the various bulb characteristics for the participant and non-participant populations. Participants rated all but three of the characteristics higher in importance than their non-participant counterparts.

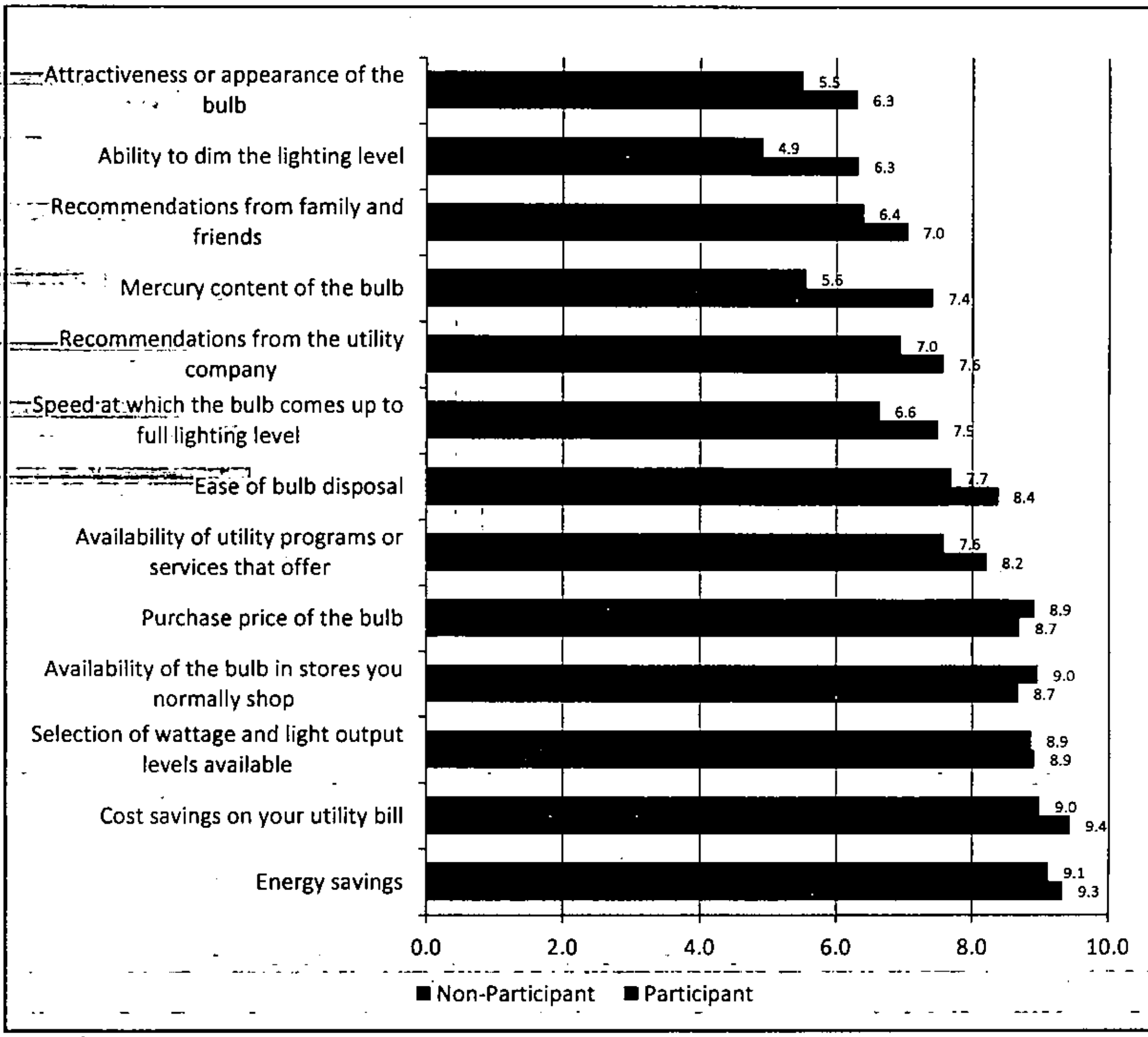


Figure 4. Importance of Bulb Characteristics, Participants vs. Non-Participants

Participant Satisfaction

Overall program and CFL satisfaction levels are very high, and overall Duke Energy satisfaction is high.

Participants were asked to rate their satisfaction, on a 1-to-10 scale on a variety of program attributes: the ease of ordering their CFLs (weighted mean =9.5), the delivery time of the CFLs (weighted mean=9.3), the light quality of the CFLs obtained (weighted mean=8.6), the overall quality of the CFLs obtained through the CFL program (weighted mean =9.0), and the overall satisfaction with the CFL direct mail program (weighted mean=9.7). The satisfaction means, stratified by income type, are shown in Figure 5.

Participants who rated their satisfaction for any category at a seven or lower were also asked a follow-up question as to the reason for their satisfaction level. These reasons are listed following each distribution.

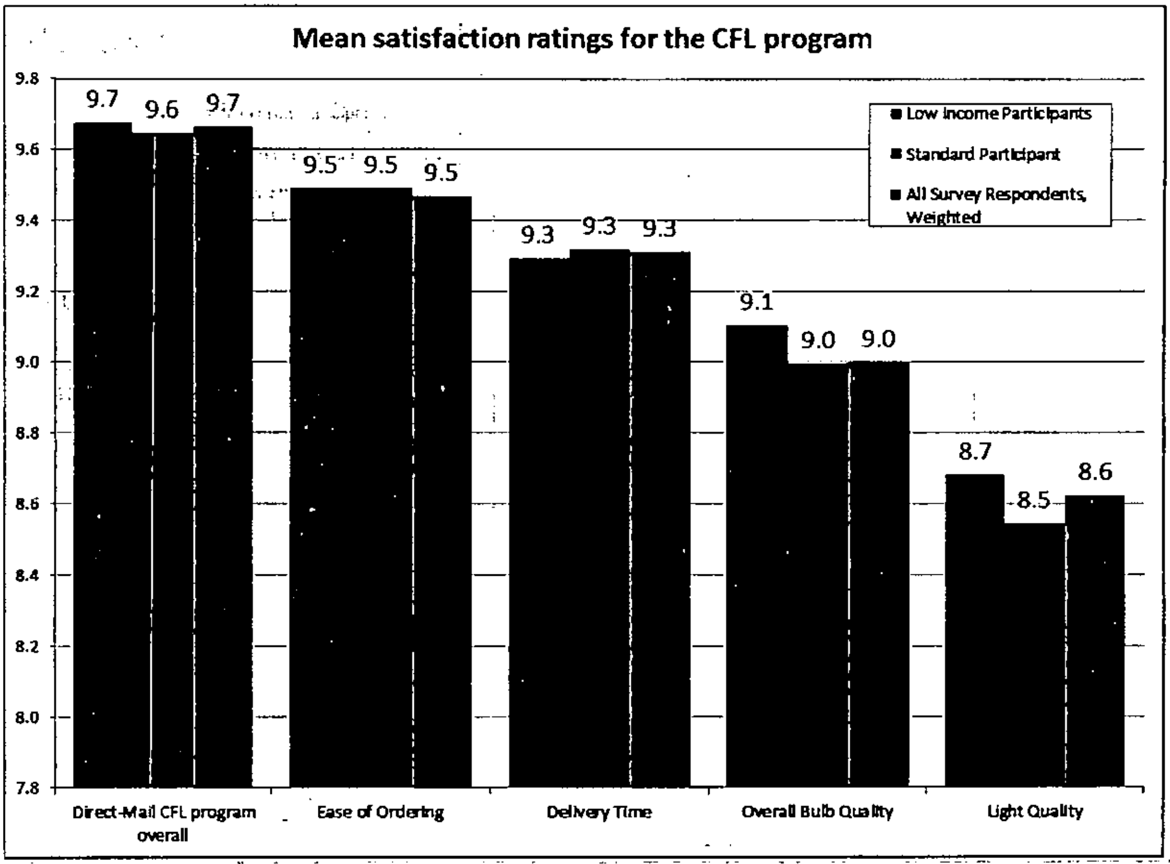


Figure 5. Mean Satisfaction Ratings for CFL Direct Mail Program

Reasons for ratings of seven or less for "Ease of Ordering":

- "The method to order the light bulbs was easy but I had to repeatedly dial the number because it was not working properly."
- "A score of 6 is not less than satisfied."

Reasons for ratings of seven or less for "Overall Bulb Quality":

- "Bulb not bright enough" (n=10)
- "Bulb burned out too quickly" (n=4)

Reasons for ratings of seven or less for "Quality of the CFLs":

- "Bulb too dim" (n=27)
- "Takes too long to warm up" (n=5)
- "Prefer the color of an incandescent bulb" (n=4)

Reasons for ratings of seven or less for "CFL Delivery Time":

- "Took too long" (n=5)
- "Took several weeks" (n=3)
- "I never received my bulbs" (n=2)

Participants were also asked to rate, on a 1-to-10 scale, their satisfaction with Duke Energy overall (weighted mean=8.6). Mean ratings stratified by income type are show in Figure 6.

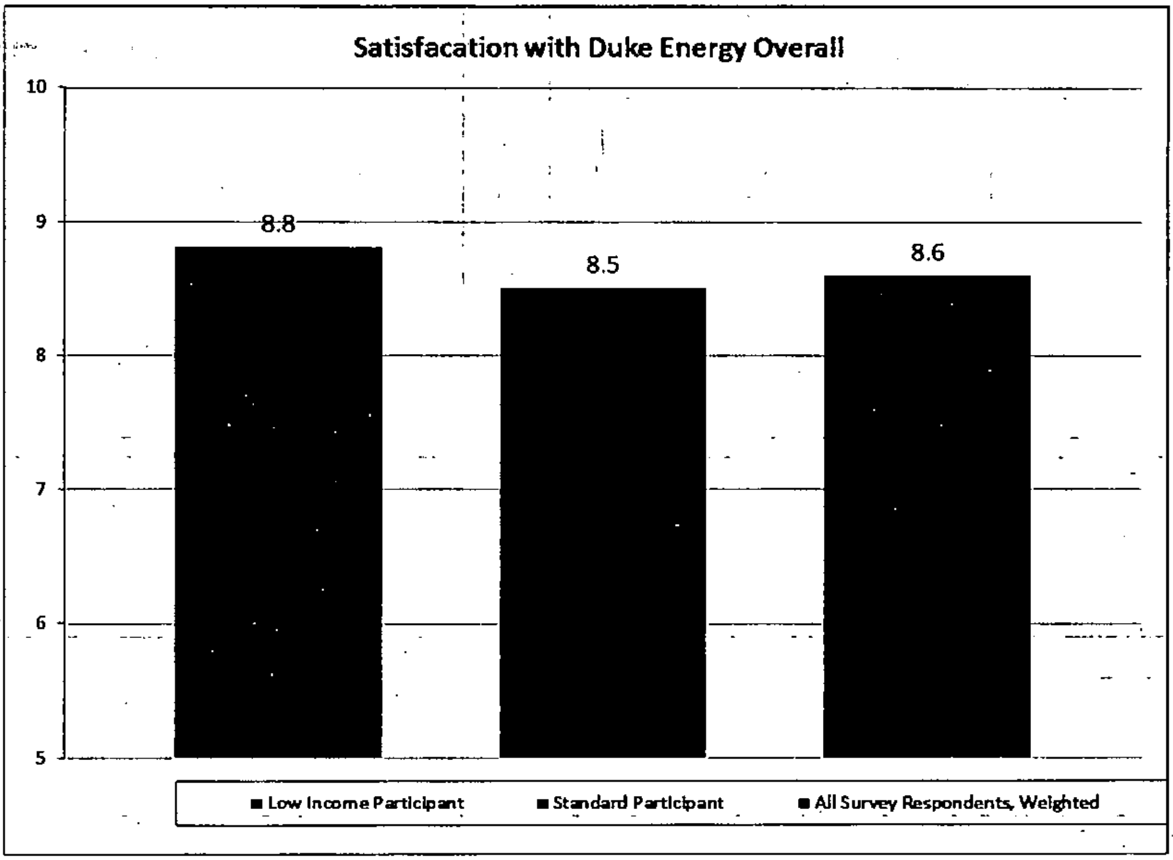


Figure 6. Duke Energy Mean Satisfaction

Reasons for ratings of seven or less for "Duke Energy Overall":

- "Duke Energy's electricity rates are too high" (n=55)
- "Need better tree trimming" (n=2)
- "Outages take too long to address" (n=2)
- "The billing system needs to be simplified for people with multiple properties"
- "Online payment system needs to be more user friendly"

Participants were asked what they liked most about the CFL program, and provided the following responses. Participants overwhelmingly liked that the CFLs were free.

Low-Income Participants

- They are free (n=51)
- Opportunity to try CFLs for free (n=41)
- Ease of ordering (n=35)
- Convenience (n=29)
- Quick delivery (n=21)
- Saving energy and money (n=12)
- Better for the environment (n=4)
- Educational about CFLs
- Duke's concern for customers
- I like CFLs
- CFLs are long-lasting
- This survey

Standard Participants

- They are free (n=34)
- Ease of ordering (n=32)
- Convenience (n=25)
- It was easy, free and convenient (n=25)
- Opportunity to try CFLs for free (n=22)
- Quick delivery (n=11)
- Saving energy and money (n=12)
- Duke's concern for customers (n=6)
- Better for the environment (n=2)
- I like CFLs (n=1)
- Educational about CFLs (n=1)
- I like the quality of the CFLs (n=1)

Participants were asked what they liked least about the CFL program, and provided the following responses.

Low-Income Participants

- Limited choice of bulb wattage and types (n=12)
- I did not receive enough bulbs (n=9)
- It took too long to receive the bulbs (n=8)
- Bulbs burned out soon after installing (n=3)
- All bulbs were the same wattage
- Dimmable bulbs not offered
- I didn't receive any instructions on how to safely dispose of CFLs
- I do not like quality of the light
- I don't want to have CFLs delivered when I do not need them
- LEDs not offered
- Mailman left the box on the porch with no notice of delivery

- I prefer manufacturers' coupons
- There is a short window for ordering the CFLs
- The rumors about them catching on fire quickly

Standard Participants

- Limited choice of bulb wattage and types (n=5)
- The poor quality of the CFLs. (n=5)
- It took too long to receive the bulbs (n=5)
- The CFLs are too dim (n=4)
- The program was not publicized well (n=3)
- Bulbs burned out soon after installing (n=3)
- I didn't receive any instructions on how to safely dispose of CFLs (n=2)
- I did not receive enough bulbs (n=2)
- Bulbs take too long to warm up
- Fire risk of CFLs
- I have not received the bulbs
- Too much cardboard used in packing the bulbs
- I had problems with my second order. I couldn't find anyone at Duke who would be able to track down the problem.
- That there may be a catch down the road
- The process of calling in for bulbs was automated and it rejected my order numerous times before it went through
- Taking this survey
- They mailed out a variety of sizes but I am unable to use half of them because the wattages are too high
- To be perfectly honest, I would have liked it much better if you sent the old, traditional bulbs

Participation and Interest in Other Duke Energy Programs

TecMarket Works asked the CFL participants if they were participants of any of the following Duke Energy programs.

- Online Services
- Power Manager®
- Home Energy House Call
- Home Energy Comparison Report
- Personalized Energy Report
- Residential Smart $aver®

We also asked what their level of interest is in other Duke Energy programs (after providing a brief description of the program[13]) on a 1-to-10 scale with 1 indicating "not at all interested" and 10 indicating "very interested".

The most commonly reported program they have participated in was "Online Services" which is a variation of the Personalized Energy Report in which customers can log into their Duke Energy accounts online and complete a survey about their home to receive recommendations for energy efficiency improvements that they can make. However, it should be noted that many of these customers may not have been aware of the survey and the report (and free CFLs) that they would receive for completing the survey, and instead believed that having on online account with Duke Energy meant the same thing as completing the survey and being a participant in the program.

With the similarity of the Personalized Energy Report and Online Services, we did not ask about their interest in Online Services.

As presented in Table 19 below, participants of the CFL program typically are not participating in other Duke Energy programs, and have only a mild interest in them.

Table 19.Participant and Interest in Other Duke Energy Programs

Program	Number Low-Income Participants Indicating Participation	Number Standard Participants Indicating Participation	Weighted Percent Indicating Participation (n=364)	Weighted Mean Level of Interest in Program's Offerings
Online Services	38	39	21.3%	N/A
Power Manager	15	15	8.3%	4.7
Home Energy House Call	6	15	6.2%	6.1
Home Energy Comparison Report[14]	10	8	4.9%	5.8
Personalized Energy Report	10	8	4.9%	5.7
Residential Smart $aver	6	10	4.6%	6.4

Redeemers were asked what other services Duke Energy could provide to help them improve their energy efficiency. The verbatim responses are below. Not all of the responses are about energy efficiency, but are included here for completeness.

Low-Income Responses

- Lower energy rates (n=5)
- Rebates for energy efficient items (n=4)
- Weatherization and insulation programs (n=4)
- Assistance for low-income customers (n=3)
- Solar panel program (n=3)
- Education about saving energy (n=2)
- Home energy inspection (n=2)

[13] Please see questions 78a-78e in Appendix B: Participant Survey Instrument for the program descriptions provided to the customers.
[14] This program is now named "My Home Energy Report".

- Newsletter (n=2)
- Duke could put more information on its website (n=2)
- Work with landlords (n=2)
- A way to easily turn off energy "Vampires"
- Assistance for the disabled
- Discount program for purchase of programmable thermostats
- Duke should have database of disabled and elderly customers for repair priority
- Encourage motion-sensing switches
- Financing for energy efficient projects
- Information on new EE products
- Infrared scans and air flow analysis
- Keep the power on
- Discount or free LEDs
- Make paying by phone more accessible
- Duke could provide more detailed information about heating and cooling systems, investment costs versus savings, etc.
- More free CFLs
- More tree trimming to prevent power outages
- None; it is individuals' responsibility to change behavior if they want to conserve energy
- Tell us when you are coming to check our meters if you even check them so we can place our pets inside. (I am extremely angry about losing my dog.) Replace my old meter with a new one, and place it outside my fence
- Duke should use a Smart Grid and allow me to monitor my energy usage either online or with my smartphone
- Duke should keep streetlights on 24 hours by the junkyard
- Teach kids to conserve energy, via TV ads or classroom presentations
- Tips for apartment dwellers

Standard Participant Responses

- Lower rates (n=11)
- Solar panels (n=7)
- Education about saving energy (n=3)
- Tips for apartment dwellers (n=3)
- Credit for lowering power usage (n=2)
- Rebates for energy-efficient devices (n=2)
- Weatherization and insulation programs (n=2)
- Duke could offer a trade-in program. Customers would bring in incandescents to get CFLs. Offer a program for residential customers to encourage smoothed-out use of energy across 24-hour day, similar to programs available to businesses (incentives to run programmable dishwashers, washers at non-peak hours). Solar hot water heaters (as in Greece). More detailed information on appliances on cost per hour of use - real time energy use meters.
- A way to easily turn of energy "Vampires"
- Alternative energy sources

- Duke should have a better way to alert homeowners when the power is going to be off. It needs to be easier to call Duke and get through to personnel, especially in winter.
- Duke could call customers to discuss appliance usage, and heating and cooling usage. (I had a spike of usage and Duke called to ask questions about it.)
- Duke could explain the cost and benefits over time of Energy Star Appliances, light bulbs, etc. I would like to know at what point I make my money back for buying something more expensive.
- Duke could offer deductions on bills. Bills are going up and people's income is not. Duke is making a huge profit already.
- Discount program for purchase of programmable thermostats
- Discounts for preferred customers
- Duke could distribute blankets and wraps for water heaters and pipes.
- Duke could have an e-newsletter reminding customers of energy saving tips.
- Duke could offer free insulation materials.
- Duke could help with insulation analysis, expert advice, material savings similar to CFLs and help with costs of installation. This is last big area I can improve on.
- Duke could hold meetings where people from the community could come and talk about how they save energy and compare their methods with others.
- Duke could provide information about energy use, tips, suggestions, on the bill, not just with the bill. The information should be displayed in a spot on the bill where people would see it. Attachments included with bills are perceived as junk mail and are not read. They just get thrown out.
- Discount or free LEDs
- Assistance for seniors
- Sign up for energy-efficiency tips mailings
- Duke could offer a program in which customers trade old bulbs for CFLs
- I'd like to know how an instant hot water heater compares to a standard one
- Work with landlords
- I would like to see comparable year-to-date energy usage statistics with my bill
- Duke could offer public charging posts for golf carts and electric cars

Interest in Specialty CFLs

Surveyed participants were asked to list the number of bulbs currently installed in their homes that are specialty bulbs. As a follow-up to that question, they were asked how many of the specialty bulbs are CFLs. The results are summarized in Table 20. There are a total of 4,279 specialty bulbs of various types installed in the homes of surveyed participants. Of these, 2,234 (52%) are located in standard households. The majority of specialty bulbs are non-CFLs, 3,482 (18.6%) across the entire surveyed population. Of these 797 specialty CFLs, 437 (55%) are from the standard income group.

Table 20. Currently Installed Specialty Bulbs and CFLs

Bulb Type	Low Income, n=181		Standard, n=175		Population Total	
	Total	CFL	Total	CFL	Total	CFL
Dimmable	320	39	372	102	692	141

Outdoor flood	347	48	424	57	771	105
Three-way	199	55	197	58	396	113
Spotlight	152	34	234	36	386	70
Recessed	323	61	313	51	636	112
Candelabra	583	83	522	86	1105	169
*Other	121	40	172	47	293	87
TOTAL	2045	360	2234	437	4279	797

When surveyed participants were asked to rate their interest in Duke Energy providing a direct mail specialty CFL program, their responses had a weighted average of 7.87 on a scale from one to ten, where one indicated no interest and ten indicated great interest. Low income and standard survey respondents were similarly interested in the proposition, as can be seen in Table 21.

Table 21. Interest in Specialty CFL Program by Income Group (n=360)

Low Income	Standard	Weighted Population Average
7.9	7.8	7.87

After providing a rating of their general interest in specialty CFL programs, respondents were asked to indicate their interest in receiving specific types of specialty bulbs if they were to be offered in the future. As a follow-up, if they were interested, they were asked to include an estimate of how many hours per day they would use the bulb. Their responses are summarized in Table 22. Of the surveyed participants, the highest level of interest was in dimmable CFLs, and surveyed participants indicated that these bulbs would be used just over 3 hours a day, on average. The lowest level of interest was in spotlight CFLs, and they also would be used the least hours per day (3.01 hours, weighted mean).

Table 22. Interest in Specific Specialty CFLs by Income Group (n=364)

Bulb Type	Low Income, n=188		Standard, n=176		Population Total	
	Percent Interested	Mean Hours of Use	Percent Interested	Mean Hours of Use	Weighted Percent Interested	Weighted Hours of Use
Dimmable	42.6%	3.42	83.5%	2.97	66.2%	3.16
Outdoor flood	52.1%	2.56	60.8%	3.48	57.1%	3.09
Three-way	68.1%	4.07	56.3%	3.95	61.3%	4.00
Spotlight	24.5%	2.93	37.5%	3.06	32.0%	3.01
Candelabra	38.8%	3.21	43.8%	3.23	41.7%	3.22

Non-Participant Surveys

The Residential Smart $aver CFL program, as implemented in the Carolina System by Duke Energy, gives Duke Energy residential customers the ability to 'opt-in' and order CFLs by responding to a direct mail piece (campaign ID = 664), or by calling the IVR toll free number, or by logging into their account information in OLS (Online Services) (IVR and OLS, campaign ID = 701). Customers are eligible for up to 15 CFLs (depending on past program participation).

To assess barriers to, and interest in, program participation, TecMarket Works conducted phone surveys with a random sample of 67 non-participants, 33 low income and 34 standard customers, from the Carolina System between February 14th, and April 2nd, 2012.

The non-participant survey was aimed at addressing the following key questions:

- Are customers aware of the program, and if yes, how did they learn of the program?
- What is their interest in participation and what are the reasons behind non-participation?
- What are some ways the program could try to increase participation?
- What is their current level of CFL usage?
- What is their interest in Duke Energy providing additional programs?
- What are the attitudes and actions surrounding energy use in this population?
- What are the demographic and household characteristics of this population? How do these characteristics compare to the participant population?

Program Awareness

Only five (3%) of the survey respondents (three low income and two standard income) reported that they did not recall seeing information about the program. The vast majority, 62 (97%), remembered learning about the program through various sources, as summarized in Table 23.

Table 23. Source of Program Information for Non-Participants (n=67)

How did you learn of the free CFL program?	Count – Low Income	Count - Standard
I got a brochure in the mail	22	10
Advertisement in my bill	20	1
From friend/family	15	3
I visited Duke Energy's website	1	0
Email from family/friend	1	1
Other	15	2

Note: Non-participants were allowed multiple responses

The "other" responses are as follows:

- I received a call from Duke (n=4)
- I learned of it from TV ads
- My daughter reads e-mail for me
- I heard about it from a co-worker

- I heard about it on the news
- I received a postcard in the mail
- I read about it in the newspaper
- I work for newspaper and have seen advertisements for it
- From a Business Reply Card
- I received something in the mail and I remember seeing on the table

Reasons for Non-Participation

Of the 67 non-participants surveyed, 15% (6 low income nonparticipants, 4 standard income participants) attempted to enroll in the free CFL program. As shown in Table 24, of those who attempted to enroll, one went to the Duke Energy website, three called the toll free number, four sent in the business reply card, and two received a phone call from a Duke Energy representative. When asked why they were unsuccessful they gave the following replies:

- I mailed in the form and never heard back (n=4)
- I didn't hear back (n=2)
- I was ineligible, because I already had the full amount of bulbs
- Automated phone error or difficulty
- I tried 5 or 6 times, but received an automated error that the phone number was out of service
- I ordered the bulbs, but did not receive them

Table 24. Method of Enrollment Attempts Among Non-Participants

	Duke Energy Web Site	Toll free number	Customer service number	Mail-in card	Other
Low Income	0	2	0	2	2
Standard	1	1	0	2	0
Total Population	1	3	0	4	2

When asked why they decided not to participate in the program, respondents gave a variety of reasons. The most frequently cited reason for not participating came from the "Other" category (75%, weighted), which saw 25 low income and 51 standard non-participants giving their own individual reasons for not participating. Of those "Other" reasons, 30 (22%, weighted) of all responding non-participants indicated that they did not enroll because they did not find the program compelling enough to take action. Their responses are shown in Table 25 below.

Table 25. Reasons for Not Enrolling in the Program by Income Group

	Low Income N=33		Standard Income N=34		Total Population N=67	
	Number of Respondents	%	Number of Respondents	%	Number of Respondents	Weighted %
Too much hassle	0	0%	2	6%	2	3%
Do not use CFLs	1	3%	1	3%	2	3%

Don't like CFLs	1	3%	1	3%	2	3%
Already have CFLs in all sockets that use them	1	3%	1	3%	2	3%
Did not understand program	1	3%	0	0%	1	1%
Other	25	76%	25	74%	51	75%

Note: Non-participants were allowed multiple responses

The "other" responses were as follows:

- Forgot about it/Not important enough to act (n=28)
- I didn't need any bulbs. (n=6)
- I was too late to enroll (n=4)
- Bulbs are not my responsibility (n=3)
- Lost the coupon (n=2)
- Nothing is free/Thought it was a gimmick (n=2)
- Safety concerns (n=2)
- Not sure (n=2)
- Tried to enroll and failed (n=2)
- No reason (n=2)
- I've been sick and in the hospital.

As shown in Table 25, two (3%) respondents indicated that they did not enroll because they do not like the CFLs, and another two (3%) said they didn't enroll because they don't use CFLs. Their reasons for not liking or using CFLs were as follows:

- Not bright enough (n=2)
- Don't like light quality (n=2)
- Mercury disposal concerns
- Not sure

Program Promotion

Non-participants were asked if they had told anyone about the program and, if so, how many people they told and how they told them. As shown in Table 26 below, 26 (40%, weighted) of surveyed non-participants reported telling others about the program, compared to 40 (60%, weighted) who did not speak about the program. The percentages seen in the total population corresponded closely with the low income group (37%) as well as with the standard income group (42%).

Table 26. Non-Participants who Told Others About the Program by Income Group

Did you tell others about the CFL program?	Low Income n=31		Standard n=31		Total Population n=60	
	N	%	N	%	N	Weighted %

Yes	11	37%	15	42%	26	40%
No	19	63%	21	58%	40	60%
Don't Know	0	0%	0	0%	0	0%

The 26 respondents that told other people discussed the program with 79 or more family, friends, co-workers, and neighbors. All indicated that they informed others via word of mouth. One person also showed someone their power bill, and another used email. A breakdown of these conversations by income group can be seen in Table 27. Nine respondents (six low income and three standard) reported that those they spoke with had signed up for the program.

Table 27. Type and Number of People Told About the Program by Income Group

Did you tell others about the CFL program?	Low Income		Standard Income		Total Population	
	*# of Participants	# of People Told	*# of Participants	# of People Told	*# of Participants	# of People Told
Family	5	10	10	23	15	33
Friends	4	5	7	15	11	20
Co-Workers	2	7	1	5	3	12
Neighbors	3	1	1	8	4	9
Other	0	5	3	0	3	5

**Note: Non-participants were allowed multiple responses*

Program Influence

Despite not participating in the program, nearly two thirds (63%, weighted) of non-participants surveyed indicated that learning of Duke Energy's CFL program had increased their awareness about how to save energy by using CFLs. This increase in awareness was slightly less common among standard non-participants at 20 (58%), compared to low income non-participants at 22 (69%). Table 28 displays the number responses by income group. These results suggest that the program also had a transformative effect on non-participants, increasing the level of energy savings beyond what is documented in this evaluation.

Table 28. Increase in Awareness of CFL Energy Savings Potential by Income Group

Response	Low Income n=32		Standard Income n=34		Total Population n=66	
	Number of Respondents	%	Number of Respondents	%	Number of Respondents	Weighted %
Yes	22	69%	20	58%	42	63%
No	7	22%	13	38%	20	31%
Don't Know/Not Sure	3	9%	1	3%	4	6%

Duke Energy's free CFL offer inspired 25 (38%, weighted) of the non-participants surveyed to purchase CFLs. The percentage of those reporting CFL purchases was equal among low income and standard respondents (38%). The 13 standard respondents said they had purchased a total

125 CFLs, while the 12 low income respondents indicated that they had purchased 64 CFLs. Table 29 shows the number of responses by income group.

Table 29. CFL Purchases Among Non-Participants

	Low Income n=32		Standard Income n=34		Total Population n=66	
	Number of Respondents	%	Number of Respondents	%	Number of Respondents	Weighted %
Yes	12	38%	13	38%	25	38%
No	17	52%	20	59%	37	56%
Don't Know/Not Sure	3	9%	1	3%	4	6%

Survey respondents were asked to rate the program's influence on their decision to purchase the CFLs on a ten point scale, where one means the Duke Energy CFL program was not at all influential on their decision to buy additional CFLs and a ten means that the program was very influential. Twenty-four of the total population of 25 CFL purchasers gave a weighted mean influence rating of 7.4. The mean influence rating among standard income participants was 7.2, compared to 7.8 among low income participants.

Non-participants were also asked to rate the influence of several factors on their decision to buy CFLs on the same ten point scale. The data, seen in Table 30, shows that the desire to save on utility costs (weighted mean 9.2) barely edged out the desire to be environmentally responsible (weighted mean 9.1) as the most influential factor on their CFL purchases. The brand of CFLs offered by the program followed in third place with a weighted mean score of 8.4. All other factors had mean influence scores of less than 8.

Table 30. Factors Influencing CFL Purchasing Decisions

	Low Income (n=12)	Standard (n=12)	Total Population, Weighted Mean (n=24)
Your desire to save on utility costs	9.7	8.9	9.2
Your desire to be environmentally responsible.	9.7	8.7	9.1
The brand of CFLs offered by the program	8.9	8.1	8.4
Duke Energy advertising on TV, Radio, or newspaper	7.3	7.5	7.4
Friends or family by email	7.2	5.5	6.2
Other non-Duke Energy advertising	4.0	5.0	4.9
Friends or family by word of mouth	3.5	3.0	3.2
Advertising on Duke Energy's Web site	1.0	3.2	2.3
Friends or family by social media such as Facebook	1.0	2.4	1.8
Someone you don't know personally or a group that you follow on Facebook or Twitter	1.0	2.4	1.8
Duke Energy advertising on social media sites such as Facebook	1.0	2.2	1.7
Your desire to save energy	1.0	2.0	1.6

Figure 7 compares non-participant influence ratings by income group. Among standard non-participants, the highest rated influence factor was the desire to be environmentally responsible with a rating of ten out of ten. Low income non-participants' top rated factors were the desire to save on utility costs and the desire to be environmentally responsible, both of which received a mean influence score of 9.7.

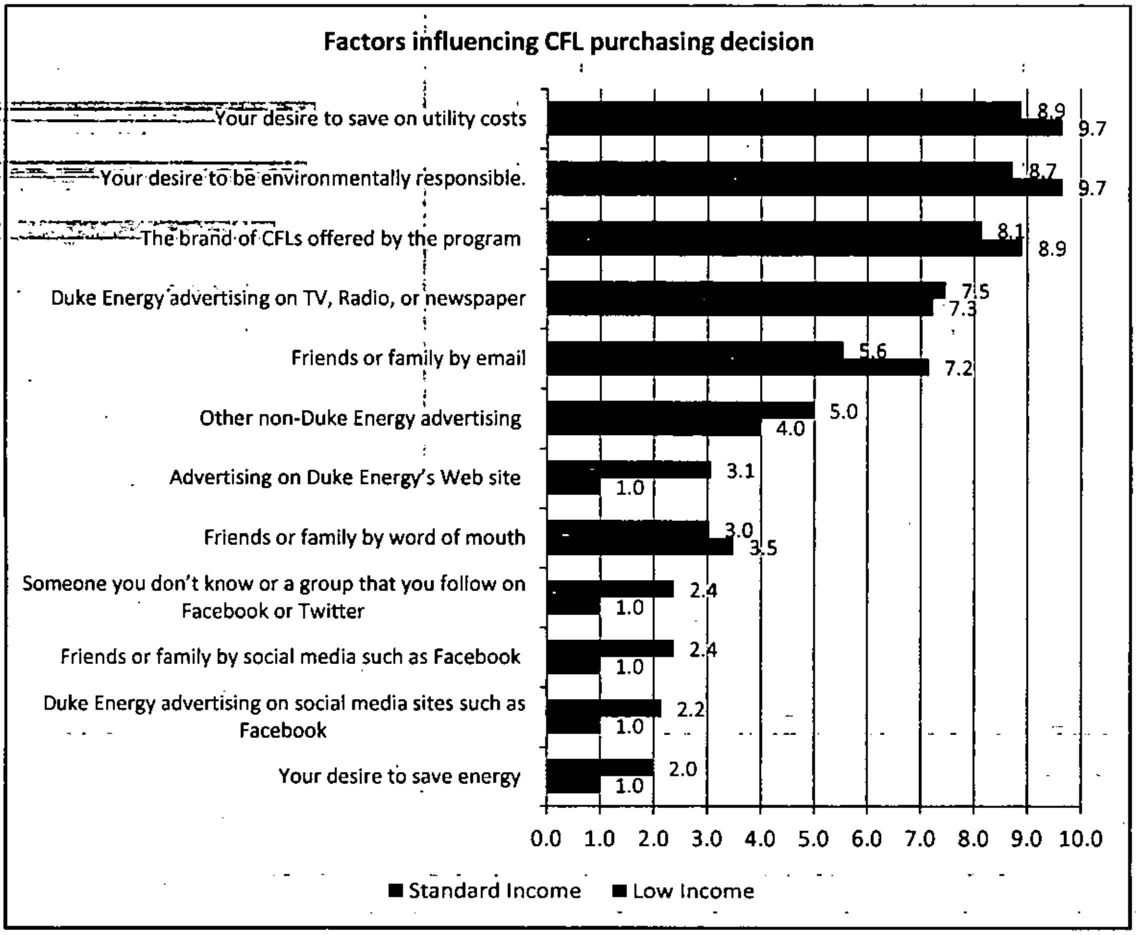


Figure 7. Factors Influencing CFL Purchasing Decisions by Income Group

When asked to rate their satisfaction with the CFLs they purchased on a scale from one to ten, where one is very dissatisfied and ten is very satisfied, satisfaction levels averaged 8.4 (weighted) for the total population of respondents. Low income CFL purchasers rated their satisfaction with an average score of 9.3, and standard income purchasers rated their satisfaction with an average score of 7.8. These ratings are displayed in Table 31.

Table 31. Program Influence and CFL Satisfaction

Population	Number of Respondents	Mean Influence Score	Weighted Mean Satisfaction with CFLs Purchased

Low Income	7	7.3	9.3
Standard	4	7.3	7.8
Total Population	11	7.3	8.4

Three respondents provided reasons for giving a rating of lower than 8. They are as follows:

- The bulbs are not bright enough and cause major concerns if broken.
- The bulbs changed my bill a bit. Also, it makes things look a little different - the colors are off.
- My wife doesn't like that they seemed dimmer, nor the special wrapping for disposal.

Eleven of 24 (weighted 46%) of CFL purchasers bought their CFLs at Wal-Mart. The remainder of the list in Table 32 represents other locations where the nonparticipants decided shop for CFLs.

Table 32. Retail Store at Which CFLs Were Purchased

Store	Low Income N	Low Income Percent	Standard Income N	Standard Percent	Total Population N	Total Population Weighted Percent
Wal-Mart	7	58%	4	33%	11	44%
Lowes	2	17%	4	33%	6	26%
Home Depot	2	17%	2	17%	4	17%
CVS pharmacy	0	0%	1	8%	1	5%
Dollar General	0	0%	1	8%	1	5%
Buy Low	0	0%	1	8%	1	5%
Sam's Club	1	8%	0	0%	1	3%
Home weatherization program (Piedmont Community Action)	1	8%	0	0%	1	3%
My uncle received them through Duke's program.	1	8%	0	0%	1	3%
Total	14		13	-	27	

Customer Satisfaction

Finally, respondents were asked to rate their overall satisfaction with Duke Energy on a scale from one to ten, where one is very dissatisfied and ten is very satisfied. As seen in Table 33, the low income group indicated slightly higher satisfaction with Duke Energy. Overall satisfaction across all non-participants surveyed has a weighted average of 8.5 on a 10 point scale.

Table 33. Overall Satisfaction with Duke Energy by Income Group (n=60)

Low Income	Standard	Total Population Weighted Average
8.7	8.4	8.5

If a customer conveyed satisfaction commensurate with a rating of seven out of ten or less, they were prompted to provide feedback on potential means of improvement. Their responses are as follows:

- Lower the rates (n=3)
- Keep operational costs down so they can pass savings along to customer (n=2)
- Lower the power rates, especially for the elderly and people on fixed incomes or Social Security
- Quicker response to power outages
- The battle over increased rates got political and customer interest was not met
- There is inconsistency with service restoration time, and costs are going up too much, but the bills are easy to understand
- There is not much of a choice in companies
- I would like to see a better breakdown of power usage on bills. Why are there such major fluctuations from month to month?

Current CFL Use

Survey respondents were asked to rate the likelihood that they would use a CFL when there is a need to change a bulb in their home on a scale from one to ten, where one is not at all likely and ten is very likely. The results are summarized in Table 34. The survey shows that the two populations are very close, but that standard customers consider themselves to be slightly more likely to replace a bulb with a CFL than standard customers.

Table 34. Likelihood of Replacing Bulbs with CFLs by Income Group (n=66)

Low Income	Standard	Total Population Weighted Average
7.3	7.8	7.6

The survey also asked respondents that currently have CFLs installed in their homes to specify how many are installed in each room. Out of all 67 non-participants surveyed, 50 (weighted 75%) have at least one CFL currently installed in their home, and 17 (weighted 25%) have none. As seen in Table 35, standard customers are more likely than low income customers to have at least one CFL in their home.

Table 35. Percentage of Households with at Least One CFL (n=67)

Do you currently have any CFLs in your home?	Low Income	Standard	Weighted Population Percent
yes	23 (70%)	27 (79%)	(75%)
no	10 (30%)	7 (21%)	(25%)

A breakdown of CFL information by room type, wattage, and income is shown in Table 36. Across all 67 non-participants surveyed, there are a total of 601 CFLs currently installed throughout the various rooms in their homes, a weighted average of 9.36 bulbs per household. Standard households have a significantly greater number of CFLs than low income households, 405 compared to 196, 67% of the total. Note that there are 33 low income households in the sample, and 34 standard households. This means that the average standard household has 11.91 CFLs installed compared to the low income household, which has an average of 5.94 CFLs installed. This is approximately a 101% difference.

Table 36. Number of CFLs Per Room by Wattage and Income (n=60)

Room Type	Low Income			Standard			Population Total		
	13W	20W	ALL	13W	20W	ALL	13W	20W	ALL
Living/family room	18	8	38	9	4	84	27	12	122
Dining room	1	8	18	4	2	30	5	10	48
Kitchen	16	4	37	10	1	56	26	5	93
Master bedroom	17	10	40	17	2	56	34	12	96
Other bedroom	10	2	25	5	1	53	15	3	78
Hall	1	1	4	4	0	20	5	1	24
Closet	0	0	0	0	0	7	0	0	7
Basement	2	0	2	0	0	9	2	0	11
Garage	0	0	0	0	1	2	0	1	2
Bathroom	20	4	29	4	1	49	24	5	78
Other	3	1	3	0	3	39	3	4	42
TOTAL	88	38	196	53	15	405	141	53	601

The "other" room types are as follows:

- Porch (n=5)
- Second bathroom (n=4)
- Laundry room (n=3)
- Extra bedroom (n=2)
- Attic
- Rec room
- Computer room
- Utility room
- Outside
- Den

Current Non-CFL Use

Survey respondents were asked to estimate the number of bulbs currently installed in their homes that are not CFLs. As a follow-up to that question, they were asked how many of the non-CFL bulbs are typically used for more than two hours per day. The results are summarized in Table 37. Throughout the homes of the 62 non-participant survey respondents, there are a total of 933 non-CFL bulbs installed, a weighted average of 15.0 bulbs per household. The two income groups have very similar numbers of non-CFLs. Low income households comprise the slight majority with 479 (51%) of these bulbs, an average of 15.5 bulbs per household. Standard households are close behind with 454 (49%) total bulbs and an average of 14.6 bulbs per household.

The numbers of non-CFLs that typically operate for more than two hours per day are also very close across both populations with averages of 4.5 and 4.9 bulbs for low income and standard households respectively.

Table 37. Non-CFLs Installed and Used for More Than Two Hours per Day (n=62)

Metric	Low Income		Standard		Population Total	
	Total	Average	Total	Average	Total	Weighted Average
Non-CFLs	479	15.5	454	14.6	933	15.0
More than 2 hours/day	140	4.5	153	4.9	293	4.7

Energy Efficiency Improvements

Table 38 shows a breakdown of all of the energy efficiency improvements made by non-participants since April of 2011. The first four measures: appliances, windows, heating systems, and cooling systems are the more expensive measures. It follows that the standard customers were much more likely to implement them, a total of 25 (63%) measure adoptions from this category compared to 13 (34%) from the low income customers. The less expensive measures were also favored by standard customers, who installed 37 (63%) compared to 22 (37%) installs by low income customers. There were 22 low income customers and 19 standard customers that reported making no additional energy efficiency improvements, for a total of 41 (weighted mean = 49%).

Table 38. Number of Energy Efficiency Improvements by Income Group (n=64)

Measure	Low Income	Standard	Population Total
High efficiency appliances	5	11	16
Energy efficient windows	2	0	2
High efficiency heating system	2	7	9
High efficiency cooling system	4	7	11
Wall or ceiling insulation	4	5	9
Caulking	6	9	15
Faucet aerators	2	4	6
Outlet or switch gaskets	2	3	5
Low flow showerhead	3	6	9
Programmable thermostat	0	0	0
Weather stripping	5	10	15

In addition to the energy efficiency improvement data presented in Table 38, survey respondents were asked if they had changed any of their habits related to energy use. Out of all 64 non-participants surveyed, 29 (weighted mean of 49%) indicated that their habits had changed. Of these 29 respondents, 18 (62%) were low income customers and 11 (38%) were standard customers, suggesting that low income customers are more likely to change their behavior as it relates to energy consumption. Respondents answering that they had changed their habits were asked to specify what about their behavior had changed. Their responses are summarized below:

- I turn lights off (n=15)
- Teaching children and grandchildren to be energy efficient (n=3)
- Turn off or unplug appliances (n=3)
- Change HVAC filters (n=2)
- Set the thermostat higher in the summer and lower in the winter (n=2)
- Caulking, weather stripping and insulation
- I do fewer loads of laundry
- I have always tried to be energy efficient
- I installed an energy efficient AC
- I started burning wood in the winter for heat
- I use fans instead of AC
- Recycle
- Window coverings to manage heat gain & loss

Light Bulb Characteristics

Surveyed non-participants were asked to rate the importance of specific bulb characteristics when making their bulb purchasing decisions. The results of these importance ratings are shown in Table 39. Responses were provided on a one to ten scale, where one is not at all important and ten is very important.

Interestingly, the energy savings (9.1 weighted average) and the availability of CFL bulbs in stores that participants normally shop (9.0 weighted average) were rated marginally higher than the purchase price of the bulb (8.9 average). Cost savings on utility bills and the selection of wattage and light output levels available both scored a 8.9 weighted average as well. Factors often perceived as barriers to CFL adoption, such as the ability to dim bulbs (5.0 weighted average), aesthetics (5.5 weighted average), and mercury content (5.5 weighted average), were rated by survey participants as the three lowest categories. A graphical representation in ascending order of importance can be seen in Figure 8.

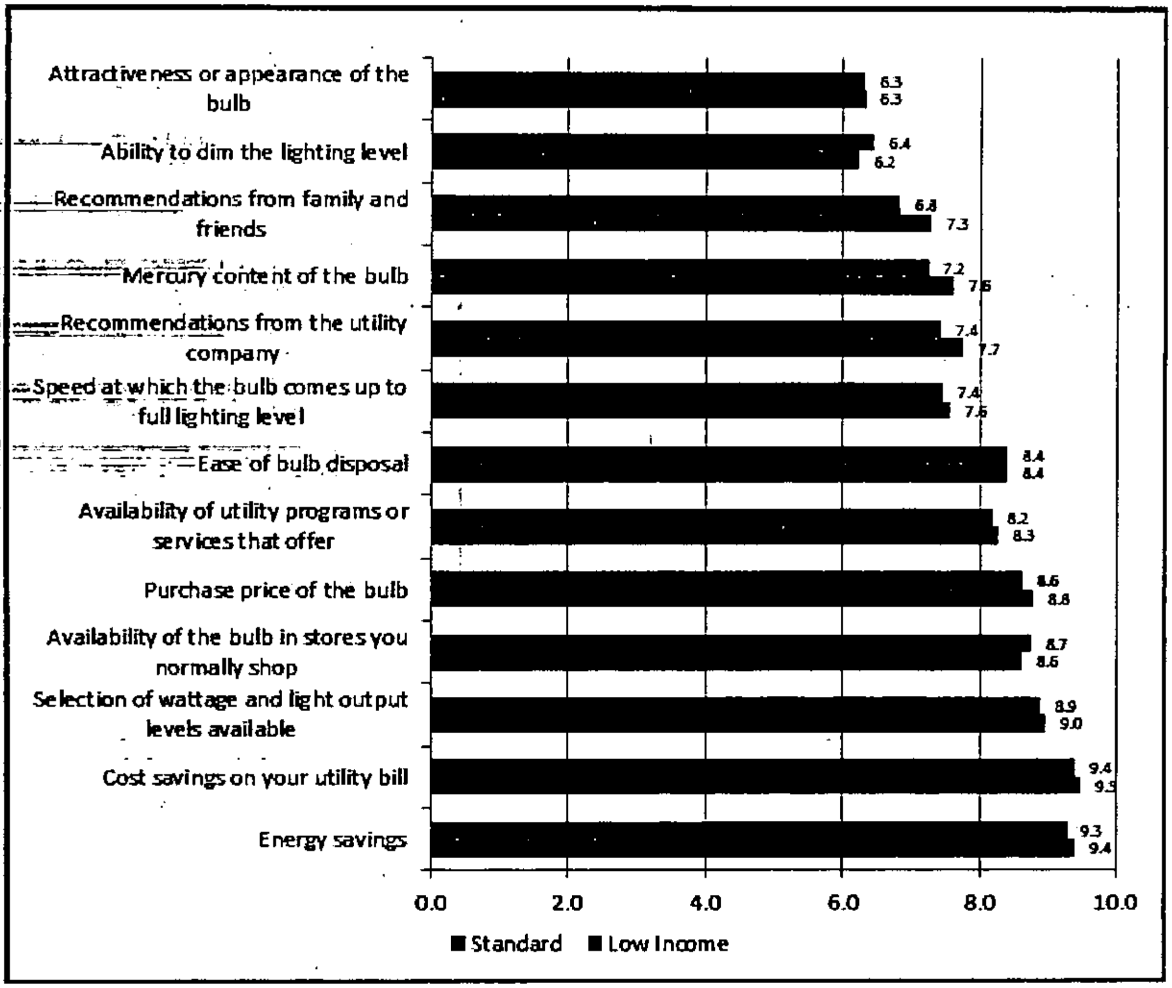


Figure 8. Importance of Bulb Characteristics by Income Group

Overall, this suggests that the most important factors for continued CFL adoption and installation by Duke Energy customers is continued utility savings from the bulbs, an affordable price point, and the availability of a good selection of wattage and light output levels of bulbs either directly from Duke Energy or in stores where people normally shop.

Table 39. Importance of Bulb Characteristics When Purchasing Bulbs

Bulb Characteristic	N	Low Income	Standard	Weighted Population Average
Energy savings	62	9.4	8.8	9.1
Cost savings on your utility bill	62	9.4	8.6	9.0
Availability of the bulb in stores you normally shop	62	9.2	8.8	9.0
Purchase price of the bulb	61	8.8	9.0	8.9
Selection of wattage and light output levels available	62	8.8	9.0	8.9
Ease of bulb disposal	62	7.2	8.2	7.8

Availability of utility programs or services that offer	61	7.8	7.4	7.6
Recommendations from the utility company	62	7.5	6.4	6.9
Speed at which the bulb comes up to full lighting level	61	6.5	6.8	6.7
Recommendations from family and friends	62	6.5	6.3	6.4
Mercury content of the bulb	50	5.6	5.5	5.5
Attractiveness or appearance of the bulb	62	5.2	5.8	5.5
Ability to dim the lighting level	61	4.1	5.7	5.0

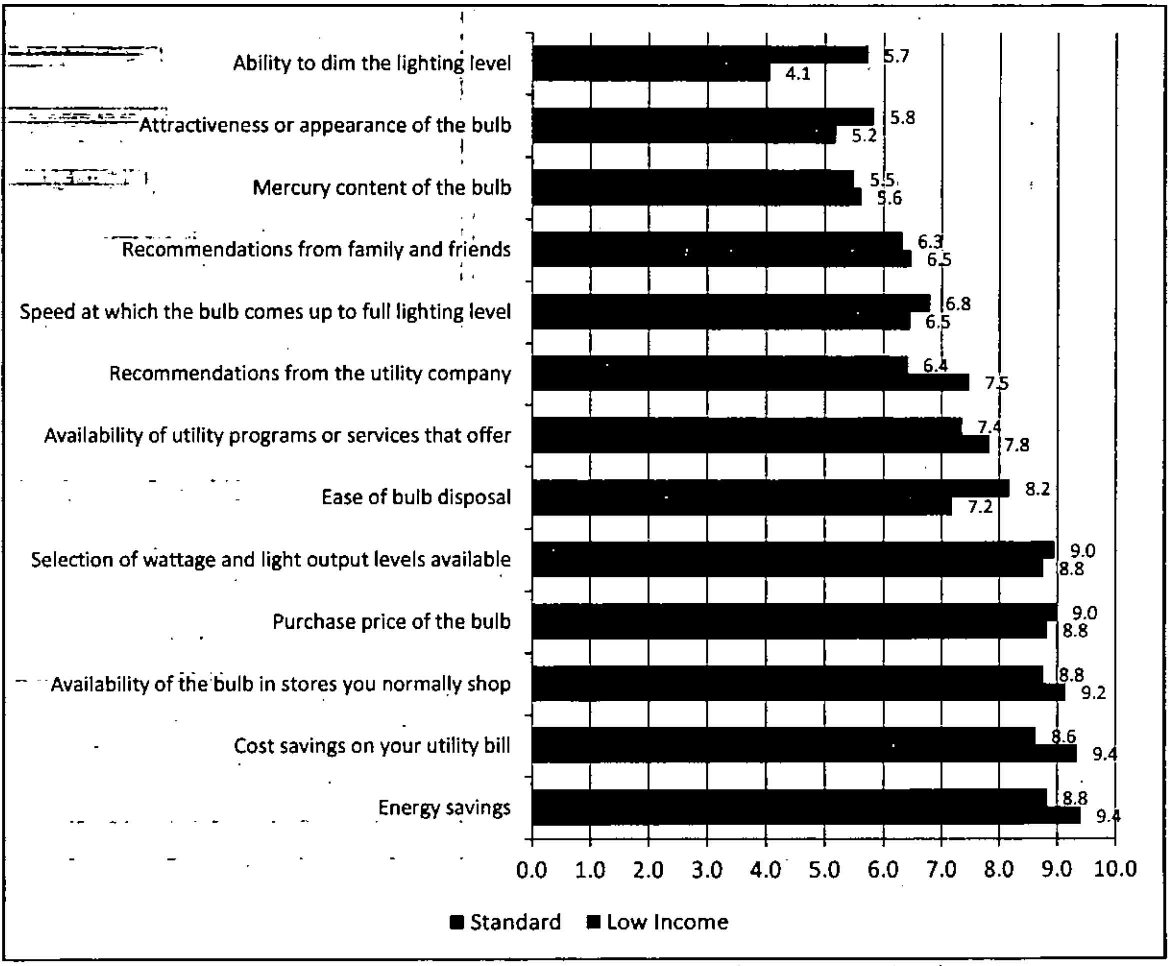


Figure 9. Importance of Bulb Characteristics by Income Group

Specialty CFLs

Survey respondents were asked to list the number of bulbs currently installed in their homes that are specialty bulbs. As a follow-up to that question, they were asked how many of the specialty bulbs are CFLs. The results are summarized in Table 40. There are a total of 586 specialty bulbs of various types installed in the homes of surveyed non-participants. Of these, 419 (72%) are located in standard households. The vast majority of specialty bulbs are non-CFLs, 90 (15%)

across the entire surveyed population. Of these 90 specialty CFLs, 80 (89%) are from the standard income group.

Table 40. Currently Installed Specialty Bulbs and CFLs

Bulb Type	N	Low Income		Standard		Population Total	
		Total	CFL	Total	CFL	Total	CFL
Dimmable	61	11	3	88	15	99	18
Outdoor flood	62	33	2	60	5	93	7
Three-way	61	16	0	24	14	40	14
Spotlight	61	3	0	16	7	19	7
Recessed	62	13	0	76	14	89	14
Candelabra	62	80	5	150	25	230	30
*Other	25	11	0	5	0	16	0
TOTAL		**167**	**10**	**419**	**80**	**586**	**90**

**No "other" bulb types were specified*

When survey participants were asked to rate their interest in Duke Energy providing a direct mail specialty CFL program, their responses had a weighted average of 7.1 on a scale from one to ten, where one indicated no interest and ten indicated great interest. Low income and standard survey respondents were similarly interested in the proposition, as can be seen in Table 41.

Table 41. Interest in Specialty CFL Program by Income Group (n=61)

Low Income	Standard	Weighted Population Average
7.4	6.9	7.1

After providing a rating of their general interest in specialty CFL programs, respondents were asked to indicate their interest in receiving specific types of specialty bulbs if they were to be offered in the future. As a follow-up, if they were interested, they were asked to include an estimate of how many hours per day they would use the bulb. Their responses are summarized in Table 42. There were a total of 139 interested responses from 48 different respondents across all of the specialty bulb types.

Table 42. Interest in Specific Specialty CFLs by Income Group (n=62)

Bulb Type	Low Income		Standard		Population Total	
	Interested	Hours of Use	Interested	Hours of Use	Interested	Weighted Hours of
Dimmable	15	3.54	16	5.50	31	4.66
Outdoor flood	14	4.44	14	3.09	28	3.67
Three-way	12	2.36	15	4.87	27	3.80
Spotlight	4	3.67	7	3.57	11	3.61
Recessed	4	4.67	11	4.45	15	4.54

Candelabra	10	3.44	15	3.50	25	3.47
*Other	1	1.00	1	1.00	2	1.00

**No "other" bulb types were specified*

Future CFL Purchases

Respondents were asked to consider their future CFL purchases and identify how many CFLs they would expect to purchase in the next year if CFLs were offered at a certain price compared to a standard (incandescent) bulb. The prices offered were:

- The same price as a standard bulb
- $1 more than a standard bulb
- $2 more than a standard bulb
- $3 more than a standard bulb

Table 43 shows the number of CFLs that survey respondents would purchase as the bulbs increase in price. As expected, the general trend is toward purchasing fewer CFLs as they become more expensive. Overall, the number of people that would buy at least one CFL decreases from 51 (weighted 91%), at the standard incandescent price, to 22 (weighted 43%) at three dollars more.

Table 43. Number of CFLs Purchased at Different Price Points by Income Group (n=60)

Income Group	Number of CFLs	Standard Incandescent Price	$1 More	$2 More	$3 More
Low Income	None	2	7	15	17
	1 to 3	4	5	4	7
	4 to 6	10	7	2	1
	7 to 9	2	1	1	0
	10 to 12	4	2	2	0
	13 or more	5	4	1	0
Standard	None	3	5	10	13
	1 to 3	1	3	1	3
	4 to 6	8	5	5	4
	7 to 9	5	4	4	2
	10 to 12	7	6	5	3
	13 or more	5	5	3	2
Population Total	None	5	12	25	30
	1 to 3	5	8	5	10
	4 to 6	18	12	7	5
	7 to 9	7	5	5	2
	10 to 12	11	8	7	3
	13 or more	10	9	4	2

Non-participants were also asked how many CFLs they would purchase if they were free, but required a mail-in rebate form or an online rebate form. Table 44 shows that, on average, a customer would use the rebate to purchase a weighted average of 8.9 bulbs. Standard customers reported that they would use the service for a much larger quantity of bulbs than did the low income customers.

Table 44. Number of Rebated Bulbs by Income Group (n=60)

Low Income	Standard	Weighted Population Average
5.5	11.4	8.9

Non-CFL Program Interest

Before being asked about their interest in participating in other Duke Energy programs, survey respondents were asked if they were currently participating in any. Survey responses are summarized in Table 45. Seven of the non-participants surveyed indicated that they are current participants in other Duke Energy Programs. (Of these, three were low income.)

Table 45. Current Participation in Duke Energy Programs (n=7)

Program Name	Low Income	Standard	Current Participants
Power Manager	0	2	2
Residential Smart $aver	1	0	1
Home Energy House Call	0	0	0
Home Energy Comparison Report	0	0	0
Personalized Energy Report	1	0	1
Online Services	1	2	3

Respondents were then asked to rate their interest in Duke Energy providing these programs. Interest ratings were provided on a scale from one to ten, where one is not at all interested and ten is very interested. Average responses by income group are shown in Table 46.

Table 46. Interest in Participating in Duke Energy Programs by Income Group

Program Name	Low Income	Standard	Weighted Population Average
Power Manager (n=58)	3.6	5.1	4.5
Residential Smart $aver (n=60)	5.6	6.1	5.9
Home Energy House Call (n=60)	6.5	6.1	6.3
Home Energy Comparison Report (n=59)	4.4	5.6	5.1
Personalized Energy Report (n=59)	6.4	6.9	6.7

Among the non-participants surveyed, there is not an overwhelming interest in any one particular program. The Home Energy House Call and Personalized Energy Report programs each received a weighted average interest rating greater than six, 6.3 and 6.7 respectively. The Residential Smart $aver program was close, with a 5.9 weighted average. The other two programs garnered less interest. A graphical comparison of the low income and standard groups can be seen in Figure 10. Standard respondents expressed more interest, on average, than did the low income group in all programs except the Home Energy House Call, where their interest trailed only marginally.

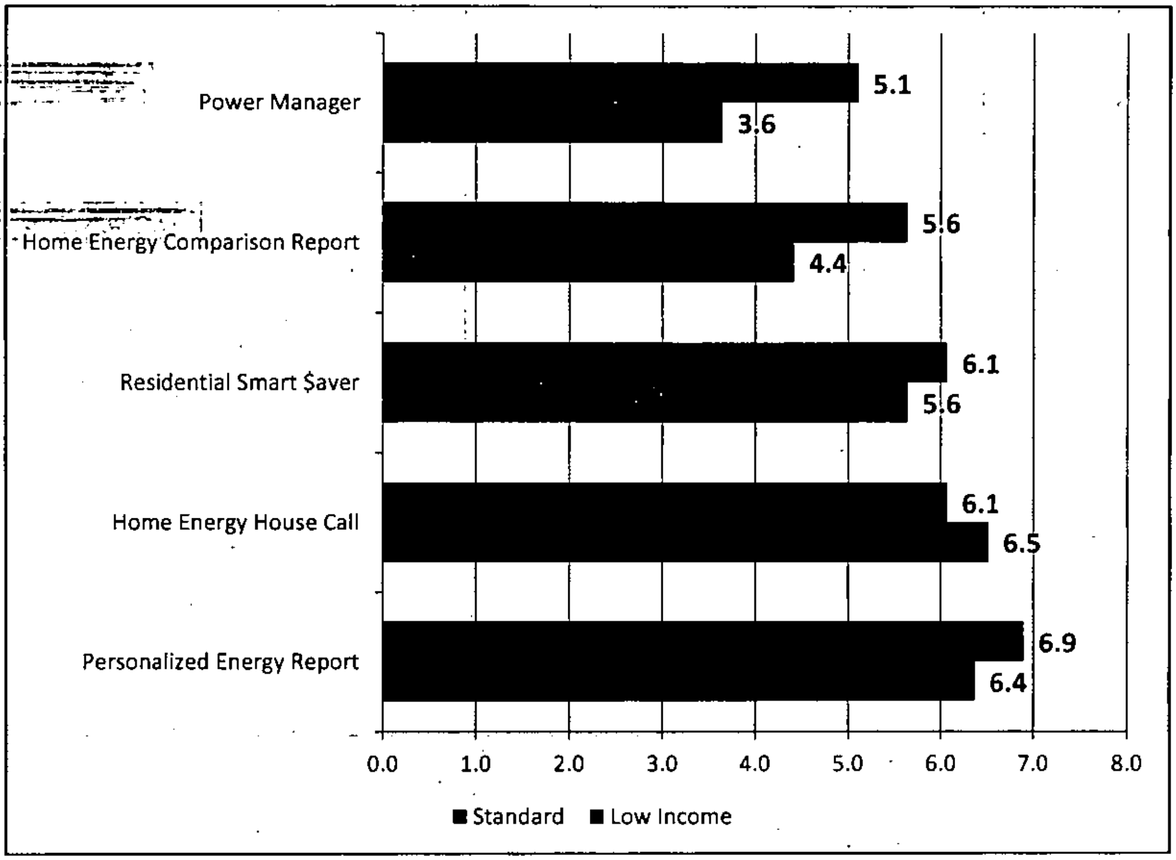


Figure 10. Program Interest by Income Group

Non-Participant Characterization

Respondents were asked how often they use the Duke Energy website. As Table 47 shows, the website is seldom used. Across all 60 non-participant respondents to this question, 48 (weighted 78%) reported that they never use the website. Only 3 people (weighted 6%) out of the total population reported that they use the website often.

Table 47. Frequency of Website Use (n=60)

How often do you use the website?	Low Income	Standard	Total Population Weighted %
Often	0 (0%)	3 (10%)	6%
Sometimes	2 (6%)	7 (24%)	16%

Never	29 (94%)	19 (66%)	78%

Survey respondents were then asked a series of questions about their recent appliance purchases, if any, their typical appliance purchasing practices, and their knowledge of the ENERGY STAR label. Of the 60 total non-participants surveyed, 21 (weighted 32%) had added a major electrical appliance to their home in the past year. Of these 10 were low income and 11 were standard income.

Table 48 shows the results of the three ENERGY STAR questions. A majority of surveyed non-participants, 45 (weighted 76%) overall, are aware of the ENERGY STAR label, and 40 (weighted 89%) of these respondents reported that they typically look for the ENERGY STAR label when purchasing an appliance. Just under half of these respondents, 18 (weighted 43%), say that they always buy ENERGY STAR appliances. The low income and standard groups were nearly identical in terms of awareness and looking for the ENERGY STAR label, with standard respondents being slightly more likely to actually buy ENERGY STAR appliances.

Table 48. ENERGY STAR Awareness and Purchasing Practices

ENERGY STAR Question		Low Income	Standard	Weighted Population Percent
Aware of ENERGY STAR label (n=60)		22 (71%)	23 (79%)	76%
Look for ENERGY STAR label (n=45)		20 (91%)	20 (87%)	89%
Buy ENERGY STAR appliances (n=40)	Always	7 (35%)	11 (55%)	46%
	Sometimes	13 (65%)	9 (45%)	54%
	Never	0 (0%)	0 (0%)	0%

The next non-participant characterization question asked respondents why they believe that Duke Energy is offering free CFLs to their customers. Their responses are summarized in Table 49, which shows that "other" was by far the most common response, with 35 (weighted 55%) respondents preferring to offer their own reason. The three most common of the provided multiple choice responses were: environmental issues, 21 (weighted 34%); saving customers money, 12 (weighted 20%); and saving energy for economic reasons, 10 (weighted 17%). These responses were collected with much higher frequency than the remaining two closed responses.

Table 49. Reasons Non-Participants Believe Duke Energy Distributes Free CFLs (n=60)

Why do you believe that Duke Energy is providing free CFLs to their customers?	Low Income N	Low Income %	Standard N	Standard %	Total N	Total Weighted %
Duke Energy wants to save their customers money	6	19%	6	21%	12	**20%**
Duke Energy wants to save energy for environmental reasons	11	35%	10	34%	21	**34%**
Duke Energy wants to save energy for economic reasons	6	19%	4	14%	10	**16%**
Duke Energy wants to look good (Public Relations)	2	6%	1	3%	3	**4%**

The government is forcing Duke Energy to do it	1	3%	2	7%	3	5%
Other	17	55%	16	55%	35	55%

**Note: Non-participants were allowed multiple responses*

The "other" responses were as follows:

- Because the bulbs use less power (n=6)
- To help out the community (n=5)
- To promote the switch from incandescents to CFLs (n=5)
- Duke Energy wants to make money (n=4)
- To create goodwill towards Duke (n=2)
- CFLs last longer than incandescents
- Duke is trying to get the government off of its back
- To keep customer base
- To raise environmental & energy awareness

A group of 67 non-participants were invited to complete this survey online in October - November of last year. They were asked if they recalled getting an email or a letter from Duke Energy to that effect. Of the 33 people responding to this question, only six (18%) recalled the email or letter inviting them to take the survey. None of them attempted to take the survey. Their reasons for not doing so are as follows:

- Didn't have the time (n=2)
- Didn't have computer access (n=2)
- I hate the bulbs and probably tore up the survey
- I didn't respond out of habit

Net to Gross Analysis

Freeridership

TecMarket Works utilized a multiple question approach from the participant survey to estimate freeridership. The instrument was established to use a primary "gateway" question to assess freeridership and adjusted it based on the responses to questions about how many CFLs were in the homes prior to the program, and how many CFLs they would have purchased if the program had not provided them[15].

The gateway question asked survey respondents what their behavior would have been if the CFL direct shipment program had not been available. The four available responses were:

a.) bought the same number of CFLs at the same time
b.) bought fewer CFLs at the same time
c.) bought the CFLs at a later time
d.) not bought any CFLs

The breakdown of responses to the gateway question can be seen in Table 51. Participants who indicated that they would have bought the same number of CFLs at the same time were assigned 100% freeridership. Participants answering that they would not have purchased any CFLs were assigned 0% freeridership.

Freeridership for participants who indicated that they would have bought CFLs at a later time was determined by how many they said would have purchased in the absence of the program. All respondents were also asked to report the number of CFLs installed in their home prior to their participation in the direct mail CFL program. Each response to this question was converted to a freerider percentage as presented in Table 50. Quantities of pre-existing CFLs range from zero to 30.

The equivalent freerider CFLs (the number of CFLs that count toward freeridership) in the case of Table 50 where a customer has indicated they would have purchased CFLs at a later time, is the product of the freerider percentage for that participant and the number of CFLs received (from Table 50: A*B=C). The 361 participants who answered the questions received a total of 3,950 CFLs from the program. Participants' freeridership contribution is the quotient of the equivalent freerider CFLs and the total number of bulbs distributed to all participants who answered the net-to-gross question battery and the allocation based on their responses (from Table 51: C/3,950=D).

[15] Using participant surveys to assess freeridership is a current and accepted practice in the industry. Please see the Basic Approach method in the section titled "Participant Net Impact Protocol" in the California Energy Efficiency Evaluation Protocols, April 2006. TecMarket Works, et al.

Table 50. Freeridership for Surveyed Standard Participants Purchasing CFLs at a Later Time

Pre-existing CFLs	Freerider Percentage (A)	Number of respondents	Number of CFLs received (B)	Number of Freerider CFLs (C)
0	0	25	327	0
1	0	2	27	0
2	0	9	108	0
3	0	2	21	0
4	0.25	5	69	17.25
5	0.25	0	0	0
6	0.25	3	45	11.25
7	0.5	0	0	0
8	0.5	1	15	7.5
9	0.5	1	6	3
10	0.75	1	15	11.25
11	0.75	0	0	0
12	0.75	0	0	0
13 or more	1	5	54	54
TOTAL		**54**	**687**	**104.25**

Table 51. Program Freeridership for Standard Participants

Gateway Question Response	Number of Respondents	Equivalent Freerider CFLs (C)	Freeridership Contribution (D)
Same # of CFLs at same time (100% freerider)	6	51	2.68%
CFLS at later time (symmetrical allocation approach	44	335	17.62%
Fewer CFLs at same time (symmetrical allocation approach	54	104.25	5.48%
No CFLs (0% freeriders)	71	0	0.00%
TOTAL	**175**	**490.25**	**25.79%**

For those who said they would have purchased fewer bulbs at the same time, an allocation approach that assigns freeridership contribution as the percentage of the number of CFLs that a respondent said they would have purchased compared to the number of CFLs that they received via the program was used. The rest of the bulbs they received above the number that they had indicated they would have purchased are counted as non-freerider bulbs.

The freerider analysis approach for low income participants is not based on survey responses but instead is based on standard practice in the evaluation field to assume low income customers will not spend a significant amount of their limited resources on $3.00 light bulbs with or without the influence of the program. Based on this past practice, freeridership for low income participants is assumed to be zero. In the Carolinas, approximately 42.3% of residents fall into the low income category, set at 200% of the Federal Poverty Level. Total program freeridership is weighted accordingly and thus established at 14.88%.

$$0.423 * \text{Low Income FR} + 0.577 * \text{Standard FR} = 0.423 * 0\% + 0.577 * 25.79\% = 14.88\%$$

Validity and Reliability of the Freerider Estimation Approach

The field of freeridership assessment as specified in the California Evaluation Protocols basic estimation approach requires the construction of questions that allow the evaluation contractor to estimate the level of freeridership. The basic approach used in this evaluation is based on the results of a set of freerider questions incorporated into participant survey instruments. The approach used in this assessment examines the various ways in which the program impacts the customer's acquisition and use of CFLs in their home, and allocates a freeridership factor for each of the types of responses contained in the survey questions. The allocation approach assigns high freeridership values to participants who would have acquired CFLs on their own and that factor is influenced by their past purchase behavior and their stated intent. Within the basic approach, the use of a structured freeridership assessment that partitions non-low-income responses into different categories and assigns a freerider value to each participant represents a best practice self-response approach. The scoring approach is proportional to the degree to which the standard income participant would have acquired and used CFLs on their own.

Spillover

TecMarket Works utilized three questions to calculate the amount of spillover.

Surveyed participants were asked how many CFLs, if any, they had purchased since receiving the free CFLs from the direct mail program. Participants who indicated they had purchased CFLs were asked how many of them they had installed. Participants were also asked to rate the influence of the program on their decision to purchase CFLs using a 1-to-10 scale, with one signifying no program influence and ten meaning that the program was very influential. Each customer's influence rating was converted to an influence factor for the purposes of calculating spillover. The conversion method, along with a breakdown of customer ratings, can be seen in Table 52.

Participants that were assigned 100% freeridership were automatically assigned zero percent spillover. The remaining participants' spillover was determined as the product of their influence factor and the number of CFLs purchased since their participation in the program. Standard survey respondents with less than 100% freeridership purchased and installed a total of 271.5 CFLs after participating in the CFL direct mail program. The number of CFLs that count toward spillover is the product of the influence factor and the number of CFLs purchased and installed since participating (from Table 52: A*B=C). The 175 standard participants who answered the questions received a total of 1,901 CFLs from the program. The spillover contribution is the quotient of the equivalent spillover CFLs and the total number of bulbs distributed to all participants who answered the net-to-gross question battery (from Table 52: C/1,901=D).

Spillover for low income participants is assumed to be zero. In the Carolinas, approximately 42.3% of residents fall into the low income category, set at 200% of the Federal Poverty Level. Total program spillover is weighted accordingly and thus established at 7.01%.

$$0.423 * \text{Low Income SO} + 0.577 * \text{Standard SO} = 0.423 * 0\% + 0.577 * 12.15\% = 7.01\%$$

Table 52. Program Spillover for Standard Participants

Influence Rating	Influence Factor (A)	Number of respondents	CFLs Purchased Since Participating (B)	Equivalent Spillover CFLs (C)	Spillover Contribution (D)
1	0.0	1	1	0	0.00%
2	0.1	2	8	0.8	0.04%
3	0.2	1	2	0.4	0.02%
4	0.3	1	5	1.5	0.08%
5	0.4	3	7	2.8	0.15%
6	0.6	3	19	11.4	0.60%
7	0.7	3	10	7	0.37%
8	0.8	8	59	47.2	2.48%
9	0.9	3	6	5.4	0.28%
10	1.0	29	154.5	154.5	8.13%
TOTAL		**54**	**271.5**	**231**	**12.15%**

The net to gross ratio is calculated as follows:

NTGR = (1-freeridership)*(1+spillover)
= (1 - 0.1488) * (1 + 0. 0701)
= 0. 9109

Total Discounting to be Applied = 1 - NTGR
= 1- 0. 9109
= 0. 0891
= 8.91%

Impact Analysis

Table 53 shows the savings per bulb distributed adjusted downward for the ISR of 80.0% and incorporating the self-reporting bias and daylength adjustments applied to the hours of use as well as the freeridership and spillover percentages computed from participants' survey responses. A mixture of 13-watt and 20-watt CFLs were distributed. Approximately 52% of the distributed bulbs were 13-watt and 48% were 20-watt.[16] Estimated energy savings were calculated using the weighted average CFL wattage, 16.35. The average wattage of a replaced bulb was 64.5 watts.

Table 53. Adjusted Impact: kWh and Coincident kW per Bulb Distributed

Metric	Low Income	Standard	*Weighted Overall Results
Population Weight	42.3%	57.7%	
Number of Bulbs	529	502	1,031
In Service Rate	80.1	79.9	80.0%
Gross kW per bulb	0.0055	0.0056	0.0056
Gross kWh per bulb	35.4	32.3	33.6
Freeridership rate	0%	25.79%	14.88%
Spillover rate	0%	12.15%	7.01%
Total Discounting to be applied to Gross values[17]	0%	16.77%	8.91%
Net kW per bulb	0.0055	0.0047	0.0051
Net kWh per bulb	35.4	26.9	30.6
Measure Life[18]	5 years	5 years	5 years
Effective useful life net kWh per bulb	177.0	134.5	153

The in service rate, gross savings, freeridership, and spillover were calculated using a weighted average of the low income and standard populations with the weights in the Population Weight row. The total discount to be applied to gross values, as well as net savings, is not the result of a weighted average calculation. The total discount was determined from the weighted overall freeridership and spillover values: 1-[(1-14.88%)(1+7.01%)] = 8.91%. See total discounting equation beneath Table 52 on page 61 of this report for full calculation details. Net kW and kWh savings was then calculated using this newly obtained discount factor. Finally, the effective useful life net kWh per bulb is the product of the net kWh per bulb and the measure life.

Survey Data

Participants were asked how many CFLs ordered through Duke Energy's CFL direct mail program were currently installed in light fixtures. Additional, more specific information was collected for a maximum of three bulbs, including the location of the CFL, the type and wattage of the bulb that it replaced, and the average hours per day that it is in use. The compilation of this data is presented in Table 54 in its unadjusted form, that is before the self-reporting bias and daylength adjustments are applied to the hours of use. The adjusted values appear in Table 56. Figure 11 graphically shows the prevalence of CFL installations by income group in each room type in ascending order. The graph shows that low income participants tend to place CFLs into

[16] The participation database contains distribution information indicating the number of CFLs a participant received. If a customer received a 3-pack or 15-pack of CFLs, they received 2 or 8 13-watt CFLs, respectively. Participants receiving 6-, 8-, or 12-packs of CFLs received an equal number of 13-watt and 20-watt bulbs.

[17] NTGR= .9109. See total discounting equation beneath Table 52 on page 61 of this report for full calculation details

[18] Consistent with prior evaluations of CFL programs for Duke Energy, a measure life of five years was used for installed CFLs. No derate was performed for post-EISA years.

higher use sockets more frequently than standard participants, resulting in higher average daily hours of use for low income participants.

Table 54. Unadjusted CFL Survey Data

Room Type	Number of Installations		Average Wattage of Bulb Removed		Average Daily Hours of Use (Old)		Average Daily Hours of Use (New)	
	LI	S	LI	S	LI	S	LI	S
Basement	1	5	60.00	81.25	7.50	1.00	7.50	1.30
Other bedroom	44	36	63.20	65.04	4.98	3.06	5.07	3.14
Dining room	35	34	59.61	62.10	3.46	3.21	3.53	3.34
Garage	3	10	46.67	75.00	1.00	6.50	1.00	2.40
Hall	21	23	60.95	66.59	3.76	2.35	3.90	2.35
Kitchen	89	62	64.29	63.67	5.87	5.73	6.19	5.53
Living/family room	146	141	63.72	67.83	5.45	5.03	5.54	5.19
Master bedroom	113	98	63.60	64.13	3.48	3.48	3.68	3.64
Bathroom	39	44	69.64	59.02	4.61	3.21	4.61	3.40
Closet	8	9	65.00	69.44	1.38	1.28	1.38	1.17
Other	30	40	68.33	62.57	6.71	6.01	7.57	6.29
AVERAGE/TOTAL	529	502	63.98	65.06	4.79	4.27	4.98	4.29

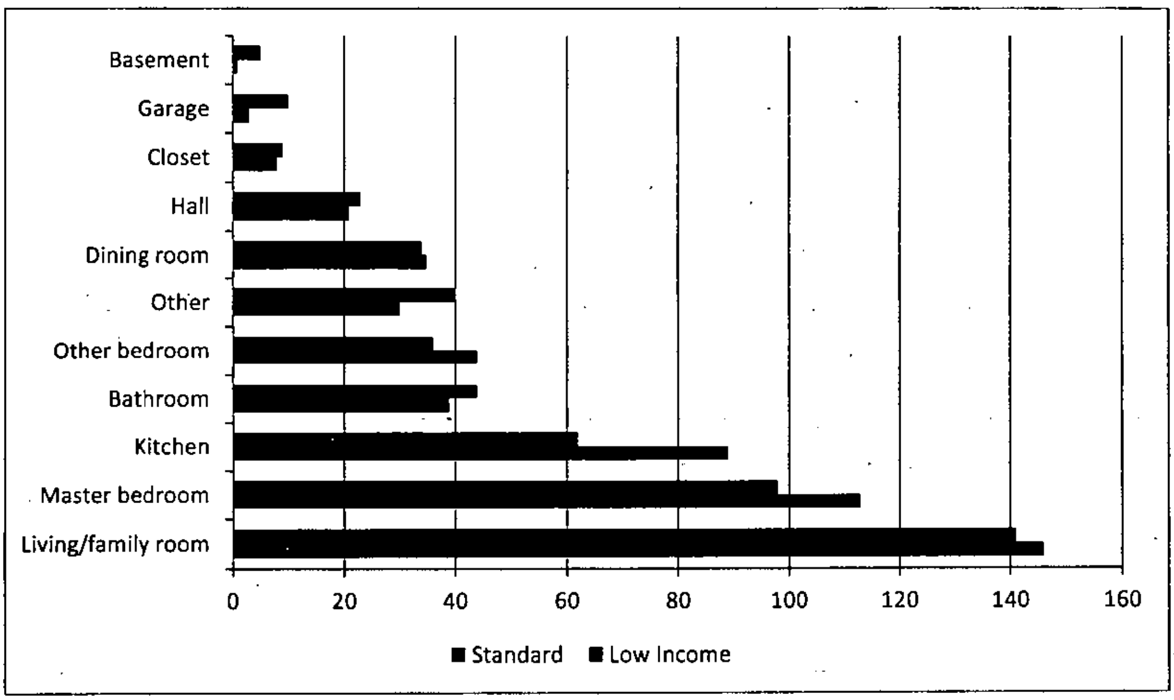


Figure 11. Percent of CFL Installations by Room Type

In Service Rate (ISR) Calculation

The data in the column headed "Number of Installations" of Table 54 and Table 56 represents the number of installations for which detailed information was collected, not the *total* number of installations. A total of 3,953 CFLs were distributed to survey participants. Respondents reported that 2,656 of them are currently installed in light fixtures, a first year ISR of 67.2%. The ISR is calculated to be 80.0% using the following formula:

ISR = first year ISR + (43% * remainder) = **67.2% + (43% * 29.8%) = 80.0%**

The remainder is the percentage of bulbs that are not installed in the first year (100% - 67.2% = 32.8%) less 3% for the 97% lifetime ISR[19]. In this case, the remainder is 29.8%. The 43% represents the percentage of the remainder that will replace an incandescent bulb rather than a CFL[20].

Self-Reporting Bias

Previous studies that have included both customer surveys and lighting loggers have shown that, comparing customers' self-reported hours of operation to the actual hours of operation, customers responding to the survey overestimated their lighting usage by about 40%[21]. As this study did not employ lighting loggers, there is no data with which to make a comparison for this program specifically. Consequently, the self-reported hours of use obtained from the survey were reduced by the 40% established in the Ohio Residential Smart $aver CFL Program report dated June 29, 2010.

Daylength Adjustment

The frequency and length of time a customer uses their CFL is affected by daylength. As days become longer and shorter throughout the year, the length of time a bulb needs to be used increases and decreases in rooms where natural lighting is used to offset CFL use. Depending on which time of the year lighting usage is measured, the amount of use recorded by the lighting loggers may over- or under-predict a customer's overall usage for the year. The amount of daylight during any given season is a factor of the position of the sun which determines the sunrise and sunset time and the number of hours of daylight. The increase and decrease in hours of daylight experienced throughout the year can be expressed as a sine function, and the average over- or under-prediction in hours of use as a result of increased or decreased daylight can be calculated using the following equation[22]:

Equation 1: Hours/day = hours/day average + Max deviation * $\sin(\theta d)$

This approach was used by the Cadmus Group to analyze seasonal light logger data in a large residential CFL study in California. To calculate the impact of daylight on daily use, a regression

[19] As established in the Nexus Market Research, RLW Analytics, and GDS Associates study, dated January 20, 2009: "New England Residential Lighting Markdown Impact Evaluation".
[20] As established in the Nexus Market Research, RLW Analytics, dated October 2004: "Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs", table 6-4 where 24 out of 56 respondents indicated that they did not purchase the CFLs as spares.
[21] TecMarket Works and Building Metrics. "Ohio Residential Smart Saver CFL Program". June 29th, 2010. Pg. 35.
[22] The Cadmus Group. "Upstream Lighting Program Evaluation Report. Prepared for CPUC". November 16th, 2009. Pg. 16.

analysis was used to estimate the average hours per day and maximum deviation variables in Equation 1 from observed light logger data. The right side of the function represents a progression through the year where the right hand term goes to zero on the spring and fall equinox, and is a maximum value at the winter solstice and a minimum value at the summer solstice.

Equation 2: $\theta d = 2\pi * (284 + n) / 365$
Where n = Julian date (1 = Jan 1; 365 = Dec 31)

The Cadmus regression model predicted the annual average hours of use and the maximum deviation. The ratio of the maximum deviation to the annual average represents the maximum percent difference in the daily hours of use relative to the annual average. Equation 2 above can be used to predict the percent over- or under-estimation of lighting hours on any particular day of the year. This is the daylength adjustment factor. The predicted maximum deviation from the annual average hours of use from the Cadmus study is on the order of ±16%.

To calculate the daylength adjustment factor for this study, Equation 2 was evaluated at the median date of the survey period (December 26th). This value was applied to the max deviation of ±16% to estimate the daylight adjustment as follows:

$$\theta d = 2\pi * (284 + n) / 365 = \mathbf{2\pi * (284 + 360) / 365 = 11.09}$$

Finally, Equation 1 is evaluated using the average hours per day determined through the survey and adjusted for self-reporting bias:

Hours/day = hours/day average + Max deviation * sin(θd) = 2.61 + 16% * sin(11.09) = 2.45

Impact Estimates

Customers were asked if they had increased or decreased their lighting usage since installing the CFLs they received through the program. This enabled the detection of a slight increase in hours of use going from an incandescent bulb to a CFL.

Table 55 shows the unadjusted weighted average hours of use values for both income groups along with the updated weighted average values after both the self-reporting bias and the daylength adjustments are applied. The final values for average daily hours of use are 2.67 and 2.79 for low income compared to 2.37 and 2.38 for standard income, for incandescent bulbs and CFLs, respectively.

Table 55. Adjusted Average Daily Hours of Use

Adjustment	Magnitude of Adjustment		Average Daily Hours of Use (Old)		Average Daily Hours of Use (New)	
	LI	S	LI	S	LI	S
Unadjusted	N/A	N/A	4.79	4.27	4.98	4.29
Self-Reporting Bias	40.82%	40.82%	2.83	2.52	2.95	2.54
Daylength	5.6% /	6.3% /	2.67	2.37	2.79	2.38

		5.4%	6.3%				

Applying these biases to each individual room type allows a look at bulb savings by room type. This data can be seen in Table 56 and Table 57. Savings by room type are for installed bulbs only, it does not include the ISR. Again, bulb savings at the room type level is an unreliable figure and should not be used in any calculations. Only the weighted average across all room types, in the bottom row of Table 56, should be used.

Table 56. Adjusted CFL Survey Data with Gross Savings by Room Type for Installed Lamps for Low Income Participants

Room Type	Number of Installations	Average Wattage of Bulb Removed	Average Daily Hours of Use (Old)	Average Daily Hours of Use (New)	kWh per Bulb	kW per Bulb
Basement	1	60.00	4.28	4.28	65.7	0.0063
Other bedroom	44	63.20	2.79	2.84	45.6	0.0067
Dining room	35	59.61	1.89	1.93	28.4	0.0062
Garage	3	46.67	0.43	0.43	4.6	0.0044
Hall	21	60.95	2.07	2.15	31.9	0.0064
Kitchen	89	64.29	3.31	3.51	54.7	0.0069
Living/family room	146	63.72	3.07	3.12	50.8	0.0068
Master bedroom	113	63.60	1.90	2.02	30.9	0.0068
Bathroom	39	69.64	2.57	2.57	48.1	0.0077
Closet	8	65.00	0.65	0.65	11.2	0.0070
Other	30	68.33	3.81	4.32	66.8	0.0075

Table 57. Adjusted CFL Survey Data with Gross Savings by Room Type for Installed Lamps for Standard Participants

Standard Room Type	Number of Installations	Average Wattage of Bulb Removed	Average Daily Hours of Use (Old)	Average Daily Hours of Use (New)	kWh per Bulb	kW per Bulb
Basement	5	81.25	0.43	0.61	8.8	0.0093
Other bedroom	36	65.04	1.65	1.70	27.9	0.0070
Dining room	34	62.10	1.74	1.82	27.5	0.0066
Garage	10	75.00	3.69	1.26	89.9	0.0084
Hall	23	66.59	1.23	1.23	21.7	0.0072
Kitchen	62	63.67	3.23	3.11	54.4	0.0068
Living/family room	141	67.83	2.82	2.91	50.4	0.0074
Master bedroom	98	64.13	1.90	1.99	31.4	0.0069
Bathroom	44	59.02	1.74	1.85	25.5	0.0061
Closet	9	69.44	0.60	0.53	11.5	0.0076
Other	40	62.57	3.40	3.56	54.3	0.0066

Total Program Savings Extrapolation

There were a total of 743,804 participants from July 1st 2010 through April 28th 2011. These participants received 7,578,536 CFLs. This information is presented in Table 58. Multiplying the number of bulbs by the ISR yields the number of bulbs in service. The bulbs in service are then multiplied by the savings per bulb for the program to produce total annual program kW and kWh savings.

Table 58. Total Program Gross Savings Extrapolation

Campaign	Participation Count	Number of Bulbs	In Service	Gross kWh	Gross kW
664	296,589	1,775,202	1,420,162	59,646,787	9,941
701	447,215	5,803,334	4,642,667	194,992,022	32,499
TOTAL	**743,804**	**7,578,536**	**6,062,829**	**254,638,810**	**42,440**

Appendix A: Management Interview Instrument

Name: ______________________________

Title: ______________________________

Position description and general responsibilities:

____

____

____

We are conducting this interview to obtain your opinions about and experiences with Duke Energy's Ohio CFL 2011 program. We'll talk about the program and its objectives, your thoughts on improving the program, and the technologies the program covers. The purpose of this study is to capture the program's current operations as well as help identify areas where the program might be improved. Your responses will feed into a report that will be shared with Duke Energy and the state regulatory agency. We will not identify you by name, however, you may provide some information or opinions that could be attributed to you by virtue of your position and role in this program. If there is sensitive information that you wish to share, please warn me and we can discuss how best to include that information in the report.

The interview will take about an hour to complete. Do you have any questions for me before we begin?

Program Background and Objectives (15 min)

1. Please describe your role and scope of responsibility in detail.
2. How long have you been involved with this program? Has your role in this program changed during that time? (if so, how?)
3. Describe the evolution of the program. Why was the program created, and how has the program changed since it was it first started?
4. How/why was the current incentive approach chosen?
5. In your own words, please describe the program's objectives. (e.g. enrollment, energy savings, non-energy benefits)
6. Can you please walk me through the program's implementation, starting with how the program is marketed and how you target your customers, through how the customer participates and finishing with how savings are verified?

   a. Marketing/Targeting: How & Who *(can you send a copy of the solicitations?)*

   b. Enrollment/Participation

   c. Rebate processing

   d. Savings verification: How & Who

7. Of the program objectives you mentioned earlier, do you feel any of them will be particularly easy to meet, and why?

8. Which program objectives, if any, do you feel will be relatively difficult to meet, and why?

9. Are there any objectives you feel should be revised prior to the end of this program cycle? If yes, why?

Vendors (10 min)

10. Do you use any vendors or contractors to help implement the program?

    a. What responsibilities do they have?

    b. Are there any areas in which think they can improve their services?

11. *(If not captured earlier)* Please explain how activities of the program's vendors, customers and Duke Energy are coordinated.

    a. Do you think methods for coordination should be changed in any way? If so, how and why?

Rebates (15 min)

12. Describe your quality control and process for tracking participants, rebates, and other program data.

13. How effective is the current rebate program? *(and clarify standard for "effective")*

    a. How does it compare to other programs?

    b. What do you think should be changed, and why?

Contractor Training (5 min)

14. What contractors, if any, are involved with carrying out this program?

15. Do you have any suggestions for improving contractor effectiveness?

Improvements (10 min)

16. Are you currently considering any changes to the program's design or implementation?
    a. What are the changes?
    b. What is the process for deciding whether or not to make these changes?
17. Do you have suggestions for improvements to the program that would increase participation rates, or is Duke Energy happy with the current level of participation?
18. Do you have suggestions for increasing energy impacts *per participant*, given the same participation rates, or is Duke Energy happy with the current per participant impact?
19. Overall, what would you say about the program is working really well?
    a. Is there anything in this program you could highlight as a best practice that other utilities might like to adopt?
20. What area needs the most improvement, if any?
    a. (If not mentioned before) What would you suggest can be done to improve this?
21. Are there any other issues or topics we haven't discussed that you feel should be included in this report?
22. Do you have any supporting materials about the program that you could share with me? E.g., communication plan, program objectives, advertisement copy
23. Do you have any further questions for me about this study or anything else?
24. Whom else do you recommend that we interview?
25. Thank you!

Appendix B: Participant Survey Instrument

Use four attempts at different times of the day and different days before dropping from contact list. Call times are from 10:00 a.m. to 8:00 p.m. EST or 9-7 CST Monday through Saturday. No calls on Sunday.

SURVEY

Introduction

Note: Only read words in bold type.

Hello, my name is ___________. I am calling on behalf of Duke Energy to conduct a customer survey about the Duke Energy CFL Program. This was a program that provided free compact fluorescent light bulbs via direct mail. May I speak with _ please?

If person talking, proceed. If person is called to the phone reintroduce.
If not home, ask when would be a good time to call and schedule the call-back:

Call 1:	Date: _______	Time: _______ ❑AM or ❑PM
Call back 2:	Date: _______	Time: _______ ❑AM or ❑PM
Call back 3:	Date: _______	Time: _______ ❑AM or ❑PM
Call back 4:	Date: _______	Time: _______ ❑AM or ❑PM

❑ Contact dropped after fourth attempt.

We are conducting this survey to obtain your opinions about the Duke Energy CFL Program. Duke Energy's records indicate that you participated in the program by calling a toll-free number and receiving [#] CFLs. We are not selling anything. Your responses to our survey questions will be combined with other responses and used to help us make improvements to the program to better serve others. If you qualify for the survey it will take about 20-30 minutes, but when we are done with the survey I will confirm your address and we will send you $20 for your time.

Note: If this is not a good time, ask if there is a better time to schedule a callback.

1. **Do you recall participating in the CFL program?**

a. ❑ Yes, *begin* → *Skip to Q2.*
b. ❑ No,
c. ❑ DK/NS

This program was provided through Duke Energy. In this program, Duke Energy sent (#) CFLs directly to your household.

Do you remember participating in this program?

a. ❑ Yes, *begin* → *Go to Q2.*
b. ❑ No,
c. ❑ DK/NS

If No or DK/NS terminate interview and go to next participant.

2. **How did you learn of the free CFL Program?**
   a. _ I visited Duke Energy's website
   b. _ From another Web Site (**which one?**)
   c. _ I got a brochure in the mail
   d. _ Advertisement in my bill
   e. _ Email from family/friend
   f. _ Email from a Duke Energy employee
   g. _ Paperless billing email
   h. _ From friend/family *(ask if through email, if so, select e above)*
   i. _ Social media (**which one?__**)
   j. _ CAP Agency (low income agency)
   k. _ Other Low income service: __
   l. _ Other:

3. **Why did you decide to take advantage of the offer?** (Select all that apply)
   a. I needed light bulbs
   b. To save energy
   c. Because it was free
   d. To save money
   e. To try CFLs
   f. It was environmentally correct
   g. Offer made it easy to get bulbs (convenient)
   h. The bulbs last longer than standard bulbs
   i. Other (please specify):

4. **Our records indicate that you ordered the free CFLs using (800 number/Web site/mail-in reply card), is this correct?**
   a. Yes
   b. No
   c. Don't Know

   4a. *If no to Q4*, **How did you order the CFLs?**

i. Automated 800 number
ii. Web Site
iii. Mail-in card
iv. Called customer service
v. Other (please specify)

5. **Which of the following statements best describes the level of success you had in completing your order for CFLs:**
   a. **You were successful at placing the order on your first attempt**
   b. **You had to make more than one attempt using the same method**
   c. **You had to make more than one attempt using different methods (which ones? ()**
   d. Don't remember
   e. Other:

6. **On a 1-to-10 scale with 1 being very dissatisfied and 10 being very satisfied, please rate your satisfaction with the ease of ordering your free CFLs.**

Very dissatisfied									very satisfied
1	2	3	4	5	6	7	8	9	10

If 7 or less, 6a. **Why were you less than satisfied with the ease of ordering?** __

If 7 or less, 6b. **Would you have preferred another method to order the free CFLs?**
   a. Yes (**which method?**)
   b. No
   c. Don't know

7. **On a 1-to-10 scale with 1 being very dissatisfied and 10 being very satisfied, please rate your satisfaction with the delivery time in ordering your free CFLs.**

Very dissatisfied									very satisfied
1	2	3	4	5	6	7	8	9	10

If 7 or less, 7a. **Why were you less than satisfied with the delivery time?** __

8. **Were you aware of the order-tracking feature that allowed you to check the progress of your CFL order?**

a. Yes
b. No

If yes to 8, **8a. Did you use the order-tracking feature?**

i. Yes
ii. No
iii. Don't Know

If yes to 8a, **8b. On a 1-to-10 scale with 1 being very dissatisfied and 10 being very satisfied, please rate your satisfaction with the order-tracking feature of the CFL program.**

very dissatisfied very satisfied
1 2 3 4 5 6 7 8 9 10

If 7 or less,. **Why were you less than satisfied with the order tracking feature?**

9. **On a scale of 1 to 10 where 1 is not likely and 10 is very likely, how likely would you be to continue to buy and use CFLs in the future?**

   very unlikely very likely
   1 2 3 4 5 6 7 8 9 10

10. **How likely are you to use CFLs when there is a need to change a bulb in your home?**

    very unlikely very likely
    1 2 3 4 5 6 7 8 9 10

11. **On a scale of 1 to 10 where 1 is not likely and 10 is very likely, how likely would you be to tell friends and/or family about this offer?**

    very unlikely very likely
    1 2 3 4 5 6 7 8 9 10

We would like to know if the direct mailing of CFLs to your home made you more likely or less likely to obtain and use CFLs compared to several other methods:

On a 1-to-10 scale with 1 being very unlikely and 10 being very likely, please rate your likelihood of participating in a CFL program that:

12. **Offers free** [or discounted] **CFLs by direct-mail sent to your home**

    very unlikely very likely
    1 2 3 4 5 6 7 8 9 10

13. Offers free [or discounted] **CFLs through a retailer or store coupon**

very unlikely very likely

1 2 3 4 5 6 7 8 9 10

14. Offers free [or discounted] **CFLs through a manufacturers coupon that can be used at any store where that brand is sold**

very unlikely very likely

1 2 3 4 5 6 7 8 9 10

15. Offers free [or discounted] **CFLs at a stand at a community event such as a fair**

very unlikely very likely

1 2 3 4 5 6 7 8 9 10

16. Offers free [or discounted] **CFLs at a stand in a public parking lot**

very unlikely very likely

1 2 3 4 5 6 7 8 9 10

17. Offers free [or discounted] **CFLs through an online vendor such as Amazon.com**

very unlikely very likely

1 2 3 4 5 6 7 8 9 10

On a 1-to-10 scale with 1 being not at all important and 10 being very important, please rate the importance of each of the following characteristics on choosing a light bulb for your home

18. Mercury content of the bulb

1 2 3 4 5 6 7 8 9 10 DK

19. Ability to dim the lighting level

1 2 3 4 5 6 7 8 9 10 DK

20. Speed of which the bulb comes up to full lighting level

1 2 3 4 5 6 7 8 9 10 DK

21. Purchase price of the bulb

1 2 3 4 5 6 7 8 9 10 DK

22. Availability of the bulb in stores you normally shop

1 2 3 4 5 6 7 8 9 10 DK

23. Selection of wattage and light output levels available

1 2 3 4 5 6 7 8 9 10 DK

24. Cost savings on your utility bill
1 2 3 4 5 6 7 8 9 10 DK

25. Energy savings
1 2 3 4 5 6 7 8 9 10 DK

26. Attractiveness or appearance of the bulb
1 2 3 4 5 6 7 8 9 10 DK

27. Recommendations from family and friends
1 2 3 4 5 6 7 8 9 10 DK

28. Recommendations from the utility company
1 2 3 4 5 6 7 8 9 10 DK

29. Availability of utility programs or services that offer the bulbs to you directly
1 2 3 4 5 6 7 8 9 10 DK

30. Ease of bulb disposal
1 2 3 4 5 6 7 8 9 10 DK

31. I'd like to talk about the CFLs you received from this program. Our records indicate that you received (#) CFLs, is this correct?
a. Yes
b. No
c. Don't Know

31a. *If no to Q31*, **how many CFLs did you receive?**
Enter response:

32. Did you order all of the bulbs that you were eligible to receive?
a. Yes
b. No
c. Don't know

If No, 32a. **Why not?** __

33. How many of the CFLs are now installed in light fixtures?
Enter response:

"Now I'm going to ask you about each bulb you put into a light fixture..."
(Repeat 34 a to e for up to 3 installed bulbs)

34. **For the** <first, second, third> **CFL, in which room was the bulb installed?**
a. Living/family room
b. Dining room
c. Kitchen
d. Master bedroom
e. Bedroom 2
f. Bedroom 3 or other bedroom
g. Hall
h. Closet
i. Basement
j. Garage
k. Other (specify_)

34a. **Was the bulb you removed a standard bulb or a CFL?**
a. Standard Incandescent
b. CFL
c. There was no bulb in the socket

34b. **How many watts was the old bulb that you took out?**
a. Less than 44
b. 45-70
c. 71-99
d. 100 or more

34c. **What did you do with the incandescent you removed?**
a) Recycled It
b) Threw it away
c) Stored it
d) Other....

34d. **On average, approximately how many hours per day is this light used?**
a. Less than 1
b. 1 to 2
c. 3 to 4
d. 5 to 10
e. 11 to 12
f. 13 to 24

34e. **Did the hours of use for this fixture increase, decrease or stay the same since you replaced the old bulb with the CFL?**
a. Increased (**how many hours?**_)
b. Decreased (**how many hours?**__)
c. Stayed the same

If less than 6 were installed:

35. What have you done with the remaining CFLs that were not installed?

a. Put them in storage/closet/shelf
b. Gave them away **(35a. To whom?)--** *ask question 35b then skip to Q39*
c. Threw them out - *skip to Q39*
d. Recycled them - *skip to Q39*
e. Other

35b. **How many did you give away?** __ ☐ DK

If answered a. " Put them in storage" to question (35), ask (36-39)

36. Do you plan on using the remaining CFLs in the next year?

a. Yes
b. No 36a. **Why Not?** __
c. Maybe/DK

37. Thinking of the CFL bulbs you have stored for later use, what are the reasons that you have not installed these bulbs?

(Select all that apply)

a. I am waiting for my other standard bulbs to burn out
d. I am waiting for my other CFL bulbs to burn out
e. I already have CFLs installed everywhere they will fit
f. The other lamps or light fixtures in my home are on a dimmer and don't work with the CFLs
g. The CFL bulbs are too dim for the other locations where I could install them
h. I don't like the way the CFL bulbs look in some of my fixtures
i. Other (please specify):

38. How many standard incandescent bulbs do you have in storage to replace bulbs that burn out?

a. 0
b. 1
c. 2
d. 3
e. 4
f. 6
g. 7 – 11
h. 12+
i. DK/NS

39. How long do you think it will be before you will have used all of the free bulbs you received from the Duke Energy program?

a) 1 year or less

b) 12 to 24 months (2 years)
c) 25 to 36 months (3 years)
d) 37 to 48 months (4 years)
e) 49 to 60 months (5 years)
f) More than 5 years
g) dk/ns

40. **Have you removed any of the CFLs you installed that you received through the direct mail CFL program?**
   a. Yes (**How many?__**)
   b. No (*skip to Q42*)

41. *If yes to Q40*, **Why did you remove them?**
   a. Not bright enough
   b. Did not like the color of the light
   c. The light was too bright
   d. Too slow to start
   e. Burned out
   f. Not working properly
   g. Did not like appearance/shape of the bulbs
   h. Other (**Please specify_**)

42. **On a 1-to-10 scale with 1 being very dissatisfied and 10 being very satisfied, please rate your satisfaction with the <u>light quality</u> of your free CFLs.**

very dissatisfied									very satisfied
1	2	3	4	5	6	7	8	9	10

If 7 or less, 42a. **Why were you less than satisfied with the light quality? __**

43. **On a 1-to-10 scale with 1 being very dissatisfied and 10 being very satisfied, please rate your satisfaction with the <u>overall bulb quality</u> of your free CFLs.**

very dissatisfied									very satisfied
1	2	3	4	5	6	7	8	9	10

If 7 or less, 43a. **Why were you less than satisfied with the quality of the CFLs? __**

On a scale from 1-10, with 1 indicating that you were very dissatisfied, and 10 indicating that you were very satisfied, please rate your satisfaction with...

44. the direct mail CFL program

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less (NC and SC only), **How could this be improved?** _

45. **...Duke Energy overall.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**_

46. What did you like most about the direct mail CFL program?

Response:

47. What did you like least about the direct mail CFL program?

Response:

48. Before you received the free CFLs from Duke Energy, had you already installed CFLs in your home?

a) Yes (*ask question 50a*)
b) No
c) Don't Know

If yes to Q50
50a. **How many CFLs were you using in your home when you received the shipment from Duke Energy?**
___ Bulbs
___ Don't know / Not sure

49. **How many years have you been using CFLs**?
a) Never purchased until now
b) 1 year or less
c) 1 to 2 years

d) 2 to 3 years
e) 3 to 4 years
f) 4 or more years

50. If the CFL direct shipment program had not been available, would you have:

a. **Purchased the same amount of CFLs at the same time**
b. **Purchased fewer CFLs at the same time**
    i. *If b,* **How many? __**
c. **Purchased CFLs at a later time, or**
    i. *If c,* **When? __**
    ii. *If c,* **How many?__**
d. **Not purchased CFLs**

51. On a scale from 1-10, with 1 indicating that the factor was not at all influential, and 10 indicating that the factor was very influential, please rate the level of influence of the following factors on your decision to obtain CFLs through the Duke Energy \ program.

53a. **Duke Energy advertising on TV, Radio, or newspaper**
Not at all influential — very influential
1 2 3 4 5 6 7 8 9 10

53b. **Advertising on Duke Energy's Web site**
Not at all influential — very influential
1 2 3 4 5 6 7 8 9 10

53c. **Duke Energy advertising social media sites such as Facebook**
Not at all influential — very influential
1 2 3 4 5 6 7 8 9 10

53d. **The brand of CFLs offered by the program**
Not at all influential — very influential
1 2 3 4 5 6 7 8 9 10

53e. **Other non-Duke Energy advertising**
Not at all influential — very influential
1 2 3 4 5 6 7 8 9 10

53f. **Friends or family by word of mouth**
Not at all influential — very influential
1 2 3 4 5 6 7 8 9 10

53g. **Friends or family by email**

Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

53h. **Friends or family by social media such as Facebook**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

53i. **Someone you don't know personally or a group that you follow on Facebook or Twitter**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

53j. **Your desire to save energy**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

53k. **Your desire to save on utility costs**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

53l. **Your desire to be environmentally responsible.**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

55. Did you tell anyone about the program?
a. Yes (*ask 55a and 55b*)
b. No
c. Don't know

55a. **Who did you tell?** *(add number to all that apply)*
i. _Friends **(How many?)**
ii. _Family **(How many?)**
iii. _Co-workers **(How many?)**
iv. _Neighbors **(How many?)**
v. _Other **(How many?)**

55b. **How did you tell them?**
i. Word of mouth
ii. Email
iii. Facebook
iv. Twitter
v. Web site forum
vi. Other __

56. Did your experience with the CFLs provided by the Duke Energy Free CFL program make it more or less likely that you would purchase and install CFLs in the future?

a. **More likely** (*ask 56a*)
b. **Less likely** (*ask 56b*)
c. **Neither more or less likely**

56a. **Why are you more likely to use CFLs in the future?**

56b. **Why are you less likely to use CFLs in the future?** __

57. Have you purchased any additional CFLs since receiving the free CFLs from Duke Energy?

a. Yes – *ask 57a, 57b and 57c.*
b. No – ask 57d
c. Don't Know

If yes to Q57, 57a. **How many did you purchase?** _

*If yes to Q57, 57*b. **How many of those are you currently using?**_

If yes to Q57, 57c.. **Using a 1 to 10 scale, with 1 meaning that the Duke program had no influence, and a 10 to mean that the Duke program was very influential, please rate the influence of the Duke Energy free CFL program on your decision to purchase additional CFLs.**

Not at all influential								very influential	
1	2	3	4	5	6	7	8	9	10

If no to Q57, ask 57d. **57d. On a 1-to-10 scale with 1 being very unlikely and 10 being very likely, please rate your likelihood of buying and using CFLs in the future:**

very unlikely									very likely
1	2	3	4	5	6	7	8	9	10

58. Considering future CFL purchases, how many CFL bulbs would you purchase in the next year if they were...

a. **The same price as standard bulbs ()**
b. **$1 more than standard bulbs ()**
c. **$2 more than standard bulbs ()**
d. **$3 more than standard bulbs ()**
e. **Free, but you had to mail in a rebate form to get your money back ()**

f. Free, but you had to fill out a form online (__)

59. What is your best estimate of the number of bulbs installed in your home that are not CFLs?

_

60. How many of these non-CFL bulbs are in sockets that are typically used for more than 2 hours a day?

61. Please list the number of bulbs currently installed in your home that are specialty bulbs such as dimmable bulbs, three-way bulbs, recessed, flood or directional lights, candelabra lights or other non-standard bulbs... *How many <a> do you have in your home?... how many <b>, etc.*

   a. _Dimmable bulbs
   b. _Outdoor flood bulbs
   c. _Three-way bulbs
   d. _Spotlight bulbs
   e. _Recessed bulbs
   f. _Candelabra bulbs
   g. _Other (specify)_

62. For each of these specialty bulbs installed, how many are CFLs?

   a. _Dimmable CFLs
   b. _Outdoor flood CFLs
   c. _Three-way CFLs
   d. _Spotlight CFLs
   e. _Recessed CFLs
   f. _Candelabra CFLs
   g. _Other (specify)_

63. On a scale from 1-10, with 1 indicating not at all interested and 10 indicating very interested, please rate your interest in Duke Energy providing a direct mail specialty CFL program that shipped discounted specialty bulbs directly to your home:

Not at all interested								very interested	
1	2	3	4	5	6	7	8	9	10

Please tell me if you would be interested in receiving the following types of CFLs if they were to be offered in the future...

64. Dimmable CFLs

   a. Yes (about how many hours per day would these bulbs be used?)

b. No
c. Don't Know

65. Outdoor flood CFLs

a. Yes **(about how many hours per day would these bulbs be used?)**
b. No
c. Don't Know

66. Three-way CFLs

a. Yes **(about how many hours per day would these bulbs be used?)**
b. No
c. Don't Know

67. Spotlight CFLs

a. Yes **(about how many hours per day would these bulbs be used?)**
b. No
c. Don't Know

68. Candelabra CFLs

a. Yes **(about how many hours per day would these bulbs be used?)**
b. No
c. Don't Know

69. *(If responder indicated a different specialty bulb)* **Other _**

a. Yes **(about how many hours per day would these bulbs be used?)**
b. No
c. Don't Know

70. **Since you received the free CFLs from Duke Energy,**

70a. **Have you purchased and installed any energy efficiency equipment (such as high efficiency appliances, windows or heating and cooling equipment?**

i. Yes
ii. No
iii. Don't Know

70b. **Have you made energy efficiency improvements in your home, such as...?**

i. __Wall or ceiling insulation
ii. __Caulking
iii. __Faucet aerators
iv. __Outlet or switch gaskets
v. __Lowflow showerhead
vi. __Programmable thermostat
vii. __Weatherstripping

viii. __None of these

70c. **Have you changed any of your habits related to energy use?**
   i. Yes (*ask:* **Please specify:)**
   ii. No
   iii. Don't Know

71. Please rate the influence of your experience with the Duke Energy CFL program regarding your decision to purchase additional equipment on your own on a scale from 1-10, with 1 indicating that the program was not at all influential, and 10 indicating that the program was very influential:

Not at all influential								very influential	
1	2	3	4	5	6	7	8	9	10

72. How often do you use the Duke Energy Web Site?
   a. Often (once a month or more)
   b. Sometimes (less than once a month)
   c. Never

73. Have you added any major electrical appliances to your home in the past year?
   a. Yes
   b. No

74. Are you aware of the ENERGY STAR label?
   a. Yes
   b. No

75. **Do you typically look for the ENERGY STAR label when purchasing an appliance?**
   a. Yes
   b. No

76. **Do you typically buy appliances with the ENERGY STAR label?**
   a. Yes, all of the time
   b. Yes, some of the time
   c. No, never

77. Why do you believe that Duke Energy is providing free CFLs to their customers
   a. Duke Energy wants to save their customers money
   b. Duke Energy wants to save energy for environmental reasons
   c. Duke Energy wants to save energy for economic reasons
   d. Duke Energy wants to look good (PR)
   e. The government is forcing Duke Energy to do it
   f. Other (specify)

78. Are you currently a participant in any of the following Duke Energy programs (check all that apply):

a. **Power Manager**
b. **Residential Smart Saver**
c. **Home Energy House Call**
d. **Home Energy Comparison Report**
e. **Personalized Energy Report**
f. **Online Services**

For all programs not checked in Q78, ask the following question

On a scale from 1-10, with 1 indicating not at all interested and 10 indicating very interested, please rate your interest in Duke Energy providing the following programs:

78a. (Power Manager) **A program that provides bill credits in exchange for allowing Duke Energy to temporarily cycle your air conditioning unit during periods of high use**

Not at all interested very interested
1 2 3 4 5 6 7 8 9 10

78b. (Residential Smart Saver) **A program that provides rebates for energy efficient improvements to your house such as energy efficient heating and cooling units.**

Not at all interested very interested
1 2 3 4 5 6 7 8 9 10

78c. (Home Energy House Call) **A program in which an assessor comes to your house, suggests energy efficiency improvements, and Duke Energy provides certain low-cost improvement materials for free.**

Not at all interested very interested
1 2 3 4 5 6 7 8 9 10

78d. (Home Energy Comparison Report/) **A program that provides an ongoing comparison of your energy use with that of people who live in similar homes**

Not at all interested very interested
1 2 3 4 5 6 7 8 9 10

78e. (Personalized Energy Report) **A program that provides personalized energy analysis and ways to save energy and money by filling out a few questions about your home either online or by mail.**

Not at all interested								very interested	
1	2	3	4	5	6	7	8	9	10

79. What other services could Duke Energy provide to help improve home energy efficiency?
Response:

Finally, we have some general demographic questions...

80. In what type of building do you live?
a. Single-family home, detached construction
b. Single family home, factory manufactured/modular
c. Single family, mobile home
d. Row House
e. Two or Three family attached residence-traditional structure
f. Apartment (4 + families)---traditional structure
g. Condominium---traditional structure
h. OTHER
i. REFUSED
j. DON'T KNOW

81. What year was your residence built?
a. 1959 and before
b. 1960-1979
c. 1980-1989
d. 1990-1997
e. 1998-2000
f. 2001-2007
g. 2008-present
h. Don't Know

82. How many rooms are in your home (excluding bathrooms, but including finished basements)?
a. None
b. 1-3
c. 4
d. 5
e. 6
f. 7
g. 8
h. 9
i. 10 or more
j. DK/NS

83. Which of the following best describes your home's heating system?

a. None
b. Central forced air furnace
c. Electric Baseboard
d. Heat Pump
e. Geothermal Heat Pump
f. Other

84. How old is your heating system?

a. 0-4 years
b. 5-9 years
c. 10-14 years
d. 15-19 years
e. 19 years or older
f. Don't know
g. Do not have

85. What is the primary fuel used in your heating system?

a. Electricity
b. Natural Gas
c. Oil
d. Propane
e. Other

86. What is the secondary fuel used in your primary heating system, if applicable?

a. Electricity
b. Natural Gas
c. Oil
d. Propane
e. Other
f. None

87. Do you use one or more of the following to cool your home? *(Mark all that apply)*

a. None, do not cool the home
b. Heat pump for cooling
c. Central air conditioning
d. Through the wall or window air conditioning unit
e. Geothermal Heat pump
f. Other (specify?)

88. How many window-unit or "through the wall" air conditioner(s) do you use?

a. None
b. 1

c. 2
d. 3
e. 4
f. 5
g. 6
h. 7
i. 8 or more

89. What is the fuel used in your cooling system?

a. Electricity
b. Natural Gas
c. Oil
d. Propane
e. Other
f. None

90. How old is your cooling system?

a. 0-4 years
b. 5-9 years
c. 10-14 years
d. 15-19 years
e. 19 years or older
f. Don't know
g. Do not have

91. What is the fuel used by your water heater? *(Mark all that apply)*

a. Electricity
b. Natural Gas
c. Oil
d. Propane
e. Other
f. No water heater

92. How old is your water heater?

a. 0-4 years
b. 5-9 years
c. 10-14 years
d. 15-19 years
e. More than19 years

93. What type of fuel do you use for indoor cooking on the stovetop or range? *(Mark all that apply)*

a. Electricity

99. **Does your home have a heated or unheated basement?**
    a. Heated
    b. Unheated
    c. No basement

100. **Does your home have an attic?**
    a. Yes
    b. No

101. **Are your central air/heat ducts located in the attic?**
    a. Yes
    b. No
    c. Not applicable

102. **Does your house have cold drafts in the winter?**
    a. Yes
    d. No

103. **Does your house have sweaty windows in the winter?**
    a. Yes
    b. No

104. **Do you notice uneven temperatures between the rooms in your home?**
    a. Yes
    b. No

105. **Does your heating system keep your home comfortable in winter?**
    a. Yes
    b. No

106. **Does your cooling system keep your home comfortable in summer?**
    a. Yes
    b. No

107. **Do you have a programmable thermostat?**
    a. Yes
    b. No

108. **What temperature is your thermostat set to on a typical summer weekday afternoon?**
    a. Less than 69 degrees
    b. 69-72 degrees
    c. 73-78 degrees
    d. Higher than 78 degrees

114. Are you planning on making any large purchases to improve energy efficiency in the <u>next 3 years</u>?

a. Yes
b. No
c. Not sure

The following questions are for classification purposes only and will not be used for any other purpose than to help Duke Energy continue to improve service.

115. What is your age group?

a. 18-34
b. 35-49
c. 50-59
d. 60-64
e. 65-74
f. Over 74

116. Please indicate your annual household income.

a. Under $15,000
b. $15,000-$29,999
c. $30,000-$49,999
d. $50,000-$74,999
e. $75,000-$100,000
f. Over $100,000
g. Prefer Not to Answer

That completes our survey. As I mentioned at the start of the survey, we'd like to send you $20 for your time. Should we send it to <name> **at** <address>**?** *(note corrections in excel call tracking sheet)*

Thank you for your time and feedback today! *(Politely end call)*

Appendix C: Non-Participant Survey

If CFL non-participant, then contact for survey. Use four attempts at different times of the day and different days before dropping from contact list. Call times are from 10:00 a.m. to 8:00 p.m. EST or 9-7 CST Monday through Saturday. No calls on Sunday.

SURVEY

Introduction

Note: Only read words in bold type.

Hello, my name is ______. I am calling on behalf of Duke Energy to conduct a customer survey about compact fluorescent light bulbs. May I speak with ____________ please?

If person talking, proceed. If person is called to the phone reintroduce.
If not home, ask when would be a good time to call and schedule the call-back:

Call 1:	Date: __________	Time: ____________	❑AM or ❑PM
Call back 2:	Date: __________	Time: ____________	❑AM or ❑PM
Call back 3:	Date: __________	Time: ____________	❑AM or ❑PM
Call back 4:	Date: __________	Time: ____________	❑AM or ❑PM

❑ Contact dropped after fourth attempt.

We are conducting this survey to obtain your opinions about the Duke Energy and CFLs. We are not selling anything. Your responses to our survey questions will be combined with other responses and used to help us make improvements to Duke Energy's customer services. If you qualify for the survey it will take about 20 minutes, but when we are done with the survey I will confirm your address and we will send you $10 for your time.

May we begin the survey?

1. **Do you recall seeing or hearing about the free CFL program from Duke Energy?**

   1. ❑ Yes, *begin* → *Skip to Q3.*
   2. ❑ No,
   99. ❑ DK/NS

   (No / DK/NS →) **This program was provided through Duke Energy. In this program, through a web site or an 800-telephone number, Duke Energy offered you up to 15 CFLs by mail.**

Do you recall seeing or hearing information on this program?

1. ☐ Yes, *begin* → *Go to Q2.*
2. ☐ No,
99. ☐ DK/NS

If No or DK/NS terminate interview and go to next participant.

2. **Did you receive CFLs through this program?**
   a. Yes
   b. No
   c. DK/NS

If yes to Q2, mark participant as ineligible for a non-participant survey and proceed with a participant survey.

3. **How did you learn of the free CFL Program?**

   m. ____ I visited Duke Energy's website
   n. ____ From another Web Site (**which one?**______)
   o. ____ I got a brochure in the mail
   p. ____ Advertisement in my bill
   q. ____ Email from family/friend
   r. ____ Email from a Duke Energy employee
   s. ____ Paperless billing email
   t. ____ From friend/family (ask if through email, if so, select e above)
   u. ____ Social media (**which one?**________)
   v. ____ CAP Agency (low income agency)
   w. ____ Other Low income service: ____________________________
   x. ____ Other: ____________________________

3a. On a scale of 1 to 10 where 1 is not likely and 10 is very likely, how likely are you to use CFLs when there is a need to change a bulb in your home?

very unlikely									very likely
1	2	3	4	5	6	7	8	9	10

4. **Do you currently have any CFLs installed in your home?**
   a. Yes
   b. No
   c. Don't Know

If yes 4a.

4a. Please list the location, quantity and wattage of all installed CFLs? *PROBE TO GET EXACT TYPE AND QUANTITY AND LOCATION*

Wattage 1: ________________ Quantity 1: _____ Location 1:__________
Wattage 2: ________________ Quantity 2: _____ Location 2:__________
Wattage 3: ________________ Quantity 3: _____ Location 3:__________
Wattage 4: ________________ Quantity 4: _____ Location 4:__________
Enter response: ________________

5. **Did you make any attempts to enroll in the free CFL program from Duke Energy?**
    a. Yes **(how many attempts?____)**
    b. No (skip to question 8)
    c. Don't Know (skip to question 8)

6. **How did you attempt to enroll?**
    a. ___Went to Duke Energy Web Site
    b. ___Called Toll free number
    c. ___Called Duke Customer service number
    d. ___Sent Mail-in card

7. **Why were you unsuccessful in enrolling?**
    a. Ineligible (already had full amount of bulbs) – *skip to Q9*
    b. Ineligible (**Why?**______________)– *skip to Q9*
    c. Web site error or difficulty – *skip to Q9*
    d. Automated phone error or difficulty – *skip to Q9*
    e. Mailed in form – never heard back – *skip to Q9*

8. **Why did you decide not to enroll in the Duke Energy free CFL program?**
    a. Too much hassle
    b. Do not use CFLs (*go to question 8a*)
    c. Do not want to give out personal information
    d. Do not have internet connection
    e. Prefer the former coupon program
    f. Like seeing the product firsthand
    g. Want to buy American
    h. Received CFLs in the past and thought I would be ineligible
    i. Already have CFLs in all sockets that use them
    j. Did not understand program
    k. Don't like CFLs (*go to question 8a*)
    l. Other (Specify_______)

8a. Could you please tell me why you don't like/use CFLs (*check all that apply*)**?**

i. ___I don't like the color of the light
ii. ___They are too expensive
iii. ___Not bright enough
iv. ___They are too bright
v. ___Take too long to "warm up"
vi. ___I don't like appearance/shape of CFLs
vii. ___Mercury/disposal concerns
viii. ___I require specialty bulbs for my lighting
ix. ___Landlord has incandescent bulbs installed
x. ___Other: ________________________

9. **Did you tell anyone about the program?**
   d. Yes (*ask 23a and 23b*)
   e. No
   f. Don't know

9a. **Who did you tell?** *(add number to all that apply)*

vi. ____Friends **(How many?)**
vii. ____Family **(How many?)**
viii. ____Co-workers **(How many?)**
ix. ____Neighbors **(How many?)**
x. ____Other **(How many?)**

9b. **How did you tell them?**

i. Word of mouth
ii. Email
iii. Facebook
iv. Twitter
v. Web site forum

9c. Did they sign up and receive free CFLs?

i. Yes
ii. No
iii. Don't know

10. **Would you say that learning of the Duke Energy CFL direct mail program increased your awareness of how you could save energy by using compact fluorescent light bulbs?**

   a. Yes
   b. No
   c. DK

11. **Did the free CFL offer inspire you to purchase CFLs?**
    a. Yes (**How many?**________) – *skip to question 12*
    b. No – *ask question 10a*

12. **We now want to ask you about how influential the Duke Energy CFL direct mail program was to your decision to purchase and install additional CFLs.**

    Using a 1 to 10 scale, with 1 means that your experience with the Duke Energy CFL direct mail program was Not at all Influential on your decision to buy additional CFLs and a 10 means that the Duke Energy CFL direct mail program was Very Influential in your decision, please rate the influence of the Duke Energy CFL direct mail program on your decision to purchase additional CFLs.

    very dissatisfied — very satisfied
    1 2 3 4 5 6 7 8 9 10

13. **On a scale from 1-10, with 1 indicating that you were very dissatisfied, and 10 indicating that you were very satisfied, please rate your satisfaction with CFL(s) that you have purchased.**

    very dissatisfied — very satisfied
    1 2 3 4 5 6 7 8 9 10

    If 7 or less, 12a. **Why were you dissatisfied with the CFLs?**

    ____
    ____

14. **At which store or Web site did you purchase the CFLs?** ___________

On a scale from 1-10, with 1 indicating that the factor was not at all influential, and 10 indicating that the factor was very influential, please rate the level of influence of the following factors on your decision to buy CFLs:

15a. **Duke Energy advertising for CFLs on TV, Radio, or newspaper**
Not at all influential — very influential
1 2 3 4 5 6 7 8 9 10

15b. **CFL advertising on Duke Energy's Web site**
Not at all influential — very influential
1 2 3 4 5 6 7 8 9 10

15c. **Duke Energy CFL advertising on social media sites such as Facebook**

Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

15d. **The brand of CFLs purchased or obtained**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

15e. **Other non-Duke Energy advertising for CFLs**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

15f. **Friends or family by word of mouth**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

15g. **Friends or family by email**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

15h. **Friends or family by social media such as Facebook**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

15i. **Someone you don't know personally or a group that you follow on Facebook or Twitter**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

15j. **Your desire to save energy**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

15k. **Your desire to save on utility costs**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

15l. **Your desire to be environmentally responsible.**
Not at all influential very influential
1 2 3 4 5 6 7 8 9 10

16. **Since April of this year,**

a. **Have you purchased and installed any energy efficiency equipment (such as high efficiency appliances, windows or heating and cooling equipment?**

i. ☐ Yes
ii. ☐ No
iii. ☐ Don't Know

b. **Have you made energy efficiency improvements in your home, such as?**

i. _____**Wall or ceiling insulation**
ii. _____**Caulking**
iii. _____**Faucet aerators**
iv. _____**Outlet or switch gaskets**
v. _____**Lowflow showerhead**
vi. _____**Programmable thermostat**
vii. _____**Weatherstripping**
viii. _____**None of these**

c. **Have you changed any of your habits related to energy use?**

i. ☐ Yes
ii. ☐ No
iii. ☐ Don't Know

On a 1-to-10 scale with 1 being very unlikely and 10 being very likely, please rate your likelihood of participating in a CFL program that:

17. **Offers free CFLs by direct-mail**

very unlikely very likely
1 2 3 4 5 6 7 8 9 10

18. **Offers free CFLs through a retailer coupon**

very unlikely very likely
1 2 3 4 5 6 7 8 9 10

19. **Offers free CFLs through a manufacturers coupon**

very unlikely very likely
1 2 3 4 5 6 7 8 9 10

20. **Offers free CFLs at a stand at a community event such as a fair**

very unlikely								very likely	
1	2	3	4	5	6	7	8	9	10

21. **Offers free CFLs at a stand in a public parking lot**

very unlikely								very likely	
1	2	3	4	5	6	7	8	9	10

22. **Offers free CFLs through an online vendor such as Amazon.com**

very unlikely								very likely	
1	2	3	4	5	6	7	8	9	10

23. On a 1-to-10 scale with 1 being not at all important and 10 being very important, please rate the importance of each of the following characteristics on choosing a light bulb for your home

23a. **Mercury content of the bulb**
1 2 3 4 5 6 7 8 9 10 DK

23b. **Ability to dim the lighting level**
1 2 3 4 5 6 7 8 9 10 DK

23c. **Speed of which the bulb comes up to full lighting level**
1 2 3 4 5 6 7 8 9 10 DK

23d. **Purchase price of the bulb**
1 2 3 4 5 6 7 8 9 10 DK

23e. **Availability of the bulb in stores you normally shop**
1 2 3 4 5 6 7 8 9 10 DK

23f. **Selection of wattage and light output levels available**
1 2 3 4 5 6 7 8 9 10 DK

23g. **Cost savings on your utility bill**
1 2 3 4 5 6 7 8 9 10 DK

23h. **Energy savings**

1 2 3 4 5 6 7 8 9 10 DK

23i. Attractiveness or appearance of the bulb
1 2 3 4 5 6 7 8 9 10 DK

23j. Recommendations from family and friends
1 2 3 4 5 6 7 8 9 10 DK

23k. Recommendations from the utility company
1 2 3 4 5 6 7 8 9 10 DK

23l. Availability of utility programs or services that offer the bulbs to you directly
1 2 3 4 5 6 7 8 9 10 DK

23m. Ease of bulb disposal
1 2 3 4 5 6 7 8 9 10 DK

24. What is your best estimate of the number of bulbs installed in your home that are not CFLs?

____

25. How many of these non-CFL bulbs are in sockets that are typically used for more than 2 hours a day?

______

26. Please list the number of bulbs currently installed in your home that are specialty bulbs such as dimmable bulbs, three-way bulbs, recessed, flood or directional lights, candelabra lights or other non-standard bulbs... *How many <a> do you have in your home?... how many <b>, etc.*

h. ____**Dimmable bulbs**
i. ____**Outdoor flood bulbs**
j. ____**Three-way bulbs**
k. ____**Spotlight bulbs**
l. ____**Recessed bulbs**
m. ____**Candelabra bulbs**
n. ____**Other (specify)**____________

27. For each of these specialty bulbs installed, how many are CFLs?

h. ____**Dimmable CFLs**
i. ____**Outdoor flood CFLs**
j. ____**Three-way CFLs**
k. ____**Spotlight CFLs**

l. ____**Recessed CFLs**
m. ____**Candelabra CFLs**
n. ____**Other (specify)**____________

28. **On a scale from 1-10, with 1 indicating not at all interested and 10 indicating very interested, please rate your interest in Duke Energy providing a direct mail specialty CFL program:**

Not at all interested								very interested	
1	2	3	4	5	6	7	8	9	10

Please tell me if you would be interested in receiving the following types of CFLs if they were to be offered in the future...

29. **Dimmable CFLs**
    d. Yes **(about how many hours per day would these bulbs be used?___)**
    e. No
    f. Don't Know

30. **Outdoor flood CFLs**
    d. Yes **(about how many hours per day would these bulbs be used?___)**
    e. No
    f. Don't Know

31. **Three-way CFLs**
    d. Yes **(about how many hours per day would these bulbs be used?___)**
    e. No
    f. Don't Know

32. **Spotlight CFLs**
    d. Yes **(about how many hours per day would these bulbs be used?___)**
    e. No
    f. Don't Know

33. **Candelabra CFLs**
    d. Yes **(about how many hours per day would these bulbs be used?___)**
    e. No
    f. Don't Know

34. *(if responder indicated a different specialty bulb)* **Other** _
    d. Yes **(about how many hours per day would these bulbs be used?___)**
    e. No
    f. Don't Know

35. **Considering future CFL purchases, how many CFL bulbs would you purchase in the next year if they were...**
    a. **The same price as standard bulbs (___)**
    b. **$1 more than standard bulbs (___)**
    c. **$2 more than standard bulbs (___)**
    d. **$3 more than standard bulbs (___)**
    e. **Free, but you had to mail in a rebate form to get your money back (___)**

36. **How often do you use the Duke Energy Web Site?**
    a. Often (once a month or more)
    b. Sometimes (less than once a month)
    c. Never

37. **Have you added any major electrical appliances to your home in the past year?**
    a. Yes
    b. No

38. **Are you aware of the ENERGY STAR label?**
    a. Yes
    b. No.

39. **Do you typically look for the ENERGY STAR label when purchasing an appliance?**
    a. Yes
    b. No

40. **Do you typically buy appliances with the ENERGY STAR label?**
    a. Yes, all of the time
    b. Yes, some of the time
    c. No, never

41. **Why do you believe that Duke Energy is providing free CFLs to their customers?**
    g. ___Duke Energy wants to save their customers money
    h. ___Duke Energy wants to save energy for environmental reasons
    i. ___Duke Energy wants to save energy for economic reasons
    j. ___Duke Energy wants to look good (PR)
    k. ___The government is forcing Duke Energy to do it
    l. ___Other (specify)

42. **Are you currently a participant in any of the following Duke Energy programs** (check all that apply):
    g. ___**Power Manager**
    h. ___**Residential Smart Saver**
    i. ___**Home Energy House Call**
    j. ___**Home Energy Comparison Report**
    k. ___**Personalized Energy Report**
    l. ___ **Online Services**

For all programs not checked in Q59, ask the following question

On a scale from 1-10, with 1 indicating not at all interested and 10 indicating very interested, please rate your interest in Duke Energy providing the following programs:

42a. (Power Manager) **A program that provides bill credits in exchange for allowing Duke Energy to temporarily cycle your air conditioning unit during periods of high use**

Not at all interested very interested
1 2 3 4 5 6 7 8 9 10

42b. (Residential Smart Saver) **A program that provides rebates for energy efficient improvements to your house such as energy efficient heating and cooling units.**

Not at all interested very interested
1 2 3 4 5 6 7 8 9 10

42c. (Home Energy House Call) **A program in which an assessor comes to your house, suggests energy efficiency improvements, and Duke Energy provides certain low-cost improvement materials for free.**

Not at all interested very interested
1 2 3 4 5 6 7 8 9 10

42d. (Home Energy Comparison Report/) **A program that provides an ongoing comparison of your energy use with that of people who live in similar homes**

Not at all interested very interested
1 2 3 4 5 6 7 8 9 10

42e. (Personalized Energy report) **A program that provides personalized energy analysis and ways to save energy and money by filling out a few questions about your home either online or by mail.**

Not at all interested very interested
1 2 3 4 5 6 7 8 9 10

43. I'm going to read a statement. On a scale from 1-10, with 1 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate the following statement.

Overall I am satisfied with Duke Energy.

1 2 3 4 5 6 7 8 9 10 ❑ Don't Know

If 7 or less, **How could this be improved?**______________________________

____

44. **If you were rating your overall satisfaction with the CFL Program, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied, or Very Dissatisfied?**

  a. Very Satisfied
  b. Somewhat Satisfied
  c. Neither Satisfied nor Dissatisfied
  d. Somewhat Dissatisfied
  e. Very Dissatisfied
  f. Refused
  g. Don't Know

  44a. **Why do you give it that rating?**
  Response: ______________________________

Finally, we have some general demographic questions...

45. **In what type of building do you live?**
  a. Single-family home, detached construction
  b. Single family home, factory manufactured/modular
  c. Single family, mobile home
  d. Row House
  e. Two or Three family attached residence-traditional structure
  f. Apartment (4 + families)---traditional structure
  g. Condominium---traditional structure
  h. OTHER
  i. REFUSED
  j. DON'T KNOW

46. **What year was your residence built?**
  i. 1959 and before
  j. 1960-1979
  k. 1980-1989
  l. 1990-1997

m. 1998-2000
n. 2001-2007
o. 2008-present
p. Don't Know

47. How many rooms are in your home (excluding bathrooms, but including finished basements)?

k. None
l. 1-3
m. 4
n. 5
o. 6
p. 7
q. 8
r. 9
s. 10 or more

48. Which of the following best describes your home's heating system?

g. None
h. Central forced air furnace
i. Electric Baseboard
j. Heat Pump
k. Geothermal Heat Pump
l. Other

49. How old is your heating system?

a. 0-4 years
b. 5-9 years
c. 10-14 years
d. 15-19 years
e. More than 19 years
f. Don't know
g. Do not have

50. What is the primary fuel used in your heating system?

f. Electricity
g. Natural Gas
h. Oil
i. Propane
j. Other

51. What is the secondary fuel used in your primary heating system, if applicable?

a. Electricity
b. Natural Gas

c. Oil
d. Propane
e. Other
f. None

52. Do you use one or more of the following to cool your home? *(Mark all that apply)*

a. ___None, do not cool the home
b. ___Heat pump for cooling
c. ___Central air conditioning
d. ___Through the wall or window air conditioning unit
e. ___Geothermal Heat pump
f. ___Other (specify?_____)

53. How many window-unit or "through the wall" air conditioner(s) do you use?

j. None
k. 1
l. 2
m. 3
n. 4
o. 5
p. 6
q. 7
r. 8 or more

54. What is the fuel used in your cooling system?

a. Electricity
b. Natural Gas
c. Oil
d. Propane
e. Other
f. None

55. How old is your cooling system?

h. 0-4 years
i. 5-9 years
j. 10-14 years
k. 15-19 years
l. 19 years or older
m. Don't know
n. Do not have

56. What is the fuel used by your water heater? *(Mark all that apply)*

g. ___Electricity
h. ___Natural Gas
i. ___Oil
j. ___Propane
k. ___Other
l. ___No water heater

57. **How old is your water heater?**
  f. 0-4 years
  g. 5-9 years
  h. 10-14 years
  i. 15-19 years
  j. More than 19 years

58. What type of fuel do you use for indoor cooking on the stovetop or range? *(Mark all that apply)*
a. ___Electricity
b. ___Natural Gas
c. ___Oil
d. ___Propane
e. ___Other
f. ___No stovetop or range

59. What type of fuel do you use for indoor cooking in the oven? *(Mark all that apply)*
a. ___Electricity
b. ___Natural Gas
c. ___Oil
d. ___Propane
e. ___Other
f. ___No oven

60. What type of fuel do you use for clothes drying? *(Mark all that apply)*
  g. ___Electricity
  h. ___Natural Gas
  i. ___Oil
  j. ___Propane
  k. ___Other
  l. ___No clothes dryer

62. About how many square feet of living space are in your home? ***(Do not include garages or other unheated areas)***
Note: A 10-foot by 12-foot room is 120 square feet
  k. Less than 500
  l. 500 – 999
  m. 1000 – 1499

n. 1500 – 1999
o. 2000 – 2499
p. 2500 – 2999
q. 3000 – 3499
r. 3500 – 3999
s. 4000 or more
t. Don't know

63. Do you own or rent your home?
a. Own
b. Rent

64. How many levels are in your home (not including your basement)?
a. One
b. Two
c. Three

65. Does your home have a heated or unheated basement?
a. Heated
b. Unheated
c. No basement

66. Does your home have an attic?
a. Yes
b. No

67. Are your central air/heat ducts located in the attic?
a. Yes
c. No
d. Not applicable

68. Does your house have cold drafts in the winter?
a. Yes
b. No

69. Does your house have sweaty windows in the winter?
a. Yes
b. No

70. Do you notice uneven temperatures between the rooms in your home?
a. Yes
b. No

71. Does your heating system keep your home comfortable in winter?
a. Yes

b. No

72. Does your cooling system keep your home comfortable in summer?

a. Yes
b. No

73. Do you have a programmable thermostat?

c. Yes
d. No

74. What temperature is your thermostat set to on a typical summer weekday afternoon?

g. Less than 69 degrees
h. 69-72 degrees
i. 73-78 degrees
j. Higher than 78 degrees
k. Off
l. DK

75. What temperature is your thermostat set to on a typical winter weekday afternoon?

a. Less than 67 degrees
b. 67-70 degrees
c. 71-73 degrees
d. 74-77 degrees
e. Higher than 78 degrees
f. Off
g. DK

76. Do You Have a Swimming Pool or Spa?

a. Yes
b. No

77. Would a two-degree increase in the summer afternoon temperature in your home affect your comfort....

a. Not at all
b. Slightly
c. Moderately, or
d. Greatly

78. How many people live in this home?

a. 1
b. 2
c. 3
d. 4
e. 5

f. 6
g. 7
h. 8 or more

79. How many persons are usually home on a weekday afternoon?

a. 0
b. 1
c. 2
d. 3
e. 4
f. 5
g. 6
h. 7
i. 8 or more

80. Are you planning on making any large purchases to improve energy efficiency in the next 3 years?

a. Yes
b. No
c. Not sure

The following questions are for classification purposes only and will not be used for any other purpose than to help Duke Energy continue to improve service.

81. What is your age group?

g. 18-34
h. 35-49
i. 50-59
j. 60-64
k. 65-74
l. Over 74

82. Please indicate your annual household income.

a. **Under $15,000**
b. **$15,000-$29,999**
c. **$30,000-$49,999**
d. **$50,000-$74,999**
e. **$75,000-$100,000**
f. **Over $100,000**
g. **Prefer Not to Answer**

That completes our survey. As I mentioned at the start of the survey, we'd like to send you $10 for your time. Should we send it to <name> **at** <address>**?**

Thank you for your time and feedback today! (*Politely end call*)

Appendix E: Scan of CFL Box Insert and Online Offer Screenshots

A SMALL CHANGE CAN MAKE A BIG DIFFERENCE

Duke Energy®

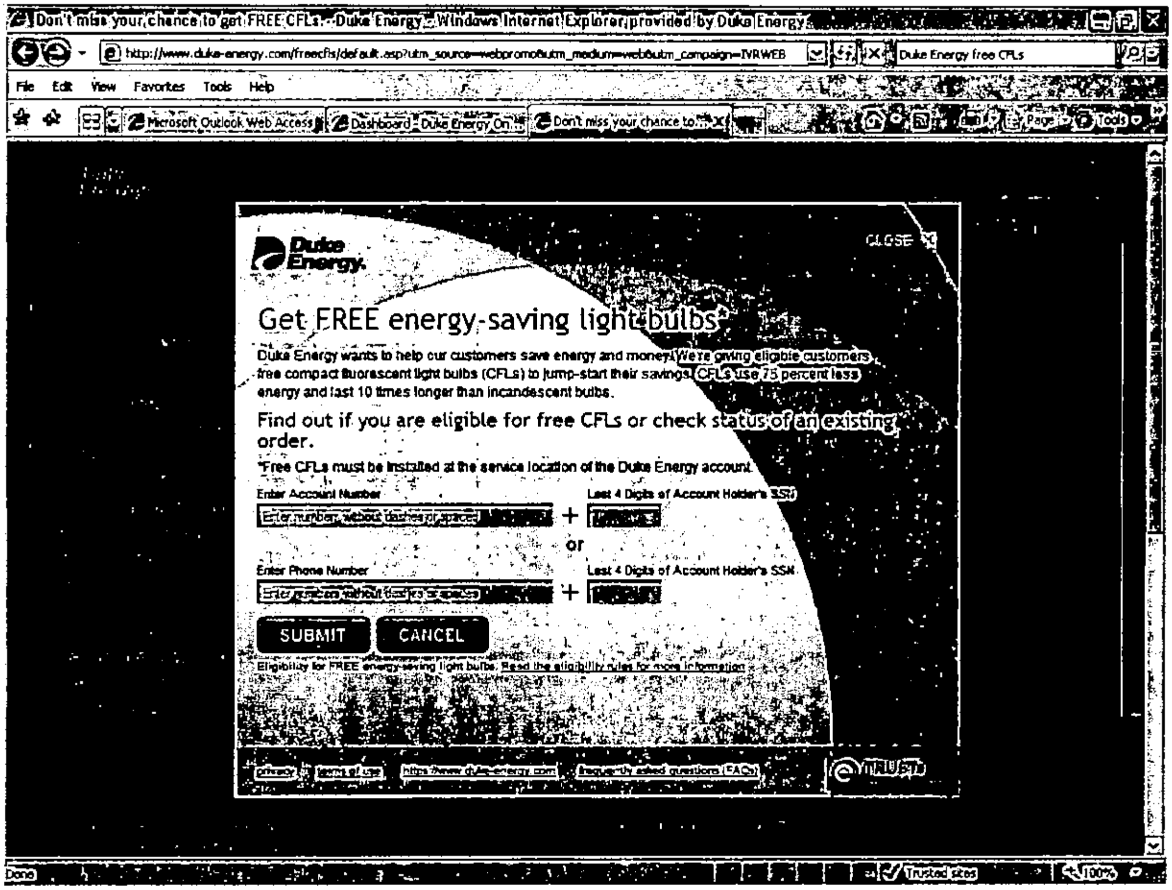
Thank you for participating in Duke Energy's compact fluorescent light (CFLs) energy savings program. Working together we can make a difference. Through your involvement you can reduce your energy use, save money and help the environment.

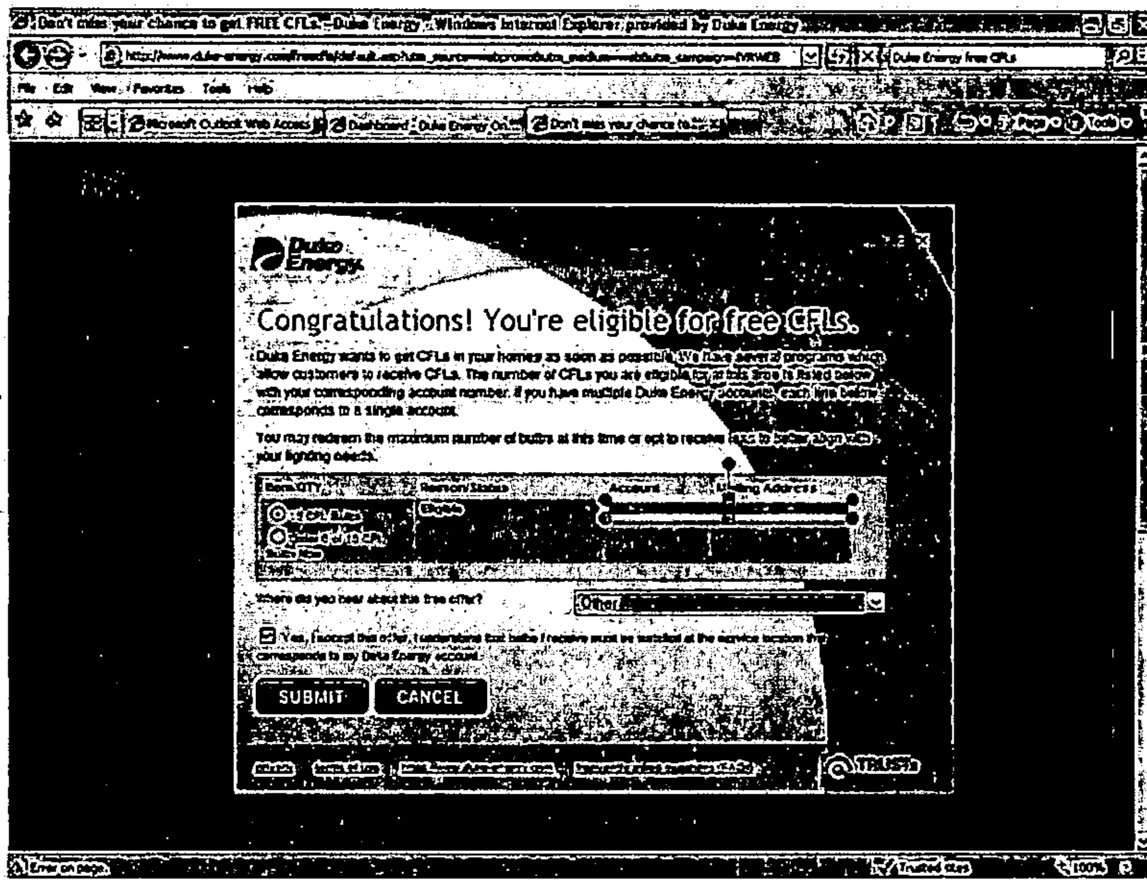
One of the quickest and easiest things you can do is replace your home's most used incandescent light bulbs with the enclosed ENERGY STAR® rated CFLs. Don't wait until your incandescent lights burn out; replace them today to start saving money.

CFL bulbs help you:

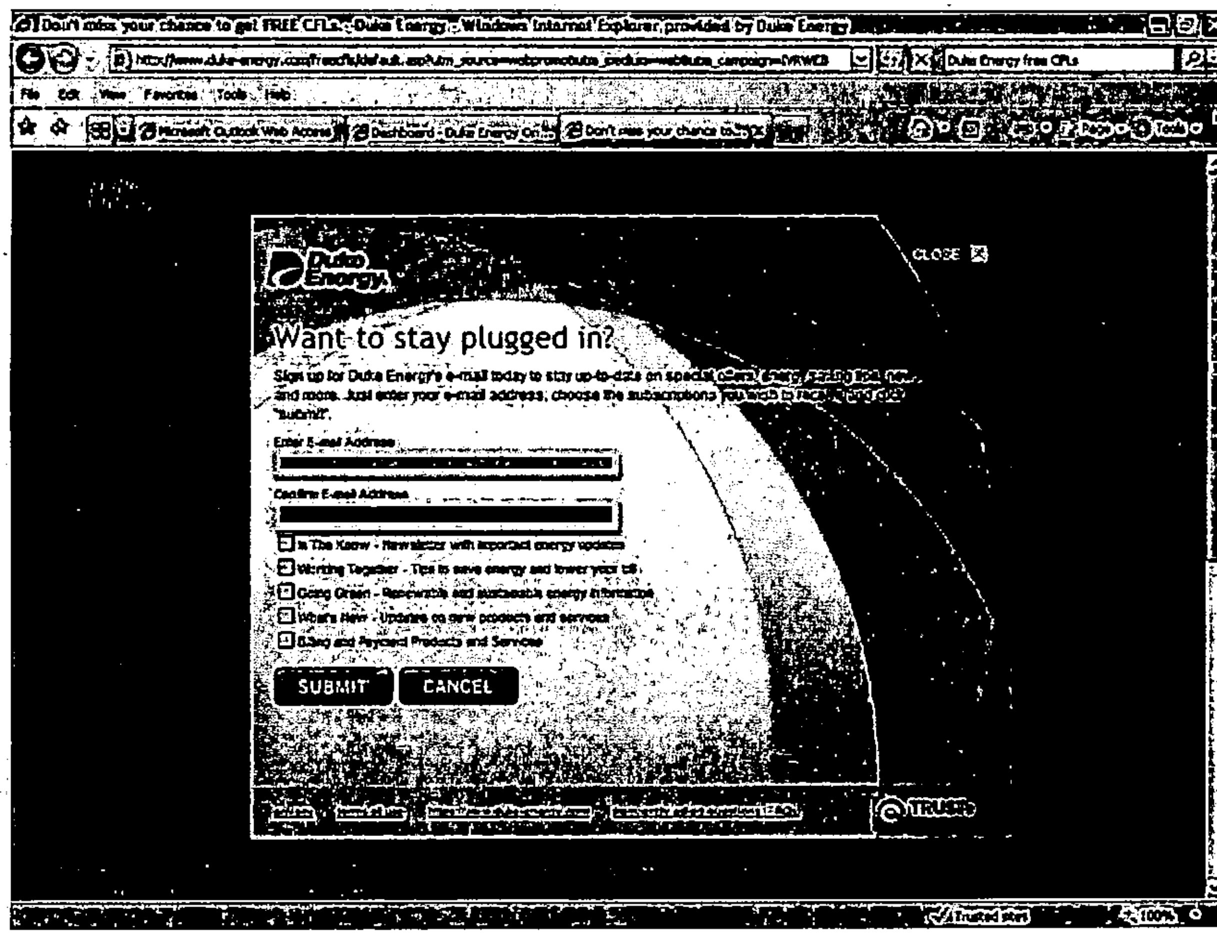
- **Save money.** Just one ENERGY STAR qualified CFL can save approximately $30 or more in electricity costs over its lifetime. Plus CFLs produce about 75 percent less heat, so they're safer to operate and can reduce the energy costs associated with cooling your home.
- **Save time.** CFL bulbs are convenient to use in hard-to-reach and high-use fixtures. Because CFLs last six to 10 times longer, you save time and effort in replacing burned out bulbs.
- **Save the environment:** A qualified CFL bulb prevents more than 400 pounds of greenhouse gas emissions over its lifetime.

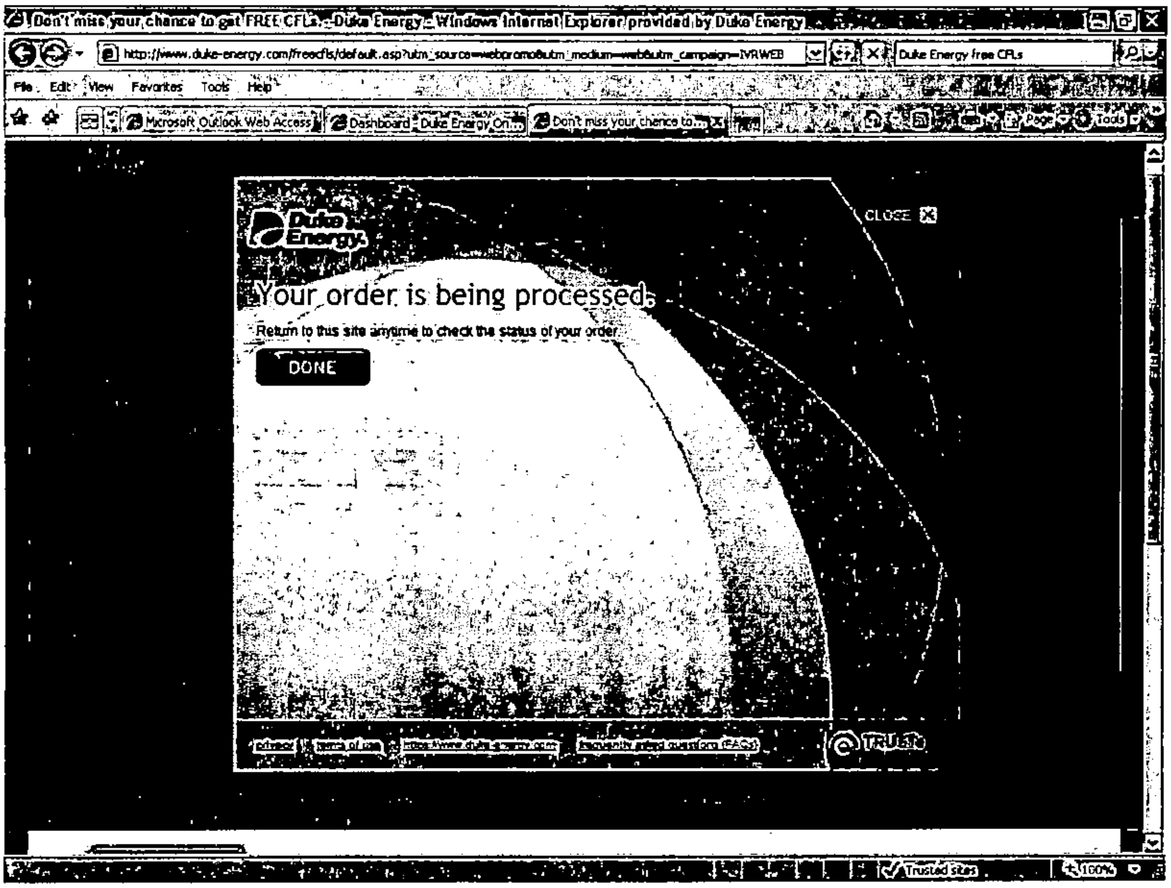
Visit **www.duke-energy.com** for more on CFLs and their disposal. If you have questions about the contents of this kit, please call Niagara Conservation at 800-292-7687.


Don't miss your chance to get FREE CFLs - Duke Energy - Windows Internet Explorer provided by Duke Energy
File Edit View Favorites Tools Help
Duke Energy
CLOSE
Get FREE energy-saving light bulbs
Duke Energy wants to help our customers save energy and money. We're giving eligible customers free compact fluorescent light bulbs (CFLs) to jump-start their savings. CFLs use 75 percent less energy and last 10 times longer than incandescent bulbs.
Find out if you are eligible for free CFLs or check status of an existing order.
*Free CFLs must be installed at the service location of the Duke Energy account.
Enter Account Number
Last 4 Digits of Account Holder's SSN
or
Enter Phone Number
Last 4 Digits of Account Holder's SSN
SUBMIT
CANCEL
Done
Trusted sites
100%


Congratulations! You're eligible for free CFLs.
Other
SUBMIT
CANCEL


Thank you for your order.
DONE


CLOSE
Want to stay plugged in?
Enter E-mail Address
Confirm E-mail Address
SUBMIT
CANCEL


Don't miss your chance to get FREE CFLs - Duke Energy - Windows Internet Explorer provided by Duke Energy
Duke Energy free CFLs
File Edit View Favorites Tools Help
Microsoft Outlook Web Access
Don't miss your chance to...
CLOSE
Duke Energy.
Your order is being processed.
Return to this site anytime to check the status of your order.
DONE
Trusted sites
100%


Ohio - Ohio - Duke Energy - Windows Internet Explorer provided by Duke Energy
https://www.duke-energy.com/ohio.asp
Duke Energy free CFLs
File Edit View Favorites Tools Help
Microsoft Outlook Web Access
Dashboard - Duke Energy On...
Ohio - Ohio - Duke Energy
Duke Energy
Contact Us
Search
GO
RESIDENTIAL
BUSINESS
LARGE BUSINESS
OUR COMPANY
Welcome Ohio customer!
CHANGE STATE
Online Services
Billing & Payment
Moving?
Customer Service
Ohio Customer Choice
Save Energy & Money
Special Assistance
Products & Services
Storm and Outage Information
Renewable Energy
Contractor Information
Natural Gas Services
Our Community
Customer Owned
Take the surprise out of high winter bills.
Sign up for Budget Billing.
learn more
SIGN IN
Help
User Name
Password (case sensitive)
Remember my user name
Forgot user name?
Forgot password?
Register
Sign In
Online Services
Want to know more about how you can manage your account online?
Ohio Tax Issue
Agreement minimizes short-term community impact.
GoGreen Ohio
Sign up today and build a greener future!
Done
Trusted sites
100%

Appendix F: Household Characteristics and Demographics

State * participate CFL IVR Crosstabulation

			participate CFL IVR		Total
			1 Participant	2 Non-participant	
State	North Carolina	Count	184	31	215
		% of Total	43.9%	7.4%	51.3%
	South Carolina	Count	175	29	204
		% of Total	41.8%	6.9%	48.7%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Type of Housing * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Type of Housing	Apartment (4 + families)---traditional structure	Count	10	6	16
		% of Total	2.4%	1.4%	3.8%
	Condominium---traditional structure	Count	7	3	10
		% of Total	1.7%	.7%	2.4%
	DK/NS	Count	1	1	2
		% of Total	.2%	.2%	.5%
	Duplex/two-family	Count	3	0	3
		% of Total	.7%	.0%	.7%
	Multi-family building (3 or more units)	Count	18	0	18
		% of Total	4.3%	.0%	4.3%
	Other	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Row House	Count	1	2	3
		% of Total	.2%	.5%	.7%
	Single family, mobile home	Count	44	9	53
		% of	10.5%	2.1%	12.6%

		Total			
	Single-family home, detached construction	Count	260	39	299
		% of Total	62.1%	9.3%	71.4%
	Townhouse	Count	10	0	10
		% of Total	2.4%	.0%	2.4%
	Two or Three family attached residence-traditional structure	Count	3	0	3
		% of Total	.7%	.0%	.7%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Year Built * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Year Built	1959 and before	Count	59	14	73
		% of Total	14.1%	3.3%	17.4%
	1960 to 1979	Count	94	11	105
		% of Total	22.4%	2.6%	25.1%
	1980 to 1989	Count	51	9	60
		% of Total	12.2%	2.1%	14.3%
	1990 to 1997	Count	34	7	41
		% of Total	8.1%	1.7%	9.8%
	1998 to 2000	Count	20	2	22
		% of Total	4.8%	.5%	5.3%
	2001 to 2007	Count	43	7	50
		% of Total	10.3%	1.7%	11.9%
	2008 to present	Count	22	2	24
		% of Total	5.3%	.5%	5.7%
	DK/NS	Count	36	8	44
		% of Total	8.6%	1.9%	10.5%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Number of Rooms (excluding bathrooms but including finished basement) * participate CFL IVR Crosstabulation

			CFLs	Total

			1 Participant	2 Non-participant	
Number of Rooms (excluding bathrooms but including finished basement)	1 to 3	Count	21	7	28
		% of Total	5.0%	1.7%	6.7%
	10 or more	Count	30	4	34
		% of Total	7.2%	1.0%	8.1%
	4	Count	48	11	59
		% of Total	11.5%	2.6%	14.1%
	5	Count	63	8	71
		% of Total	15.0%	1.9%	16.9%
	6	Count	82	16	98
		% of Total	19.6%	3.8%	23.4%
	7	Count	56	7	63
		% of Total	13.4%	1.7%	15.0%
	8	Count	35	4	39
		% of Total	8.4%	1.0%	9.3%
	9	Count	23	3	26
		% of Total	5.5%	.7%	6.2%
	DK/NS	Count	1	0	1
		% of Total	.2%	.0%	.2%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Home Heating System * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Home Heating System		Count	1	0	1
		% of Total	.2%	.0%	.2%
	Cable heat in ceiling	Count	1	0	1
		% of	.2%	.0%	.2%

		Total			
	Central forced air furnace	Count	155	31	186
		% of Total	37.0%	7.4%	44.4%
	Coleman heater	Count	1	0	1
		% of Total	.2%	.0%	.2%
	DK/NS	Count	4	0	4
		% of Total	1.0%	.0%	1.0%
	Electric and oil	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Electric Baseboard	Count	15	5	20
		% of Total	3.6%	1.2%	4.8%
	Electric fire place	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Electric radiator and kerosene heaters	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Gas heat	Count	10	1	11
		% of Total	2.4%	.2%	2.6%
	Gas heat upstairs and apollo system downstairs	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Gas log fireplace and gas space heater	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Gas pack	Count	6	0	6
		% of Total	1.4%	.0%	1.4%
	Geothermal Heat Pump	Count	3	1	4
		% of Total	.7%	.2%	1.0%
	Heat Pump	Count	120	10	130
		% of Total	28.6%	2.4%	31.0%
	Heat pump and Central forced air	Count	16	8	24
		% of Total	3.8%	1.9%	5.7%

	Heat pump and gas heat	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Hot water	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Kerosene	Count	2	0	2
		% of Total	.5%	.0%	.5%
	None	Count	3	0	3
		% of Total	.7%	.0%	.7%
	None (broken)	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Oil furnace	Count	1	1	2
		% of Total	.2%	.2%	.5%
	Oil-fueled hot water boiler/radiant heat	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Propane and electric heaters	Count	0	1	1
		% of Total	.0%	.2%	.2%
	Radiator and wood stove/fireplace	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Space heaters	Count	5	1	6
		% of Total	1.2%	.2%	1.4%
	Warm morning heater	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Window heater unit	Count	1	1	2
		% of Total	.2%	.2%	.5%
	Window unit and space heaters, gas heat but can't afford the gas	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Wood stove/fireplace	Count	1	0	1
		% of Total	.2%	.0%	.2%
Total		Count	359	60	419

	% of Total	85.7%	14.3%	100.0%

Age of heating system * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Age of heating system		Count	3	0	3
		% of Total	.7%	.0%	.7%
	0 to 4 years	Count	111	19	130
		% of Total	26.5%	4.5%	31.0%
	10 to 14 years	Count	53	9	62
		% of Total	12.6%	2.1%	14.8%
	15 to 19 years	Count	25	7	32
		% of Total	6.0%	1.7%	7.6%
	5 to 9 years	Count	87	6	93
		% of Total	20.8%	1.4%	22.2%
	DK/NS	Count	49	10	59
		% of Total	11.7%	2.4%	14.1%
	more than 19 years	Count	31	9	40
		% of Total	7.4%	2.1%	9.5%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Primary fuel used in heating system * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Primary fuel used in heating system		Count	3	0	3
		% of Total	.7%	.0%	.7%
	DK/NS	Count	5	1	6
		% of Total	1.2%	.2%	1.4%
	Electricity	Count	204	31	235
		% of Total	48.7%	7.4%	56.1%
	Electricity and Natural Gas	Count	2	0	2
		% of Total	.5%	.0%	.5%

	Heat Pump	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Kerosene	Count	3	0	3
		% of Total	.7%	.0%	.7%
	LP Gas	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Natural Gas	Count	111	21	132
		% of Total	26.5%	5.0%	31.5%
	Oil	Count	12	4	16
		% of Total	2.9%	1.0%	3.8%
	Propane	Count	14	3	17
		% of Total	3.3%	.7%	4.1%
	Wood	Count	2	0	2
		% of Total	.5%	.0%	.5%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Secondary fuel used in primary heating system * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Secondary fuel used in primary heating system		Count	3	0	3
		% of Total	.7%	.0%	.7%
	Electricity	Count	50	4	54
		% of Total	11.9%	1.0%	12.9%
	Gas logs	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Kerosene	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Natural Gas	Count	15	1	16

		% of Total	3.6%	.2%	3.8%
	Not applicable	Count	258	55	313
		% of Total	61.6%	13.1%	74.7%
	Oil	Count	5	0	5
		% of Total	1.2%	.0%	1.2%
	Propane	Count	18	0	18
		% of Total	4.3%	.0%	4.3%
	Wood	Count	6	0	6
		% of Total	1.4%	.0%	1.4%
	Wood and Propane	Count	1	0	1
		% of Total	.2%	.0%	.2%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Home Cooling System * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Home Cooling System		Count	1	0	1
		% of Total	.2%	.0%	.2%
	Air	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Central air conditioning	Count	191	32	223
		% of Total	45.6%	7.6%	53.2%
	Central air conditioning and Fans	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Central air conditioning and Geothermal heat pump	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Central air conditioning and Through the wall or window	Count	6	0	6
		% of	1.4%	.0%	1.4%

		Total			
	DK/NS	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Fans	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Geothermal Heat Pump	Count	3	1	4
		% of Total	.7%	.2%	1.0%
	Heat pump and Central air conditioning	Count	24	7	31
		% of Total	5.7%	1.7%	7.4%
	Heat pump and Through the wall or window	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Heat pump and Through the wall or window	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Heat pump for cooling	Count	83	8	91
		% of Total	19.8%	1.9%	21.7%
	Heat pump for cooling and Fans	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Heat pump for cooling, Fans and Open windows	Count	1	0	1
		% of Total	.2%	.0%	.2%
	None, do not cool the home	Count	2	1	3
		% of Total	.5%	.2%	.7%
	Through the wall or window air conditioning unit	Count	34	11	45
		% of Total	8.1%	2.6%	10.7%
	Through the wall or window air conditioning unit and Fans	Count	2	0	2
		% of Total	.5%	.0%	.5%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Number of window cooling units * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Number of window cooling units		Count	1	0	1
		% of Total	.2%	.0%	.2%
	1	Count	31	6	37
		% of Total	7.4%	1.4%	8.8%
	2	Count	20	7	27
		% of Total	4.8%	1.7%	6.4%
	3	Count	9	2	11
		% of Total	2.1%	.5%	2.6%
	5	Count	3	0	3
		% of Total	.7%	.0%	.7%
	8 or more	Count	1	0	1
		% of Total	.2%	.0%	.2%
	DK/NS	Count	1	0	1
		% of Total	.2%	.0%	.2%
	None	Count	293	45	338
		% of Total	69.9%	10.7%	80.7%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Cooling System Fuel * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Cooling System Fuel		Count	1	0	1
		% of Total	.2%	.0%	.2%
	DK/NS	Count	8	3	11
		% of Total	1.9%	.7%	2.6%
	Electricity	Count	324	52	376
		% of Total	77.3%	12.4%	89.7%
	Freon	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Natural Gas	Count	11	3	14
		% of Total	2.6%	.7%	3.3%
	None	Count	8	1	9
		% of Total	1.9%	.2%	2.1%
	Oil	Count	3	1	4

		% of Total	.7%	.2%	1.0%
	Propane	Count	2	0	2
		% of Total	.5%	.0%	.5%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Age of cooling system * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Age of cooling system		Count	9	0	9
		% of Total	2.1%	.0%	2.1%
	0 to 4 years	Count	110	18	128
		% of Total	26.3%	4.3%	30.5%
	10 to 14 years	Count	54	10	64
		% of Total	12.9%	2.4%	15.3%
	15 to 19 years	Count	27	4	31
		% of Total	6.4%	1.0%	7.4%
	19 years or older	Count	19	6	25
		% of Total	4.5%	1.4%	6.0%
	5 to 9 years	Count	94	9	103
		% of Total	22.4%	2.1%	24.6%
	DK/NS	Count	45	12	57
		% of Total	10.7%	2.9%	13.6%
	Do not have	Count	1	1	2
		% of Total	.2%	.2%	.5%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Water Heater Fuel * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Water Heater Fuel	DK/NS	Count	7	1	8
		% of Total	1.7%	.2%	1.9%
	Electricity	Count	245	41	286
		% of Total	58.5%	9.8%	68.3%
	Electricity and Natural Gas	Count	1	3	4

		% of Total	.2%	.7%	1.0%
	Electricity and Oil	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Electricity and Propane	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Natural Gas	Count	95	15	110
		% of Total	22.7%	3.6%	26.3%
	Natural Gas and Tankless on-demand	Count	1	0	1
		% of Total	.2%	.0%	.2%
	None	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Oil	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Propane	Count	4	0	4
		% of Total	1.0%	.0%	1.0%
	Wood	Count	1	0	1
		% of Total	.2%	.0%	.2%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Age of water heater * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Age of water heater		Count	2	0	2
		% of Total	.5%	.0%	.5%
	0 to 4 years	Count	120	17	137
		% of Total	28.6%	4.1%	32.7%
	10 to 14 years	Count	53	9	62
		% of Total	12.6%	2.1%	14.8%
	15 to 19 years	Count	19	10	29
		% of Total	4.5%	2.4%	6.9%
	5 to 9 years	Count	103	9	112
		% of Total	24.6%	2.1%	26.7%
	DK/NS	Count	51	13	64
		% of Total	12.2%	3.1%	15.3%
	more than 19 years	Count	11	2	13
		% of Total	2.6%	.5%	3.1%

Total	Count	359	60	419
	% of Total	85.7%	14.3%	100.0%

Stovetop/Range Fuel * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Stovetop/Range Fuel	DK/NS	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Electricity	Count	316	48	364
		% of Total	75.4%	11.5%	86.9%
	Electricity and Natural Gas	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Electricity and Wood	Count	0	1	1
		% of Total	.0%	.2%	.2%
	Natural Gas	Count	33	8	41
		% of Total	7.9%	1.9%	9.8%
	No stovetop or range	Count	0	2	2
		% of Total	.0%	.5%	.5%
	Propane	Count	7	1	8
		% of Total	1.7%	.2%	1.9%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Over Fuel * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Over Fuel	DK/NS	Count	2	0	2
		% of Total	.5%	.0%	.5%
	Electricity	Count	328	52	380
		% of Total	78.3%	12.4%	90.7%
	Electricity and Natural Gas	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Electricity and Propane	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Natural Gas	Count	21	6	27
		% of Total	5.0%	1.4%	6.4%

	No oven	Count	0	1	1
		% of Total	.0%	.2%	.2%
	Propane	Count	6	1	7
		% of Total	1.4%	.2%	1.7%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Clothes Dryer Fuel * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Clothes Dryer Fuel	DK/NS	Count	1	0	1
		% of Total	.2%	.0%	.2%
	Electricity	Count	319	52	371
		% of Total	76.1%	12.4%	88.5%
	Natural Gas	Count	17	1	18
		% of Total	4.1%	.2%	4.3%
	No clothes dryer	Count	20	7	27
		% of Total	4.8%	1.7%	6.4%
	Propane	Count	2	0	2
		% of Total	.5%	.0%	.5%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Square feet of living space (excluding garages and other unheated areas) * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Square feet of living space (excluding garages and other unheated areas)		Count	0	1	1
		% of Total	.0%	.2%	.2%
	1000 to 1499	Count	93	15	108
		% of Total	22.2%	3.6%	25.8%
	1500 to 1999	Count	71	16	87
		% of Total	16.9%	3.8%	20.8%
	2000 to 2499	Count	50	6	56
		% of	11.9%	1.4%	13.4%

		Total			
	2500 to 2999	Count	25	1	26
		% of Total	6.0%	.2%	6.2%
	3000 to 3499	Count	11	3	14
		% of Total	2.6%	.7%	3.3%
	3500 to 3999	Count	9	1	10
		% of Total	2.1%	.2%	2.4%
	4000 or more	Count	7	2	9
		% of Total	1.7%	.5%	2.1%
	500 to 999	Count	42	4	46
		% of Total	10.0%	1.0%	11.0%
	DK/NS	Count	49	11	60
		% of Total	11.7%	2.6%	14.3%
	Less than 500	Count	2	0	2
		% of Total	.5%	.0%	.5%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Own or Rent * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Own or Rent		Count	0	1	1
		% of Total	.0%	.2%	.2%
	Own	Count	284	42	326
		% of Total	67.8%	10.0%	77.8%
	Rent	Count	75	17	92
		% of Total	17.9%	4.1%	22.0%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Number of floors in home * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Number of floors in home		Count	0	1	1
		% of Total	.0%	.2%	.2%
	1	Count	244	44	288
		% of Total	58.2%	10.5%	68.7%
	2	Count	100	14	114
		% of Total	23.9%	3.3%	27.2%
	3	Count	15	1	16
		% of Total	3.6%	.2%	3.8%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Basement Heat * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Basement Heat		Count	0	1	1
		% of Total	.0%	.2%	.2%
	Heated	Count	46	5	51
		% of Total	11.0%	1.2%	12.2%
	No basement	Count	271	47	318
		% of Total	64.7%	11.2%	75.9%
	Unheated	Count	42	7	49
		% of Total	10.0%	1.7%	11.7%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

YN Attic * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Attic		Count	0	1	1
		% of Total	.0%	.2%	.2%
	No	Count	124	26	150
		% of Total	29.6%	6.2%	35.8%
	Yes	Count	235	33	268
		% of Total	56.1%	7.9%	64.0%

Total	Count	359	60	419
	% of Total	85.7%	14.3%	100.0%

Central air/heat ducts located in the attic * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Central air/heat ducts located in the attic		Count	0	1	1
		% of Total	.0%	.2%	.2%
	No	Count	145	21	166
		% of Total	34.6%	5.0%	39.6%
	Not applicable	Count	133	30	163
		% of Total	31.7%	7.2%	38.9%
	Yes	Count	81	8	89
		% of Total	19.3%	1.9%	21.2%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Comfort Series

Does your house have cold drafts in the winter? * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Does your house have cold drafts in the winter?		Count	0	1	1
		% of Total	.0%	.2%	.2%
	No	Count	233	34	267
		% of Total	55.6%	8.1%	63.7%
	Yes	Count	126	25	151
		% of Total	30.1%	6.0%	36.0%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Does your house have sweaty windows in the winter? * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Does your house have sweaty windows in the winter?		Count	0	1	1

		% of Total	.0%	.2%	.2%
	No	Count	262	41	303
		% of Total	62.5%	9.8%	72.3%
	Yes	Count	97	18	115
		% of Total	23.2%	4.3%	27.4%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Do you notice uneven temperatures between the rooms in your home? * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Do you notice uneven temperatures between the rooms in your home?		Count	0	1	1
		% of Total	.0%	.2%	.2%
	No	Count	149	26	175
		% of Total	35.6%	6.2%	41.8%
	Yes	Count	210	33	243
		% of Total	50.1%	7.9%	58.0%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

r Does your heating system keep your home comfortable in winter? * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Does your heating system keep your home comfortable in winter?		Count	0	1	1
		% of Total	.0%	.2%	.2%
	No	Count	39	2	41
		% of Total	9.3%	.5%	9.8%
	Not applicable	Count	5	0	5
		% of Total	1.2%	.0%	1.2%
	Yes	Count	315	57	372
		% of	75.2%	13.6%	88.8%

		Total			
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Does your cooling system keep your home comfortable in summer? * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Does your cooling system keep your home comfortable in summer?		Count	0	1	1
		% of Total	.0%	.2%	.2%
	No	Count	32	3	35
		% of Total	7.6%	.7%	8.4%
	Not applicable	Count	4	2	6
		% of Total	1.0%	.5%	1.4%
	Yes	Count	323	54	377
		% of Total	77.1%	12.9%	90.0%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Do you have a programmable thermostat? * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Do you have a programmable thermostat?		Count	0	1	1
		% of Total	.0%	.2%	.2%
	No	Count	157	33	190
		% of Total	37.5%	7.9%	45.3%
	Yes	Count	202	26	228
		% of Total	48.2%	6.2%	54.4%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

What temperature is your thermostat set to on a typical summer weekday afternoon? * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
What temperature is your thermostat set to on a typical summer weekday afternoon?		Count	0	1	1
		% of Total	.0%	.2%	.2%
	69 to 72 degrees	Count	117	25	142
		% of Total	27.9%	6.0%	33.9%
	73 to 78 degrees	Count	159	6	165
		% of Total	37.9%	1.4%	39.4%
	DK/NS	Count	13	8	21
		% of Total	3.1%	1.9%	5.0%
	Higher than 78 degrees	Count	20	0	20
		% of Total	4.8%	.0%	4.8%
	Less than 69 degrees	Count	35	11	46
		% of Total	8.4%	2.6%	11.0%
	Off	Count	15	9	24
		% of Total	3.6%	2.1%	5.7%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

What temperature is your thermostat set to on a typical winter weekday afternoon? * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
What temperature is your thermostat set to on a typical winter weekday afternoon?		Count	0	1	1
		% of Total	.0%	.2%	.2%
	67 to 70 degrees	Count	167	28	195
		% of Total	39.9%	6.7%	46.5%
	71 to 73 degrees	Count	96	12	108
		% of Total	22.9%	2.9%	25.8%
	74 to 77	Count	36	3	39

	degrees	% of Total	8.6%	.7%	9.3%
	DK/NS	Count	10	6	16
		% of Total	2.4%	1.4%	3.8%
	Higher than 78 degrees	Count	9	2	11
		% of Total	2.1%	.5%	2.6%
	Less than 67 degrees	Count	34	6	40
		% of Total	8.1%	1.4%	9.5%
	Off	Count	7	2	9
		% of Total	1.7%	.5%	2.1%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Do you have a swimming pool, spa or hot tub? * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Do you have a swimming pool, spa or hot tub?		Count	0	1	1
		% of Total	.0%	.2%	.2%
	No	Count	317	54	371
		% of Total	75.7%	12.9%	88.5%
	Yes	Count	42	5	47
		% of Total	10.0%	1.2%	11.2%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

A two-degree increase in the summer afternoon temperature in your home affect your comfort.... * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
A two-degree increase in the summer afternoon temperature in your home affect your comfort....		Count	0	1	1
		% of Total	.0%	.2%	.2%
	DK/NS	Count	6	4	10
		% of	1.4%	1.0%	2.4%

		Total			
	Greatly	Count	24	7	31
		% of Total	5.7%	1.7%	7.4%
	Moderately	Count	73	10	83
		% of Total	17.4%	2.4%	19.8%
	Not at all	Count	109	22	131
		% of Total	26.0%	5.3%	31.3%
	Slightly	Count	147	16	163
		% of Total	35.1%	3.8%	38.9%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Number of people living in home * participate CFL IVR Crosstabulation

			CFLs		Total
			1 Participant	2 Non-participant	
Number of people living in home		Count	0	1	1
		% of Total	.0%	.2%	.2%
	1	Count	70	22	92
		% of Total	16.7%	5.3%	22.0%
	2	Count	157	22	179
		% of Total	37.5%	5.3%	42.7%
	3	Count	75	6	81
		% of Total	17.9%	1.4%	19.3%
	4	Count	37	3	40
		% of Total	8.8%	.7%	9.5%
	5	Count	15	2	17
		% of Total	3.6%	.5%	4.1%
	6	Count	4	2	6
		% of Total	1.0%	.5%	1.4%
	7	Count	0	2	2
		% of Total	.0%	.5%	.5%
	Prefer Not to Answer	Count	1	0	1
		% of Total	.2%	.0%	.2%
Total		Count	359	60	419

	% of Total	85.7%	14.3%	100.0%

Number of people usually home on a weekday afternoon * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Number of people usually home on a weekday afternoon		Count	0	1	1
		% of Total	.0%	.2%	.2%
	0	Count	47	6	53
		% of Total	11.2%	1.4%	12.6%
	1	Count	105	24	129
		% of Total	25.1%	5.7%	30.8%
	2	Count	133	16	149
		% of Total	31.7%	3.8%	35.6%
	3	Count	45	5	50
		% of Total	10.7%	1.2%	11.9%
	4	Count	16	2	18
		% of Total	3.8%	.5%	4.3%
	5	Count	7	2	9
		% of Total	1.7%	.5%	2.1%
	6	Count	0	2	2
		% of Total	.0%	.5%	.5%
	7	Count	1	1	2
		% of Total	.2%	.2%	.5%
	8 or more	Count	0	1	1
		% of Total	.0%	.2%	.2%
	Prefer Not to Answer	Count	5	0	5
		% of Total	1.2%	.0%	1.2%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Planning to make a large purchase to improve energy efficiency in the next 3 years * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Planning to make a large purchase to improve energy efficiency in the next 3 years		Count	0	1	1
		% of Total	.0%	.2%	.2%
	No	Count	195	42	237
		% of Total	46.5%	10.0%	56.6%
	Not sure	Count	107	3	110
		% of Total	25.5%	.7%	26.3%
	Yes	Count	57	14	71
		% of Total	13.6%	3.3%	16.9%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Age Group * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Age Group		Count	0	1	1
		% of Total	.0%	.2%	.2%
	18 to 34	Count	52	5	57
		% of Total	12.4%	1.2%	13.6%
	35 to 49	Count	85	14	99
		% of Total	20.3%	3.3%	23.6%
	50 to 59	Count	75	15	90
		% of Total	17.9%	3.6%	21.5%
	60 to 64	Count	36	7	43
		% of Total	8.6%	1.7%	10.3%
	65 to 74	Count	57	13	70
		% of Total	13.6%	3.1%	16.7%
	Over 74	Count	44	5	49
		% of Total	10.5%	1.2%	11.7%
	Prefer Not to Answer	Count	10	0	10

		% of Total	2.4%	.0%	2.4%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Annual Household Income * participate CFL IVR Crosstabulation					
			CFLs		Total
			1 Participant	2 Non-participant	
Annual Household Income		Count	0	1	1
		% of Total	.0%	.2%	.2%
	$15,000-$29,999	Count	67	14	81
		% of Total	16.0%	3.3%	19.3%
	$30,000-$49,999	Count	70	12	82
		% of Total	16.7%	2.9%	19.6%
	$50,000-$74,999	Count	58	3	61
		% of Total	13.8%	.7%	14.6%
	$75,000-$100,000	Count	30	0	30
		% of Total	7.2%	.0%	7.2%
	Over $100,000	Count	17	2	19
		% of Total	4.1%	.5%	4.5%
	Prefer Not to Answer	Count	69	17	86
		% of Total	16.5%	4.1%	20.5%
	Under $15,000	Count	48	11	59
		% of Total	11.5%	2.6%	14.1%
Total		Count	359	60	419
		% of Total	85.7%	14.3%	100.0%

Appendix G: Impact Algorithms

CFLs

General Algorithm

Gross Summer Coincident Demand Savings

$$\Delta kW = ISR \times units \times \left[\frac{Watts_{base} - Watts_{ee}}{1000}\right] \times CF \times (1 + HVAC_d)$$

Gross Annual Energy Savings

$$\Delta kWh = ISR \times units \times \left[\frac{(Watts \times HOU)_{base} - (Watts \times HOU)_{ee}}{1000}\right] \times 365 \times (1 + HVAC_c)$$

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
units	= number of units installed under the program
$Watts_{ee}$	= connected load of energy-efficient unit = 16.35
$Watts_{base}$	= connected (nameplate) load of baseline unit(s) displaced
HOU	= Average daily hours of use (based on connected load)
CF	= coincidence factor = 0.123
$HVAC_c$	= HVAC system interaction factor for annual electricity consumption = -0.037
$HVAC_d$	= HVAC system interaction factor for demand = 0.168

The coincidence factor for this analysis was taken from Duke Energy's Residential Smart $aver lighting logger study performed in North Carolina with participants from the 2010 CFL campaigns.

$HVAC_c$ - 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. The weights were determined through appliance saturation data from the Home Profile Database supplied by Duke Energy.

Charlotte, NC

Heating Fuel	Heating System	Cooling System	Weight	HVACc
Other	Any except Heat Pump	Any except Heat Pump	0.0042	0.069
		None	0.0004	0

Any	Heat Pump	Heat Pump	0.2782	-0.1
Gas Propane Oil	Central Furnace	None	0.0067	0
		Room/Window	0.5508	0.069
		Central AC		0.069
Electricity	Electric baseboard/ central furnace	None	0.0030	-0.43
		Room/Window	0.1493	-0.31
		Central AC		-0.31
None	None	Any	0.0074	0
Total Weighted Average			1	-0.037

$HVAC_d$ - 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.

Charlotte, NC

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 12.

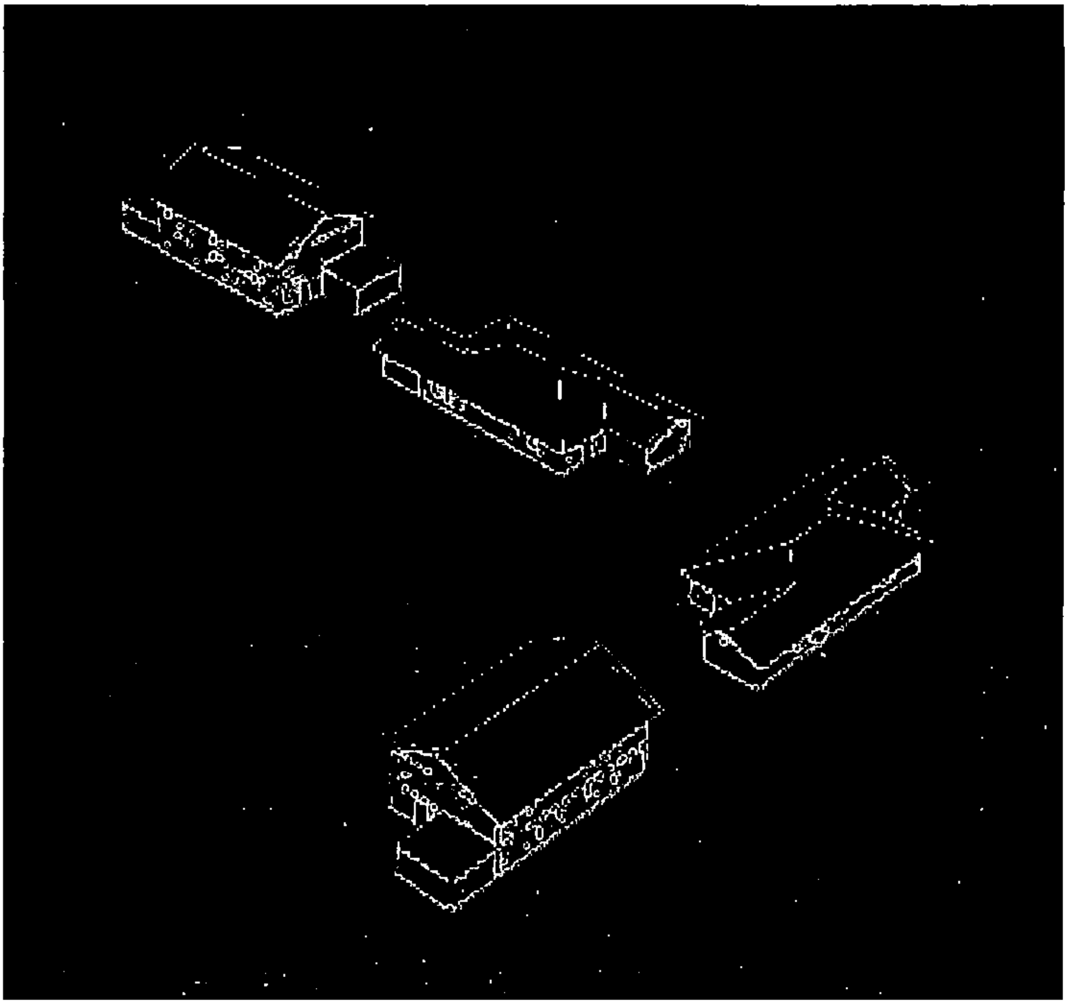


Figure 12. Computer Rendering of Residential Building Prototype Model

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 17th to October 6th
Natural ventilation	Allowed during cooling season when cooling setpoint exceeded and outdoor temperature < 65°F. 3 air changes per hour

References

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

Appendix H: DSMore Table

Impacts ⇨ Technology ⇩	Product code	State	EM&V gross savings (kWh/unit)	EM&V gross kW (customer peak/unit)	EM&V gross kW (coincident peak/unit)	Unit of measure	Combined spillover less freeridership adjustment	EM&V net savings (kWh/unit)	EM&V net kW (customer peak/unit)	EM&V net kW (coincident peak/unit)	EM&V load shape (yes/no)	EUL (whole number)
CFLs		NC & SC	33.6	0.0455	0.0056	lamp	8.91%	30.6	0.0415	0.0051	no	5
Program wide			**33.6**	**0.0455**	**0.0056**		**8.91%**	**30.6**	**0.0415**	**0.0051**		**5**

Energy Impact Evaluation of the Personalized Energy Report® Program in the Carolinas

Final Report

Prepared for
Duke Energy
139 East Fourth Street
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November 15, 2011
Revised May 24, 2012

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TABLE OF CONTENTS

May 24, 2012: This report has been revised:

- *Revised Table 1 on page 4 to reflect changes to the impact estimates. The changes were made because of an error made in the calculations, in which proper weighting of impacts (paper versus online) were not previously applied, as well as a corrected overall program free ridership %.*
- *Revised Energy Savings: Engineering Estimates Section text along with Table 4 on page 14 and Table 8 on page 16 to reflect new free ridership %.*

- *Revised the number of responses used in calculating free ridership score, referencing Figure 1 on page 6.*
- *Revised the overall program free ridership calculation in Table 3 on page 6. The changes were made to correct an Excel filter error that resulted in the assigning of partial free ridership to four participants in North Carolina who stated they had never used CFLs in the past.*
- *Added further explanation of adjustments to Level of Discounting for Biases on page 5 and updated CFL and program wide free rider %.*
- *Replaced Table 3 on page 6 to add "Number of Respondents".*
- *Changed the caption (added "Gross") and added a paragraph clarifying what the data presented in Table 11 on page 17 represents.*
- *Added "Proportion of Part. Population" to Table 16 on page 21.*
- *Added that ISR is not captured in the variable "units= number of units installed under the program" to Appendix C: Impact Algorithms on page 37.*
- *Added explanation of the inclusion of Ohio and Kentucky in the billing analysis model to Appendix D: Estimated Statistical Model on page 40.*
- *Updated the DSMore Table in Appendix F: DSMore Table on page 46 to reflect impact changes made when the corrected free ridership value and proper weights were applied.*

Executive Summary

Key Findings and Recommendations

This section presents the key findings and recommendations identified through this evaluation. Table 1 presents the estimated overall impacts of both the Personalized Energy Report (PER) and the online version (OHEC).

Table 1: Estimated Overall Impacts from Billing Analysis

	Gross Savings	Net Savings
Per Participant Annual Savings		
kW	0.028	0.025
kWh	255	221
Therms	0.102	0.088

The kWh impacts in this table are from the statistical analysis of participants' monthly electricity billing data. Since the billing data cannot provide estimates of the demand (kW) and the gas (therms) savings as well as the net to gross ratio, these impact estimates were based upon the engineering analysis impacts, adjusted by the ratio of the overall kWh savings between the billing analysis and the engineering analysis (85%). The engineering analysis also provides insight into impacts by measures (the billing analysis only produces an overall number). Therefore, while the overall result is driven by the billing analysis, an engineering analysis is required as well, so both approaches will be discussed in the report.

Significant Impact Evaluation Findings

- Both the written and online aspects of the program result in statistically significant savings.
- The online survey results in significantly higher savings than the paper version, confirming that online survey takers have higher installation rates than participants who filled out the paper survey.
- The billing data results for the both the paper and online components are larger than the gross engineering estimate, which may be due to differences between the survey sample and the population on recommended measure uptake. However, for PER®, the confidence interval about the estimate from the billing analysis contains the engineering estimate, so the observed difference between them is not statistically significant.
- CFLs make up 94% of total program savings.
- On average, the 13-watt CFL replaced a 59-watt load; the 20-watt CFL replaced a 73-watt load.

Free Ridership and Spillover

Free ridership was calculated for CFLs distributed to customers who filled out a Personalized Energy Report® survey. The level of free ridership was determined by using the responses to two questions in the survey (found in Appendix B: Participant Survey Instrument). Respondents were asked if they had any CFLs installed in their home prior to completing the Personalized Energy Report® survey, and, if so, how many. The amount of pre-installed CFLs determined the level of free ridership applied to energy savings according to Table 2 below.

Table 2. Free Ridership Factors for Energy Efficiency Kit CFLs

Did you have any CFLs installed before you completed your PER® survey?	If yes, how many?	% Free Ridership
No	n/a	0%
Yes	1 to 3	0%
	4 to 6	25%
	7 to 9	50%
	10 to 12	75%
	More than 12	100%

The percentages of survey respondents in each range of free ridership for pre-installed CFLs are presented in Figure 1 below. These percentages multiplied by the free ridership levels are then presented in Table 3 to arrive at the unadjusted free ridership for CFLs in the Personalized Energy Report® programs. These numbers amount to an unadjusted free ridership of 14.9% in North Carolina and 13.4% percent in South Carolina. There are total of 105 responses in North Carolina and 52 responses in South Carolina for these questions, therefore the weighted average of these percentages gives an unadjusted system free ridership of 14.4% for the Carolinas.

Level of Discounting for Biases

The self-selection bias discount factor for all measures for PER is 29.9%. This is also the full discount for all recommendations. The false response bias discount factor, applied only to CFLs, is 17%. The total discount to CFLs, including free ridership, is then 50.7%. The combined program-wide free ridership and bias adjustment for the engineering estimates is 44.5%. The billing analysis is free of these biases and uses only the 14.4% free ridership adjustment applied only to CFLs. The program-wide adjustment for the billing analysis is 13.6%. Detailed tables can be seen in Appendix F: DSMore Table.

The adjustments for self-selection and false response bias were taken from previous evaluations and reflect the range of values found in the evaluation literature to represent the levels of bias that have been assessed in the past. However, the field has moved away from adjusting impacts for these biases and TecMarket Works no longer does so as well unless they are specifically measured. The savings reported as the official energy savings of the program only include the free rider adjustments. TecMarket Works does not use the bias adjustments provided in the Level of Discounting for Biases section of the report.

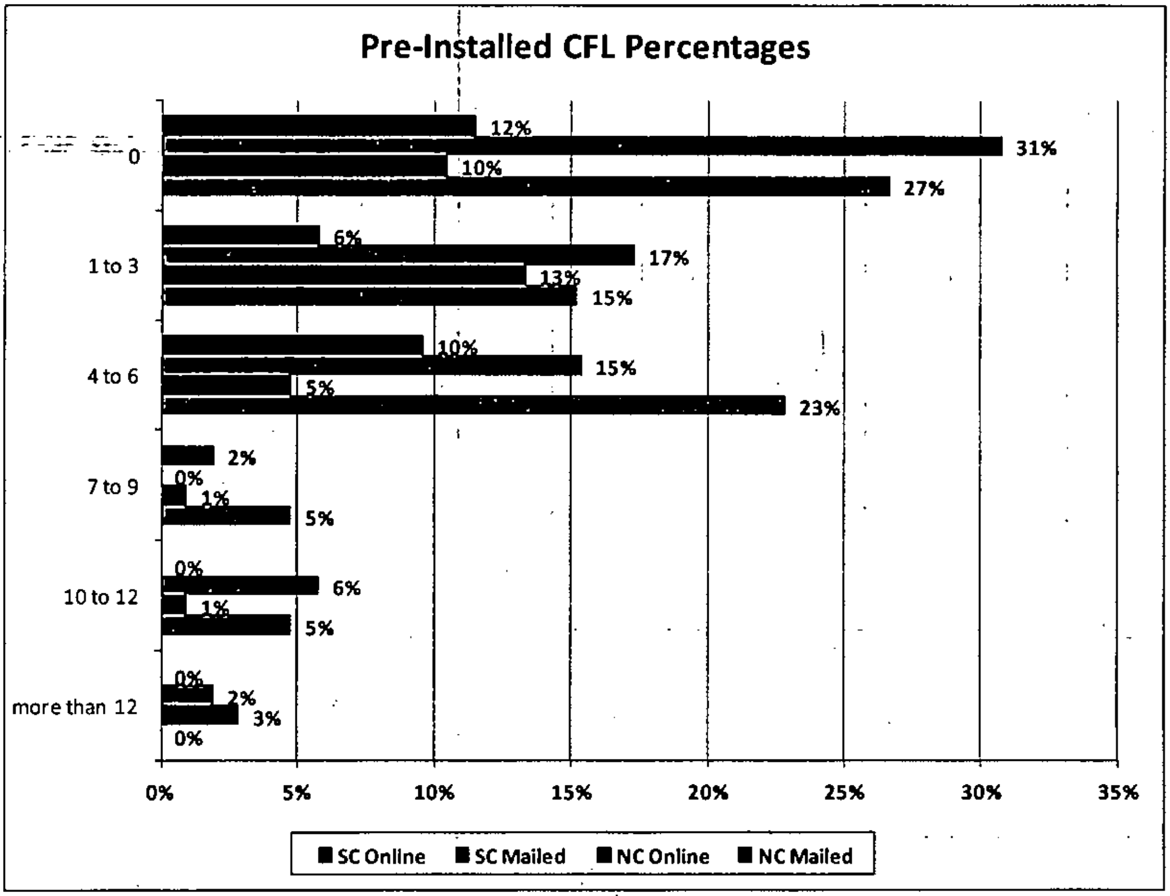

Figure 1. Percentage of Respondents by number of CFLs pre-installed

Table 3. Free Ridership in North and South Carolina

State	Type	Pre-installed CFL range	Number of respondents	Percentage in range	Free ridership Level	Free ridership
NC	Mailed	0 to 3	42	40.0%	0	0%
		4 to 6	20	19.0%	25	4.8%
		7 to 9	4	3.8%	50	1.9%
		10 to 12	4	3.8%	75	2.9%
		More than 12	0	0%	100	0%
	Online	0 to 3	25	23.8%	0	0%
		4 to 6	5	4.8%	25	1.2%
		7 to 9	1	1.0%	50	0.5%
		10 to 12	1	1.0%	75	0.7%
		More than 12	3	2.9%	100	2.9%
Sum of NC Free Ridership			105			**14.9%**
SC	Mailed	0 to 3	25	48.1%	0	0%
		4 to 6	8	15.4%	25	3.8%

		7 to 9	0	0%	50	0%
		10 to 12	3	5.8%	75	4.3%
		More than 12	1	1.9%	100	1.9%
	Online	0 to 3	9	17.3%	0	0%
		4 to 6	5	9.6%	25	2.4%
		7 to 9	1	1.9%	50	1.0%
		10 to 12	0	0%	75	0%
		More than 12	0	0%	100	0%
Sum of SC Free Ridership			52			**13.4%**

Impact Estimates for Personalized Energy Report® Recommendations

The participants of the Personalized Energy Report® Program each received a customized report with specific recommendations for improvements to their home that would increase their home's energy efficiency. In this report, we present the recommendations as they were reported to us by the random sample of 157 participants contacted during the telephone survey. We first asked them what, if any, improvements they had made to their home. We then ask if this was a recommendation that was in the Personalized Energy Report® (PER®). If they said yes (it was in the Personalized Energy Report®), we ask how influential the recommendation in the report was to their decision to install the item on a scale of 1 to 10.

Savings were calculated using engineering algorithms that can be found in Appendix C: Impact Algorithms. Self-selection bias and false response bias are then factored in to calculate the final estimated net impact for engineering estimates only.

Recommendations

- As part of ongoing research related to program marketing effectiveness, Duke Energy has been exploring whether some programs are gateways that potentiate other offers. Research on follow on offer uptake for PER® indicates that customers that first participate in PER® are approximately twice as likely to respond to an offer to participate in Power Manager® as compared to those that did not first participate in PER®. The reverse correlation does appear strong. This suggests that customers participating in PER® should be offered additional opportunities to participate. Perhaps especially in simple offers like Power Manager®. Duke Energy's research on this type of offer progression focuses on the 2009 period, as eventually the universe of participants that *first* received PER® and *then* a Power Manager® offer is reduced, as the total number of Power Manager® offers mailed increases over time. It may be that the ability to migrate customers through programming experiences, e.g. PER® to Power Manager® could drive additional value for Duke Energy, by keeping customers engaged and continuing to offer relevant programming. It may be that engagement programming like PER® drives additional dividends beyond the measurement year. Here for example follow on Demand Response program offer uptake was described. In light of the need to find new ways to get more participation to meet ramping goals, Duke Energy should consider exploring whether this gateway effect exists for other programming types.

Introduction and Purpose of Study

Summary Overview

This document presents the evaluation report for Duke Energy's Personalized Energy Report® (PER®) Program as it was administered in the Carolinas. The evaluation was conducted by TecMarket Works, Integral Analytics, and BuildingMetrics.

Summary of the Evaluation

These customers received the PER® offer by mail, and either returned the paper PER® survey, or completed the OHEC survey online as directed in the cover letter. See Appendix E for PER Channel Process. An impact analysis was performed for 6 packs of CFLs and for the measures that were installed as a result of the PER® and OHEC's recommendations. The impacts are based on engineering analysis of the impacts associated with the self-reported measure installs identified through a participant survey. To increase the reliability of the study findings, additional confirmative analysis was performed using a billing analysis comparing the pre and post program energy consumption levels of program participants.

This report is structured to provide program energy savings impact estimations per measure via the engineering analysis, and program savings based on the billing analysis results. The impact tables reporting total savings are based on the savings identified from 157 surveyed participants extrapolated to the program's total participants. The study includes participants from August 2009 through August of 2010.

	NC	SC
Completed Online Survey	35	15
Completed Mail Survey	70	37

This impact evaluation of the 6-pack of CFLs is based on surveys conducted with customers who participated in the Personalized Energy Report® program and who have received the kits mailed by the program. The impact of the Personalized Energy Report® recommendations that were implemented is based on survey responses of the actions they have taken that, according to the customer, were at least in part caused by the PER® report. The impact analysis conducted for this study was systematically adjusted downward to account for self-selection bias and potential false response bias sometimes associated with survey research of socially acceptable behaviors documented via telephone surveys. As a result, the evaluation consultants consider this study a reasonable estimate of program-induced savings.

Description of Program

The Personalized Energy Report® (PER®) (referred to from here forward as the Personalized Energy Report® or PER®) is a customized energy report offered to Duke Energy's residential customers to help them identify ways to save energy in their homes. The Personalized Energy Report® is offered both via mail and via Duke Energy's website. (The online version of the program will be referred to from here forward as the Online Audit.) The online version is identical in content to the mailed Personalized Energy Report® and has the benefit of being accessible to Duke Energy's customer service representatives. The mailed Personalized Energy Report® includes a cover letter that informs customers of the availability of the OHEC if they wish to respond online. Customers channeled from the Personalized Energy Report® to OHEC are given a tracking code to use if they wish to respond online.

Through both the mailed version and online versions of the program, customers complete a survey about their home and energy use, and in return receive the customized energy report. As an incentive for participating in the PER® and OHEC programs, customers are also offered a free package of 6 CFLs. The PER®/OHEC participation survey can be found in Appendix A: Personalized Energy Report® Paper Survey.

Program Participation

Engineering Estimates

The results from 157 surveyed participants are extrapolated to a total of 54,492 program Participants from August 2009 through August of 2010.

Billing Analysis

The results from the billing analysis are the result of the entire population of participants with usable billing data in Ohio, North and South Carolina, and Kentucky.[1]

[1] Including all the data from all the states into a regression equation increases the number of data points, which in turn makes increases the efficiency of the estimated savings as well as the statistical precision of all estimated coefficients.

Methodology

Overview of the Evaluation Approach

This impact evaluation has two components: billing analysis and engineering estimates.

Study Methodology

Engineering Estimates

A combination of engineering algorithms and building energy simulations were used. The engineering algorithms were used to estimate savings from lighting measures. Building energy simulations models of prototypical residential buildings were used to develop unit energy and demand savings estimates for building shell and HVAC measures. These unit energy savings values were applied to customers in the engineering analysis sample.

Billing Analysis

Program tracking data was used to pull billing data from all participants in Ohio, North and South Carolina, and Kentucky. The billing data was combined with information on participation date and whether the customer completed the mail or online version. This was in turn linked to weather data (temperature) to form the dataset used in the regression analysis.

Data collection methods, sample sizes, and sampling methodology

Engineering Estimates

TecMarket Works and Building Metrics developed a customer survey for the Personalized Energy Report® (PER®) Program participants to be implemented after they have had time to install at least some of the CFLs in the kit and to follow the recommendations offered.

A telephone survey was conducted with a random sample of 157 Personalized Energy Report® program participants. These participants were surveyed by phone by TecMarket Works. To help focus the survey, the questions asked were based on key results of an earlier study employing an identical approach for similar measures. The experience from the previous study for the Personalized Energy Report® program allowed this study to use those questions that were most informative to the energy impact estimation process and eliminate those questions that were found to have little impact on the results of the energy savings calculations. This allowed the Personalized Energy Report® survey to be shorter and more focused, yet still provide the information needed to estimate savings. The survey can be found in Appendix B: Participant Survey Instrument.

	North Carolina	South Carolina
Participants		
Mail	32,370	10,042
Online	9,430	2,650
Surveyed		
Mail	70	37
Online	35	15

Billing Analysis

The results from the billing analysis represent the entire population of participants with usable billing data, so no sample design was necessary.

Number of completes and sample disposition for each data collection effort

Engineering Estimates

Phone surveys were conducted with a random sample of participants. Data were collected from a total of 157 program participants. Energy savings achieved as a result of self-installations were attributed to the program if it was indicated that the improvement was suggested by the home energy report provided to the customer through the program.

Billing Analysis

Program tracking data was used to pull billing data from all participants in all states. The billing data was combined with information on participation date and whether the customer completed the mail or online version. This was in turn linked to weather data (temperature) to form the dataset used in the regression analysis.

Expected and achieved precision

Engineering Estimates

Engineering Estimates rely on participant survey responses. Sampling procedures for the participant survey had an expected and achieved precision of 90% ± 10%.

Billing Analysis

All savings estimates from the billing analysis were statistically significant at the 95% confidence level.

Description of baseline assumptions, methods and data sources

Engineering Estimates

Baseline assumptions for CFLs were taken from the draft Ohio TRM. Impact analysis for the recommendations is based on DOE-2.2 simulations of a set of prototypical residential buildings. Building shell measure baselines were selected based on typical construction practices by building vintage, using data from the US EIA Residential Energy Consumption Survey (RECS). HVAC baselines assumed normal end-of life replacement of the HVAC system, and used Federal appliance standards (NAECA) to establish the baseline efficiency.

Description of measures and selection of methods by measure(s) or market(s)

Engineering Estimates

The measures and methods are shown below. All customers are in the residential market.

Measure	Method
CFLs	Draft Ohio TRM
Double Pane Windows	DOE-2.2 simulation
14 SEER Central AC	DOE-2.2 simulation
Energy Star Doors	DOE-2.2 simulation

Billing Analysis

The billing analysis computed the overall savings associated with the program. There was no measure-level investigation.

Threats to validity, sources of bias and how those were addressed

Engineering Estimates

Customers were sampled at random for the survey and subsequent engineering analysis. Measure adoptions were self-reported by the customer. There is a potential for self response bias, but the customer has no vested interest in the reported measure adoptions, so this bias is expected to be minimal. There is a potential for bias in the engineering algorithms, which was minimized through the use of building energy simulation models, which are considered to be state of the art for building shell and HVAC system analysis.

Billing Analysis

The specification of the model used in the billing analysis was designed specifically to avoid the potential of omitted variable bias by including monthly variables that capture any non-program effects that affect energy usage. The model did not correct for self-selection bias because there is no reason to as long as the program remains voluntary.

Spillover & Persistence

Both persistence and technical degradation are included in the calculation of each measure's effective useful life shown in Appendix F: DSMore Table. For this evaluation, over this evaluation period, spillover, if it has occurred, is not expected to make enough of an impact to be a measureable component. For that reason, it was not assessed and the estimated savings is not adjusted to account for spillover.

Engineering Estimates

The Personalized Energy Report® provides a six pack of CFLs and a list of energy-saving recommendations, when applicable, to each participant. A phone survey, which can be found in Appendix B: Participant Survey Instrument, were conducted with a random sample of participants that completed the PER® survey either online or through the mail and received the six pack of CFLs. The results of this survey with the associated energy impact estimations and recommendations are presented below. Survey responses were received from 157 of the 54,492 participants from August 2009 to August 2010, 105 participants from North Carolina, and 52 from South Carolina. The responses and estimated energy savings of these 157 respondents have been extrapolated to the full population of 54,492 participants for the purpose of calculating overall savings estimates. All algorithms used in the calculation of the savings estimates herein can be found in Appendix C: Impact Algorithms. A summary can be seen in Table 4.

Energy Savings: Engineering Estimates

Savings estimates for the Personalized Energy Report program are driven by the billing analysis. The role of the engineering estimates is purely complementary. They are presented in this section for support and comparison purposes only and not as program savings records.

The CFLs provided through the program, when installed and used, provide energy savings to the participants and to Duke Energy. For the North and South Carolina participants, the installation of the CFLs supplied in the kit to the 54,492 participants provides an estimated net annual energy savings of -7,670 therms, 7,683,486 kWh and reduces peak load by 623.4 kW. On a per-participant basis, this equals first year annual gross energy savings of 283 kWh and .023 kW, with a net savings of 141 kWh and .011 kW per participant for the CFLs. The total first year net energy savings for the CFLs and the recommendations are 995.6 kW, 8,352,297 kWh and 7,732 therms. The total net lifetime savings for the Personalized Energy Report is 925.7 kWh and 5.06 therms per participant. Table 4 shows a summary.

Table 4. Engineering Impact Summary

	Gross Savings	Net Savings
ANNUAL SAVINGS FOR CFL INSTALLATIONS		
kW	1251.7	623.4
kWh	15,427,247	7,683,486
Therms	-15,401	-7,670
ANNUAL SAVINGS FOR RECOMMENDATION INSTALLATIONS		
kW	531.0	372.2
kWh	954,082	668,812
Therms	21,971	15,402
TOTAL ANNUAL SAVINGS FOR CFLs AND RECOMMENDATIONS		
kW	1782.6	995.6
kWh	16,381,329	8,352,297
Therms	6,570	7,732

LIFECYCLE SAVINGS FOR CFL INSTALLATIONS		
kWh		38,417,429
Therms		-38,352
LIFECYCLE SAVINGS FOR RECOMMENDATION INSTALLATIONS		
kWh		12,025,887
Therms		313,878
TOTAL LIFECYCLE SAVINGS FOR CFLs AND RECOMMENDATIONS		
kWh		50,443,316
Therms		275,526

The impact estimates are based on 157 survey responses of what actions were taken and the use conditions associated with these actions for the weather zone in which the participants reside. The energy savings estimates for the recommended actions taken are based on DOE-2 simulations of measure impact in residential buildings. This type of modeling and assessment approach is an industry standard and can be expected to provide accurate estimates of program impact that are consistent with the accuracy of the survey information provided by the program participants. Program savings broken down by measure can be seen in Table 5.

Table 5. Total Program Savings by Measure

Measure	kW	kWh	therms
CFLs	1251.65	15,427,247	-15,401
Double Pane Windows	159.59	470,249	18,639
14 SEER Central AC	339.45	385,262	-1,666
Energy Star Doors	31.93	98,572	4,998
TOTALS	**1,783**	**16,381,329**	**6,570**

Energy Savings Distributions: Engineering Estimates

The tables below present a summary of the total CFL savings from the program participants. Table 6 presents the gross energy savings based on the randomly sampled participant survey responses extrapolated to the program population of 54,492. Table 7 presents the expected savings after the false-response and self-selection biases are factored into the calculations. Table 8 presents the net savings, which includes the estimated program free ridership.

Table 6. First Year Gross Energy Savings of CFLs, All Program Participants (n=54,492)

Lamp Wattage	kW	kWh	Therms
13-Watt CFL	**596.9**	**7,176,979**	**-7,356**
20-Watt CFL	**654.8**	**8,250,268**	**-8,045**
Total	**1,251.7**	**15,427,247**	**-15,401**

Table 7. First Year Energy Savings of CFLs, Net of False-Response and Self-Reporting Bias, All Program Participants (n=54,492)

Lamp Wattage	kW	kWh	Therms
13-Watt CFL	347.3	4,175,781	-4,280
20-Watt CFL	381.0	4,800,253	-4,681
Total	728.2	8,976,035	-8,961

Table 8. First Year Net Energy Savings of CFLs, Net of False-Response, Self-Reporting Bias and Free ridership, All Program Participants (n=54,492)

Lamp Wattage	kW	kWh	Therms
13-Watt CFL	297.3	3,574,469	(3,664)
20-Watt CFL	326.1	4,109,017	(4,007)
Total	623.4	7,683,486	(7,670)

The tables below present a summary of the total recommendation savings from the program participants. Table 9 presents the gross energy savings based on the randomly sampled participant survey responses extrapolated to the program population of 54,492. Table 10 presents the net savings, which factors in the estimated program self-reporting bias.

Table 9. First Year Gross Energy Savings of Recommendations, All Program Participants (n=54,492)

Recommendation	Total Times Recommended	ΔkW	ΔkWh	Δtherms
Double Pane Windows	1041	159.59	470,249	18,639
14 SEER Central AC	694	339.45	385,262	-1,666
Energy Star Doors	694	31.93	98,572	4,998
TOTAL	**2430**	**530.97**	**954,082**	**21,971**

Table 10. First Year Net Energy Savings of Recommendations, Net of Self-Reporting Bias, All Program Participants (n=54,492)

Recommendation	Total Times Recommended	ΔkW	ΔkWh	Δtherms
Double Pane Windows	1041	111.87	329,644	13,066
14 SEER Central AC	694	237.95	270,069	(1,168)
Energy Star Doors	694	22.38	69,099	3,504
TOTAL	**2430**	**372.21**	**668,812**	**15,402**

PER® CFL Impacts

The phone surveys asked the respondents to state whether or not they used each CFL in the six pack and, if not, whether or not they plan to use them in the future. Those that indicated that they plan to use them are reported separately and should be interpreted as future potential savings rather than achieved savings. A summary of both achieved and potential savings from the CFLs can be seen in Table 11. A total of 15,427,247 kWh was achieved along with an additional 5,254,103 kWh in potential savings. The savings from CFL installations is responsible for 94% of the total program kWh savings.

Table 11. Total Achieved and Potential Gross Savings from CFLs by State

	North Carolina			South Carolina		
	ΔkW	ΔkWh	Δtherms	ΔkW	ΔkWh	Δtherms
Installed 13-Watt	466.89	5,613,894	-5,754	130.00	1,563,085	-1,602
Installed 20-Watt	498.84	6,285,598	-6,443	155.92	1,964,670	-1,602
Total Achieved	**965.73**	**11,899,492**	**-12,197**	**285.92**	**3,527,755**	**-3,204**
Potential 13-Watt	169.19	2,034,393	-2,085	19.70	236,831	-243
Potential 20-Watt	212.74	2,680,623	-2,748	23.99	302,257	-310
Total Potential	**381.94**	**4,715,015**	**-4,833**	**43.68**	**539,088**	**-553**

These are gross values and do not include free ridership, spillover, or bias adjustments. Savings are calculated using the algorithms in Appendix C: Impact Algorithms, which estimate first year annual savings based on the number of bulbs that were reported to be installed in sockets at the time the surveys were performed. No adjustment was made for an In Service Rate. Bulbs that were not reported as installed were not counted toward program savings. This approach provides a more conservative and defensible impact estimate as it only counts savings from bulbs reported to be currently installed and does not attempt to assign further savings based on assumptions about what happens to bulbs that are not initially installed.

The CFL six packs included three 13-Watt CFLs and three 20-Watt CFLs. As presented in Table 12, the survey revealed that in North Carolina, a total of 218 13-Watt and 204 20-Watt CFLs were installed, which equates to 86,785 13-Watt and 81,211 20-Watt CFLs total, or about 67% of the amount distributed. Survey participants indicated that they plan to install an additional 79 13-Watt and 87 20-Watt CFLs, which equates to 31,450 13-Watt and 34,634 20-Watt CFLs total. If all of these potential installs are actualized, 93% of the total amount distributed would be in use.

In South Carolina, the survey showed that a total of 99 13-Watt and 104 20-Watt CFLs were installed, which equates to 24,164 13-Watt and 25,384 20-Watt CFLs total, or about 65% of the amount distributed. Survey participants indicated that they plan to install an additional 15 13-Watt and 16 20-Watt CFLs, which equates to 3,661 13-Watt and 3,905 20-Watt CFLs total. If all of these potential installs are actualized, 75% of the total amount distributed would be in use.

Table 12. Total number of CFLs installed by State

	North Carolina			South Carolina		
	Survey	**%**	**Total**	**Survey**	**%**	**Total**
Installed 13-Watt	218	69%	**86,785**	99	63%	**24,164**

Installed 20-Watt	204	65%	**81,211**	104	67%	**25,384**
Potential 13-Watt	79	25%	**31,450**	15	10%	**3,661**
Potential 20-Watt	87	28%	**34,634**	16	10%	**3,905**

In the calculation of the installation rates from the surveys, the responses from the online and by-mail participants were grouped together. However, there were some notable behavior differences between the two survey groups (online/mail). Figure 2 shows the differences in installation rates between the two survey populations in both North and South Carolina. On average, participants responding online tended to report higher and more consistent installation rates.

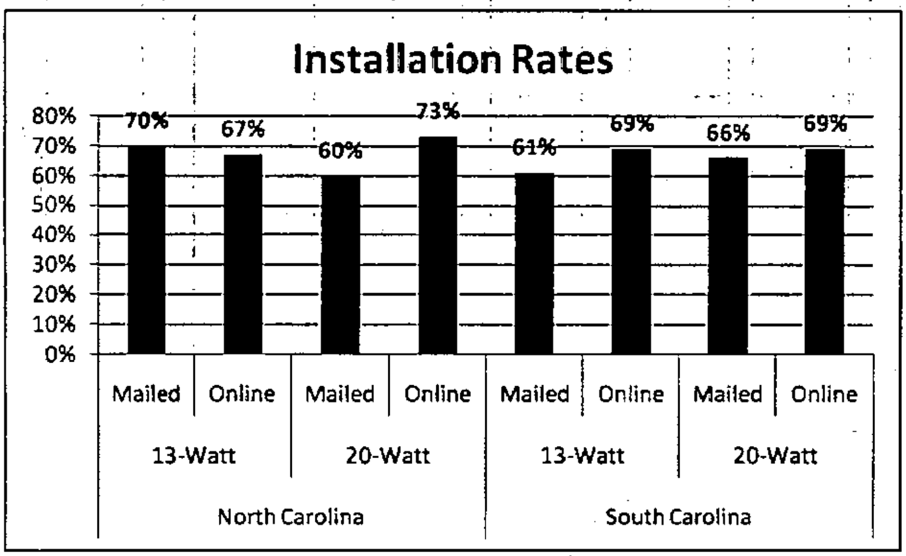

Figure 2. CFL Installation Rates Survey Group and State

From the survey, it was determined that, on average, participants use the 13-Watt CFL to replace a 59-Watt incandescent bulb and the 20-Watt CFL to replace a 73-Watt incandescent bulb. The savings from installing the CFLs are presented in Table 11. Using only the savings estimates based on those that said that they took the action, and extrapolating these estimates to the full population of program participants, PER® participants reduced their annual kWh consumption by 15,427,247 kWh, or 358 kWh per person per year. Of the total savings, 7,176,979 kWh (47%) is from 13-Watt CFLs and the other 8,250,268 kWh (53%) comes from 20-Watt CFLs. This results in per-installation savings achievements of 64.69 kWh and 77.40 kWh respectively. Mean values are shown in Table 13. The slight increase in therm consumption occurs because incandescent bulbs burn much hotter than CFLs and, consequently, homeowners must use a little bit more gas heating their homes in the winter.

Table 13. Mean Estimates per Install from Participants Installing CFLs

	kW	kWh	therms
Installed 13-Watt	0.0054	64.69	-0.0663
Installed 20-Watt	0.0061	77.40	-0.0793

Just as with the installation rate calculations, the replaced Wattage and operating hour calculations were carried out on aggregate data across both North and South Carolina. State dependent calculations were not performed. Figure 3 and Figure 4 show that survey participants that submit their survey by mail tend to use CFLs to replace higher Wattage incandescent bulbs and also that they have their lights turned on more often.

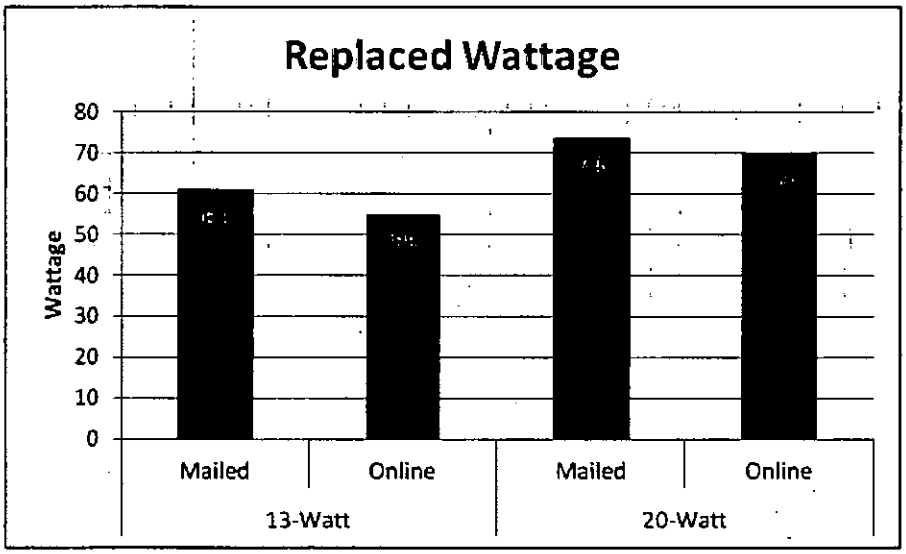

Figure 3. CFL Replaced Wattages by Survey Group

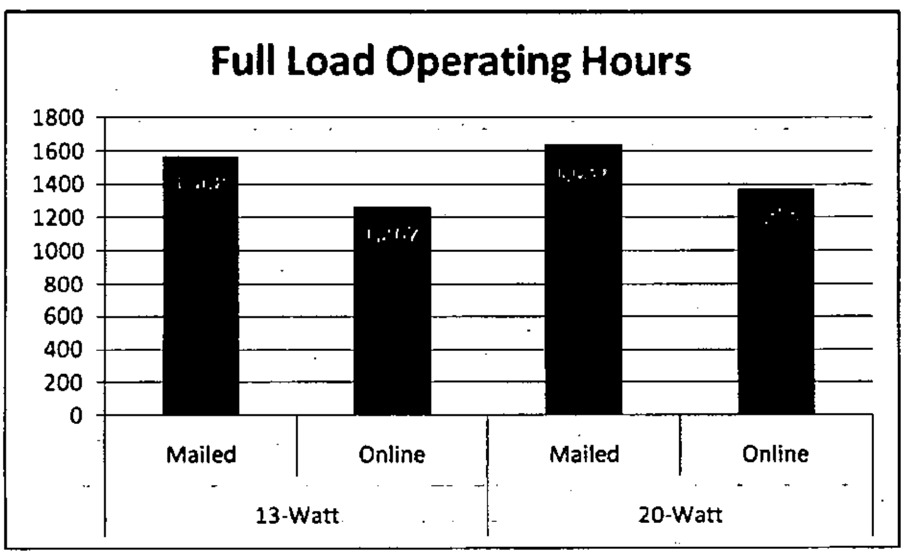

Figure 4. Stated CFL Operating Hours by Survey Group

PER Recommendation Impacts

There were a total of three different recommendations that were taken by program participants. Table 14 lists each recommendation along with how many times the recommendation was followed and the total estimated savings acquired from the measure taken. The phone survey did not allow participants to indicate whether or not they plan to take recommendations they have not yet taken as it did for the CFLs, so there are no planned or potential future savings presented for the recommendations provided by the Personalized Energy Report.

Table 14. All Recommendations with Savings Estimates

Recommendation	Times Recommendation Taken In Phone Survey	Percent of Total	Total Times Recommendation Taken	kW	kWh	therms
Double Pane Windows	3	1.91%	1041	159.59	470,249	18,639
14 SEER Central AC	2	1.27%	694	339.45	385,262	-1,666
Energy Star Doors	2	1.27%	694	31.93	98,572	4,998
TOTAL	**7**	**4.46%**	**2430**	**530.97**	**954,082**	**21,971**

There were a total of seven recommendations taken by survey participants. Double pane windows have an implementation rate of 1.91% and were hence employed by an estimated 1,041 participants out of the entire population of 54,492. Central air conditioners and Energy Star doors have an implementation rate of 1.27% and were thus employed by an estimated 694 participants. Due to this low implementation rate, the energy savings from the recommendations is quite low when compared to the savings from the CFLs, accounting for just 6% of the total program kWh savings. Mean savings estimates are shown in Table 15.

Table 15. Mean Savings Estimates for All Recommendations

	kW	kWh	therms
Double Pane Windows	0.1533	452	17.90
14 SEER Central AC	0.4890	555	-2.40
Energy Star Doors	0.0460	142	7.20

TecMarket Works and Duke Energy cross-checked the two customers that installed the AC units because of the PER recommendation, and neither of these PER participants received a rebate for these AC units by participating in the Residential Smart $aver® Program.

Billing Analysis

This section of the report presents the results of a billing analysis conducted over the participants in the North and South Carolina PER® program. Since the customer has a choice of either the mail or online version (OHEC), separate billing analyses were conducted for the mail version (referred below as PER®) and the online version (referred to as OHEC). For both analyses, billing data was obtained for all participants in the program between August, 2009 and March, 2011. For PER®, there were a total of 39,851 usable accounts after processing[2], of which 30,374 were from North Carolina, and 9,477 were from South Carolina, and for OHEC there were a total of 12,962 (9,781 from North Carolina and 2,838 from South Carolina).[3] For each program, a panel model was used to determine program impacts, where the dependent variable was monthly electricity consumption from January 2009 to March 2011. The results of the billing analysis are presented in Table 16.

Energy Savings: Billing Analysis

The estimated PER® and the online version (OHEC) program savings obtained from the billing data analysis are presented below.

Table 16. Estimated Carolina PER Impacts: Billing Analysis

	Proportion of Part. Population	95% Confidence Interval		
		Lower Bound	Estimate	Upper Bound
Per Participant Annual Savings (Gross) - PER®	77.8%	66.7	157.6	248.3
Per Participant Annual Savings (Gross) - OHEC	22.2%	319.3	598.3	695.7
Overall Per Participant Annual Savings (Gross)			255.4	

This table shows that both the written and online aspects of the PER® program produced statistically significant savings for participants in the Carolinas. The online version produced significantly higher savings, which may be due to several factors such as the customer is more involved or is more comfortable with newer technology (increasing the chance they will adopt newer, energy efficient appliances). These gross annual savings estimates are lower than the savings found from the engineering analysis, which may be due to differences in uptake of the recommended measures in the survey sample relative to the entire population of participants. Contrarily, net savings estimates from the billing analysis are higher than the net savings found from the engineering analysis. This difference is due to the heavy reductions made to the engineering estimates to account for the self-selection and false response biases that, as per the Level of Discounting for Biases section, the field has moved away from adjusting for. As it stands, the ratio of the net engineering estimate to the net billing estimate is 69% (152 kWh to 221 kWh).

[2] Useable accounts are those accounts which have billing data for both a portion of the pre- and post-participation period. It was not required that the data covers the complete evaluation period, only that there is at least one observation in each period.

[3] In order to maximize the use of the data, a single model for PER® and OHEC were estimated that included households from across all states (Ohio, North Carolina, South Carolina and Kentucky). Therefore, the actual sample size in the PER® model included 8,638 houses in Ohio and 8,451 in Kentucky, for a total sample size of 56,940 households, and the OHEC model included 6,081 from Ohio and 1,021 from Kentucky, for a total sample of 19,821.

Note that the billing data analysis did not include variables to capture effect of participation in other Duke Programs after participation in PER. This *does not* imply that the savings from PER captures the effects of participation in other programs. The extent to which the PER estimate may capture the effect of participation in other programs depends upon the correlation between these variables. This correlation is quite low because 1) there is not a sizable number of customers who first participation in PER and later participated in other programs, and 2) even for those customers who participate in other programs, there is generally a time lag between the participation dates (thus decreasing the correlation). These two effects imply that the correlation between PER participation and participation is low, and thus there is no need to capture participation in other programs in the billing data analysis.

For PER® the engineering analysis is within the 95% CI of the estimate from the bill data, so there is no statistically significant difference between the two estimates. However, that is not the case for OHEC, where the savings from the billing analysis are significantly larger (probably due to behavioral effects). The appropriate impact estimate for both PER® and OHEC is assumed to be the one based on the billing analysis because:

- The billing analysis is more likely to capture adoption of recommended measures as well as behavioral responses.
- The billing analysis was estimated over nearly all 2009-2011 participants (over 60,000 customers) while the engineering analysis relied upon the surveyed sample (157 customers).

For this analysis, data are available both across households (i.e., cross-sectional) and over time (i.e., time-series). With this type of data, known as "panel" data, it becomes possible to control, simultaneously, for differences across households as well as differences across periods in time through the use of a "fixed-effects" panel model specification. The fixed-effect refers to the model specification aspect that differences across homes that do not vary over the estimation period (such as square footage, heating system, etc.) can be explained, in large part, by customer-specific intercept terms that capture the net change in consumption due to the program, controlling for other factors that do change with time (e.g., the weather).

Because the consumption data in the panel model includes months before and after the installation of measures through the program, the period of program participation (or the participation window) may be defined specifically for each customer. This feature of the panel model allows for the pre-installation months of consumption to effectively act as controls for post-participation months. In addition, this model specification, unlike annual pre/post-participation models such as annual change models, does not require a full year of post-participation data. Effectively, the participant becomes their own control group, thus eliminating the need for a non-participant group. We know the exact month of participation in the program for each participant, and are able to construct customer specific models that measure the change in usage consumption immediately before and after the date of program participation, controlling for weather and customer characteristics.

The fixed effects model can be viewed as a type of differencing model in which all characteristics of the home, which (1) are independent of time and (2) determine the level of energy consumption, are captured within the customer-specific constant terms. In other words, differences in customer characteristics that cause variation in the level of energy consumption, such as building size and structure, are captured by constant terms representing each unique household.

Algebraically, the fixed-effect panel data model is described as follows:

$$y_{it} = \alpha_i + \beta x_{it} + \varepsilon_{it},$$

where:

y_{it} = energy consumption for home i during month t
α_i = constant term for site i
β = vector of coefficients
x = vector of variables that represent factors causing changes in energy consumption for home i during month t (i.e., weather, time, and participation)
ε = error term for home i during month t.

With this specification, the only information necessary for estimation is those factors that vary month to month for each customer, and that will affect energy use, which effectively are weather conditions and program participation. Other non-measurable factors can be captured through the use of monthly indicator variables (e.g., to capture the effect of potentially seasonal energy loads).

The effect of the written and online aspects of the PER® program are captured by including a variable which is equal to one for all months after the household participated in the program. The coefficient on this variable is the savings associated with the program. In order to account for differences in billing days, the usage was normalized by days in the billing cycle. The estimated electric model for the written aspect of PER® and OHEC are presented in Table 17 and Table 18, respectively.[4]

Table 17. Estimated Savings Model for PER® – dependent variable is daily kWh usage, January 2009 through March 2011 (savings are negative).

Independent Variable	Coefficient (kWh Savings/day)	t-value
PER® participation – Carolina	-0.432	-3.41
Sample Size	1,490,567 observations (56,940 homes)	
R-Squared	79%	

[4] As stated previously, for each aspect of PER®, a single model was estimated over participants in all states. The table however only presents the results for the Carolinas.

Table 18. Estimated Savings Model for OHEC – dependent variable is daily kwh usage, January 2009 through March 2011 (savings are negative).

Independent Variable	Coefficient (kWh Savings/day)	t-value
OHEC participation – Carolina	-1.639	-12.04
Sample Size	457,836 observations (19,821 homes)	
R-Squared	78%	

The complete estimate model, showing the weather and time factors, is presented in Appendix D: Estimated Statistical Model.

Appendix A: Personalized Energy Report® Paper Survey

0142045

RECEIVE YOUR FREE, PERSONALIZED ENERGY REPORT (PER)™

[redacted]

FOR THE ADDRESS SHOWN ABOVE, PLEASE ANSWER THE FOLLOWING QUESTIONS RELATED TO YOUR HOME AND ENERGY USAGE. FILL IN THE CIRCLES COMPLETELY USING BLUE OR BLACK INK.

PROPERTY DETAILS

1. What type of home best describes your primary residence? *(Select only one)*
   - ○ Detached single family
   - ○ Duplex / 2 family
   - ○ Townhouse
   - ○ Apartment / Multi – Family / (3 or more units)
   - ○ Condominium
   - ○ Manufactured home

2. How many levels does your home have, excluding the basement and unfinished attic?
   - ○ 1
   - ○ 2
   - ○ 3

3. In what year was your home built?
   - ○ Before 1959
   - ○ 1960 – 1979
   - ○ 1980 – 1989
   - ○ 1990 – 1997
   - ○ 1998 – 2000
   - ○ 2001 – 2007
   - ○ 2008

4. Does your home have an attic?
   - ○ Yes
   - ○ No

5. Does your home have a basement?
   - ○ Yes, heated
   - ○ Yes, unheated
   - ○ No

6. Excluding bathrooms and hallways, how many rooms are in your home? *(Include finished basement)*
   - ○ 1
   - ○ 2
   - ○ 3
   - ○ 4
   - ○ 5
   - ○ 6
   - ○ 7
   - ○ 8
   - ○ 9
   - ○ More than 9

7. How would you describe the size of the rooms in your home?
   - ○ Above average
   - ○ Average
   - ○ Below average

8. Approximate size (heated area) of your home? Your answers to questions 6 & 7 above will allow us to estimate the size of your home in square feet. Or, if you know the square footage of your home, you may choose it here and we will use your input.
   - ○ < 500
   - ○ 500-999
   - ○ 1000-1499
   - ○ 1500-1999
   - ○ 2000-2499
   - ○ 2500-2999
   - ○ 3000-3499
   - ○ 3500-3999
   - ○ 4000 or more
   - ○ Don't know

MAIN HEATING SYSTEM

9. What is the fuel used in your primary heating system?
   - ○ Electric
   - ○ Natural Gas
   - ○ Oil
   - ○ Propane
   - ○ Other (solar, wood, etc)
   - ○ No heat system

10. Which of the following bests describes your home's primary heating system?
    - ○ Electric Baseboard or ceiling cable
    - ○ Forced air furnace
    - ○ Standard heat pump
    - ○ Ground source heat pump
    - ○ Water boiler
    - ○ Steam boiler
    - ○ Wood heating system
    - ○ Heat pump with gas backup
    - ○ Heat pump with propane backup
    - ○ Heat pump with oil backup
    - ○ No heat system

11. How old is your heating system?
    - ○ 0 – 4 years
    - ○ 5 – 9 years
    - ○ 10 – 14 years
    - ○ 15 – 19 years
    - ○ 20 years or greater

COOLING SYSTEM

12. Do you have a central cooling system? (If you use window or room air conditioners, you will note this in question 14)
    - ○ No central cooling system
    - ○ Central air conditioning
    - ○ Heat Pump

13. If you have any cooling system, how old is it?
    - ○ 0 – 4 years
    - ○ 5 – 9 years
    - ○ 10 – 14 years
    - ○ 15 – 19 years
    - ○ 20 years or greater

14. Do you use room or window air conditioners?
    - ○ Yes
    - ○ No

15. How many room or window A/Cs?
    - ○ 1
    - ○ 2
    - ○ 3

16. If you have a central heating and cooling system with air ducts, are any of these ducts located in the attic?
    - ○ Yes
    - ○ No
    - ○ Not applicable

Duke Energy.

17. What is your thermostat setting for a typical heating day and a typical cooling day in the afternoon?

Heating
- <67 °
- 67 – 70 °F
- 71 – 73 °F
- 74 – 77 °F
- > 77 °F
- Thermostat off/ No thermostat

Cooling
- <69 °
- 69 – 72 °F
- 73 – 76 °F
- 77 – 78 °F
- > 78 °F
- Thermostat off/ No thermostat

18. Do you have any of the following comfort issues in your home?

a. *Cold drafts in the winter*
- Yes
- No

b. *Sweaty windows in the winter*
- Yes
- No

c. *Cooling system will not keep the home comfortable*
- Yes
- No

d. *Heating system will not keep the home comfortable*
- Yes
- No

e. *Uneven temperatures between rooms*
- Yes
- No

19. How many people live in your home?
- 1
- 2
- 3
- 4
- 5
- 6
- 7 or more

20. Do you own or rent this home?
- Own
- Rent

21. What fuel is used by your water heater?
- Electric
- Natural Gas
- Propane
- Other
- None

22. What is the age of your water heater?
- 0 – 4 years
- 5 – 9 years
- 10 – 14 years
- 15 – 19 years
- 20 years or greater

23. What type of fuel do you use for clothes drying?
- Electric
- Natural Gas
- Other
- None

24. What type of fuel do you use for your cook top?
- Electric
- Natural Gas
- Other
- None

25. What type of fuel do you use for your oven?
- Electric
- Natural Gas
- Other
- None

26. a. Do you have a swimming pool?
- Yes
- No

b. *Do you have a pool heater?*
- Yes
- No

c. *What type of fuel do you use to heat your pool?*
- Electric
- Natural Gas
- Oil
- Propane
- Not applicable

27. a. Do you have a hot tub?
- Yes
- No

b. *What type of fuel do you use to heat your hot tub?*
- Electric
- Natural Gas
- Oil
- Propane

28. Would a two degree increase in your home's indoor temperature during summer weekday afternoons affect your family's comfort?
- Not at all
- A small impact
- A moderate impact
- A large impact

29. Are you planning to make any large purchases to improve the energy efficiency of your home within the next three years?
- Yes
- No
- Not sure

30. How many CFLs* do you have installed in your home?

* 0 1 4 2 0 4 5 *

31. Please print your email address in the boxes below:

*compact fluorescent light bulbs

Appendix B: Participant Survey Instrument

The questions below require mostly short, scaled replies from the interviewee, and not all questions will be asked of all participants. This interview should take approximately 10 to 15 minutes.

Personalized Energy Report® (PER®) Program

Participant Survey

SURVEY INTRODUCTION

If PER® participant, then contact for survey. Use five attempts at different times of the day and different days before dropping from contact list. Call times are from 10:00 a.m. to 8:00 p.m. EST or 9-7 CST Monday through Saturday. No calls on Sunday. (Sample size N =150)

SURVEY

Introduction

Note: Only read words in bold type.

Hello, my name is ______. I am calling on behalf of Duke Energy to conduct a customer survey about the Personalized Energy Report® Program. This was a survey someone in your home completed and you received a report and compact fluorescent light bulbs for your participation. May I speak with ____________ please?

If person talking, proceed. If person is called to the phone reintroduce.
If not home, ask when would be a good time to call and schedule the call-back:

Call back 1:	Date: __________,	Time: _____________	❑AM or ❑PM
Call back 2:	Date: __________,	Time: _____________	❑AM or ❑PM
Call back 3:	Date: __________,	Time: _____________	❑AM or ❑PM
Call back 4:	Date: __________,	Time: _____________	❑AM or ❑PM
Call back 5:	Date: __________,	Time: _____________	❑AM or ❑PM

❑ Contact dropped after fifth attempt.

We are conducting this survey to obtain your opinions about the Personalized Energy Report® Program. Duke Energy's records indicate that you participated in the Personalized Energy Report® Program by completing and mailing a paper survey or an online survey. We are not selling anything. The survey will take about 5 or 10 minutes and your answers will be confidential, and will help us to make improvements to the program to better serve others. May we begin the survey?

Note: If this is not a good time, ask if there is a better time to schedule a callback.

1. **Do you recall participating in the Personalized Energy Report® Program?**

1. ❑ Yes, *begin* → *Skip to Q3.*
2. ❑ No,
99. ❑ DK/NS

This program was provided through Duke Energy. In this program, you completed a short survey about your home in <*month year*>, and then Duke Energy provided you with energy-saving recommendations for you and your home, and you were also provided with a free six-pack of CFLs.

Do you remember participating in this program?

1. ❑ Yes, *begin* → *Go to Q2.*
2. ❑ No,
99. ❑ DK/NS

If No or DK/NS terminate interview and go to next participant.

2. **How did you learn of the PER® Program?**

a. ____ I visited Duke Energy's website (pop-up survey)
b. ____ I got the survey in the mail -- *Did you fill out the mailed PER® survey or did you complete the survey online?*
   i. Paper ____
   ii. Online ______
c. ____ Other: ____________________________

3. Please think back to the time when you were deciding to participate in the Personalized Energy Report® program. What factors motivated you to participate? ***(do not read list, place a "1" next to the response that matches best)***

1. ____ Six pack of CFL bulbs
2. ____ Recommendation of someone else (*Probe*: **Who?**__________)
3. ____ Wanted to reduce energy costs
4. ____ The information provided by the program
5. ____ Past experience with this program
6. ____ Because of past experience with another Duke Energy program
7. ____ Recommendation from other utility program

i. (*Probe*: **What program?** ____________________________)

8. ____ Recommendation of family/friend/neighbor
9. ____ Other (SPECIFY) ______________________________________
10. ____ Don't know/don't remember/not sure (DK/NS)

If multiple responses: 3.a. **Were there any other reasons?** *(number responses above in the order they are provided - Repeat until 'no' response.)*

4. **Did you have any CFLs installed in your home before you completed your PER® survey?**

☐ Yes ☐ No ☐ DK

If yes, 4a. **How many did you have installed before you completed the PER® survey?**

Enter response: __________________

Please answer the following set of questions with a yes or no response.

5. **Do you have any cold drafts in your house during the winter?**

☐ Yes ☐ No ☐ DK

6. **Do your windows have water on them or look "sweaty" in the winter?**

☐ Yes ☐ No ☐ DK

7. **Does your cooling system keep your home comfortable?**

☐ Yes ☐ No ☐ DK ☐ Don't have a cooling system

8. **Does your heating system keep your home comfortable?**

☐ Yes ☐ No ☐ DK ☐ Don't have a heating system

9. **Does the temperature in your house stay even from room to room?**

☐ Yes ☐ No ☐ DK

10. **I'd like to talk about the CFLs that you received for participating in the PER® program. The kit came with 3 13-watt CFLs and 3 20-watt CFLs. How many of the 13-watt CFLs are you using?**

- **a.** None of them
- **b.** 1 of the CFLs
- **c.** 2 of the CFLs
- **d.** 3 of the CFLs
- **e.** Don't know

11. **For the** <first, second, third> **How many watts was the old bulb that you took out?** (repeat for all installed out of the 3 provided)

❑<=44 ❑45-70 ❑71-99 ❑100+

4. **On average, approximately how many hours per day is this light used?** (repeat for all installed out of the 3 provided)

❑<=1 ❑1-2 ❑3-4 ❑5-10 ❑11-12 ❑13-24

If less than 3:

Do you plan on using the remaining 13-watt CFLs?

❑ Yes
❑ No **Why Not?** ______________________
❑ Maybe/DK

12. **How many of the 20-watt CFLs are you using?**

- **f.** None of them
- **g.** 1 of the CFLs
- **h.** 2 of the CFLs
- **i.** 3 of the CFLs
- **j.** Don't know

13. **For the** <first, second, third> **How many watts was the old bulb that you took out?** (repeat for all installed out of the 3 provided)

❑<=44 ❑45-70 ❑71-99 ❑100+

4. **On average, approximately how many hours per day is this light used?** (repeat for all installed out of the 3 provided)

❑<=1 ❑1-2 ❑3-4 ❑5-10 ❑11-12 ❑13-24

If less than 3:

14. **Do you plan on using the remaining 20-watt CFLs?**
    i. ☐ Yes
    ii. ☐ No **Why Not?** ________________________
    iii. ☐ Maybe/DK

15. **On a scale from 1-10, with 1 indicating that you were very dissatisfied, and 10 indicating that you were very satisfied, please rate your satisfaction with the kit's 13-watt CFL(s).**

very dissatisfied									very satisfied
1	2	3	4	5	6	7	8	9	10

If 7 or less, 10a. **Why were you dissatisfied with the 13-watt CFLs?**

____

____

16. **On a scale from 1-10, with 1 indicating that you were very dissatisfied, and 10 indicating that you were very satisfied, please rate your satisfaction with the kit's 20-watt CFL.**

very dissatisfied									very satisfied
1	2	3	4	5	6	7	8	9	10

If 7 or less, 11a. **Why were you dissatisfied with the 20-watt CFL?**

____

____

17. **Have you purchased any CFLs since receiving the kit from Personalized Energy Report?**

☐ Yes ☐ No ☐ DK

If yes, 12a. **How many?** __________________

18. **Since you participated in the Personalized Energy Report® Program,**

a. have you purchased and installed any energy efficiency equipment?

1. ❑ Yes
2. ❑ No
3. ❑ Don't Know

b. have you made energy efficiency improvements in your home?

a. ❑ Yes
b. ❑ No
c. ❑ Don't Know

c. Have you changed any of your habits related to energy use that were recommended by the PER® report?

a. ❑ Yes
b. ❑ No
c. ❑ Don't Know

If any of the responses to questions 18a - 18c are "yes", continue. If all responses are "no" or "Don't Know", skip to question #23.

19. **What type and quantity of high efficiency equipment did you install on your own?**
PROBE TO GET EXACT TYPE AND QUANTITY AND LOCATION

Type 1: ________________ Quantity 1: ______ Location 1:____________
Type 2: ________________ Quantity 2: ______ Location 2:____________
Type 3: ________________ Quantity 3: ______ Location 3:____________
Type 4: ________________ Quantity 4: ______ Location 4:____________

20. **Was this improvement suggested by the home energy report provided to you through the Personalized Energy Report® program?**

Type 1: ________________ ❑ Yes ❑ No ❑ DK
Type 1: ________________ ❑ Yes ❑ No ❑ DK
Type 1: ________________ ❑ Yes ❑ No ❑ DK
Type 1: ________________ ❑ Yes ❑ No ❑ DK

21. **Was this improvement suggested through a different energy efficiency program?**

Type 1: ________________ ❑ Yes ❑ No ❑ DK
If yes: **Which program?**:____________________
Type 1: ________________ ❑ Yes ❑ No ❑ DK
If yes: **Which program?**:____________________
Type 1: ________________ ❑ Yes ❑ No ❑ DK
If yes: **Which program?**:____________________
Type 1: ________________ ❑ Yes ❑ No ❑ DK

If yes: **Which program?:**________________________

22. *For each type listed in 14 above,* **How do you know that this equipment is high efficiency? For example, was it Energy Star rated?**

Type 1: ____
Type 2: ____
Type 3: ____
Type 4: ____

I'm going to read a statement about this equipment that you purchased on your own. On a scale from 1-10, with 1 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate the following statement.

23. **My experience with the Personalized Energy Report® Program in** <2009, 2010> **influenced my decision to install** <Type 1/Type 2/Type 3/Type 4> **on my own.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

24. **What other actions, if any, have you taken in your home to save energy and reduce utility bills at least in part as a result of what you learned in this program?**

Response:1 ____

Response:2 ____

Response:3 ____

Response:4 ____

Now I am going to ask you some general satisfaction statements. On a scale from 1-10, with 1 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate the following statements.

25. **The mailed survey was easy to understand.** (If an online participant: **The web site's survey was easy to understand.**)

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**________________________________

____

26. **The energy report was easy to read and understand.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**______________________________________

____

27. **The recommendations in the PER® report provided new ideas that I was not previously considering.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**______________________________________

____

28. **The recommendations in the report increased the likelihood that I would take recommended actions.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**______________________________________

____

29. **The kit I received met my expectations.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**______________________________________

____

30. I am satisfied with the amount of time it took to receive the kit and report after completing the PER® survey.

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**______________________________

____

31. **Overall I am satisfied with the program.**

1 2 3 4 5 6 7 8 9 10

❑ Don't Know

If 7 or less, **How could this be improved?**______________________________

____

32. What additional services would you like the program to provide that it does not now provide?

Response: ____

____

33. Are there any other things that you would like to see changed about the program?

Response: ____

34. **What do you think can be done to increase people's interest in participating in the Personalized Energy Report® Program?**

Response:1 ____
Response:2 ____
Response:3 ____
Response:4 ____

35. **Have you recommended this program to others?**

If yes, **How many people did you recommend this program to?**

36. **What did you like most about this program?**

Response: ______________________________

37. What did you like least about this program?

Response: ______________________________

38. **What other services could Duke Energy provide to help improve home energy efficiency?**

Response: ______________________________

That completes our survey, thank you for your time and feedback today! (*politely end call*)

Appendix C: Impact Algorithms

CFLs

General Algorithm

Gross Summer Coincident Demand Savings

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

Gross Annual Energy Savings

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

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

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 (this does not capture the In Service Rate, see PER® CFL Impacts, page 16)
$Watts_{ee}$	= 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 = -0.04353
$HVAC_d$	= HVAC system interaction factor for demand = -0.00102
$HVAC_g$	= HVAC system interaction factor for annual gas consumption = -0.0017

13 W CFL Measure

$Watts_{ee}$ = 13, which is the input power of program supplied CFL

$Watts_{base}$ - calculated from survey responses as shown below = 58.98181818

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: = 1470.830189 for 13-watt, 1541.339 For the 20-watt bulb.

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.

Charlotte, NC

Heating Fuel	Heating System	Cooling System	HVACc	HVACg
Other	Any except Heat Pump	Any except Heat Pump	0	0
Any	Heat Pump	Heat Pump	-0.10	0
Gas Propane Oil	Central Furnace	None	0	-0.0021
		Room/Window	0.069	-0.0021
		Central AC	0.069	-0.0021
	Other	None	0	-0.0021
		Room/Window	0.079	-0.0021
		Central AC	0.079	-0.0021
Electricity	Central furnace	None	-0.43	0
		Room/Window	-0.31	0
		Central AC	-0.31	0
	Electric baseboard	None	-0.43	0
		Room/Window	-0.31	0
		Central AC	-0.31	0
	Other	None	-0.43	0

		Room/Window	-0.31	0
		Central AC	-0.31	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: = 72.5

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

Recommendations

	kW	kWh	therms	Units
Double Pane Windows	.101	317	26.4	100 SF of Window
Energy Star Doors	.02	84	9.4	Door
Energy Star Dishwasher	0	35.4	2.26	Unit
Energy Star Clothes Washer	0	97.35	6.02	Unit
Energy Star Freezer	0	70.8	0	Unit
14 SEER Central AC	.168	141	-2.3	Ton of AC

Appendix D: Estimated Statistical Model

This appendix show the complete model estimated for the billing analysis of PER® and OHEC. The model includes indicators for each month (the yearmonth variable), temperature, the state the participant resides, and the participation variables.

In regression analysis, the precision of an estimated coefficient is measured by its standard error. The larger its standard error, the larger is the confidence interval about the estimate (and the lower is its t-value). Roughly speaking (assuming independence across variables), a coefficient's estimated standard error (SE) is inversely proportional to 1 over the square root of the sample size. Thus, the billing analysis pooled observations across Ohio, Kentucky, and the Carolinas to increase the observations used in the analysis, as the more observations in the analysis, the lower the standard error of the regression coefficients, and thus the more precise are the coefficients. In practical terms, introducing more variation in the independent variables (by including multiple states) also increases the precision of the coefficients.

PER®

Variable	Coefficient	Std. Err.	t-value	P>|t|	[95% Conf.	Interval]
Ohio PER®	-1.061723	.2275592	-4.67	0.000	-1.507731	-.6157145
Carolina PER®	-.4318153	.1267935	-3.41	0.001	-.6803262	-.1833044
Kentucky PER®	-.5153296	.4109788	-1.25	0.210	-1.320834	.2901747
yearmonth- monthly indicators						
200902	.4266216	1.010806	0.42	0.673	-1.554524	2.407767
200903	1.214701	1.240542	0.98	0.327	-1.21672	3.646121
200904	-9.274887	1.621965	-5.72	0.000	-12.45388	-6.095892
200905	-46.04743	1.530528	-30.09	0.000	-49.04722	-43.04765
200906	-152.9098	2.173861	-70.34	0.000	-157.1705	-148.6491
200907	-165.0771	2.978928	-55.41	0.000	-170.9157	-159.2385
200908	-174.267	2.831219	-61.55	0.000	-179.8161	-168.7179
200909	-161.846	2.172825	-74.49	0.000	-166.1046	-157.5873
200910	-70.86816	1.265211	-56.01	0.000	-73.34794	-68.38839
200911	-19.43655	1.912648	-10.16	0.000	-23.18528	-15.68783
200912	10.43675	.9859776	10.59	0.000	8.504268	12.36923
201001	13.31447	1.187308	11.21	0.000	10.98738	15.64155
201002	6.056467	1.24992	4.85	0.000	3.606667	8.506268
201003	21.50042	1.162243	18.50	0.000	19.22247	23.77838
201004	-7.110179	1.365137	-5.21	0.000	-9.7858	-4.434557
201005	-94.58579	2.174196	-43.50	0.000	-98.84714	-90.32444
201006	-167.8692	2.085284	-80.50	0.000	-171.9563	-163.7821
201007	-209.1718	3.371102	-62.05	0.000	-215.7791	-202.5646
201008	-200.396	3.466054	-57.82	0.000	-207.1894	-193.6027
201009	-159.8892	2.277926	-70.19	0.000	-164.3538	-155.4245
201010	-104.0399	1.334106	-77.98	0.000	-106.6547	-101.4251
201011	-15.56738	1.256639	-12.39	0.000	-18.03035	-13.10441
201012	13.01914	.9093942	14.32	0.000	11.23676	14.80152
201101	2.593355	1.406553	1.84	0.065	-.1634416	5.350151
201102	17.50172	1.237131	14.15	0.000	15.07698	19.92645
201103	9.087197	1.358838	6.69	0.000	6.423922	11.75047
temperature interacted with monthly indicator						
200901	-.8448921	.0231028	-36.57	0.000	-.8901728	-.7996115
200902	-.8684181	.0217809	-39.87	0.000	-.9111078	-.8257284
200903	-.8756204	.0225642	-38.81	0.000	-.9198455	-.8313953
200904	-.6823165	.028334	-24.08	0.000	-.7378501	-.6267829
200905	-.0299153	.0215229	-1.39	0.165	-.0720994	.0122688
200906	1.610204	.0280663	57.37	0.000	1.555195	1.665213
200907	1.846985	.0413431	44.67	0.000	1.765954	1.928016
200908	1.910927	.0380102	50.27	0.000	1.836429	1.985426
200909	1.867457	.0310438	60.16	0.000	1.806612	1.928302
200910	.4744001	.0200308	23.68	0.000	.4351403	.5136598
200911	-.5401151	.037813	-14.28	0.000	-.6142272	-.4660029

200912	-1.270706	.019183	-66.24	0.000	-1.308304	-1.233108
201001	-1.288228	.033432	-38.53	0.000	-1.353754	-1.222702
201002	-1.134498	.03636	-31.20	0.000	-1.205762	-1.063234
201003	-1.295564	.0186343	-69.53	0.000	-1.332087	-1.259042
201004	-.6484281	.0191337	-33.89	0.000	-.6859294	-.6109267
201005	.7130788	.0307386	23.20	0.000	.6528322	.7733253
201006	1.7906	.0256551	69.79	0.000	1.740317	1.840884
201007	2.373414	.0427584	55.51	0.000	2.289609	2.457219
201008	2.288716	.044393	51.56	0.000	2.201707	2.375725
201009	1.837347	.0311476	58.99	0.000	1.776299	1.898395
201010	1.028331	.0193759	53.07	0.000	.9903547	1.066307
201011	-.6584072	.0228751	-28.78	0.000	-.7032416	-.6135729
201012	-1.499983	.0167263	-89.68	0.000	-1.532766	-1.4672
201101	-.9255145	.0431786	-21.43	0.000	-1.010143	-.8408859
201102	-1.228139	.0262677	-46.75	0.000	-1.279623	-1.176655
201103	-1.092089	.0248396	-43.97	0.000	-1.140774	-1.043405
state interacted with monthly indicator						
2 200901	-14.24384	.5474325	-26.02	0.000	-15.31679	-13.17089
2 200902	-13.54088	.518331	-26.12	0.000	-14.55679	-12.52497
2 200903	-16.25062	.4647394	-34.97	0.000	-17.16149	-15.33975
2 200904	-18.76405	.4715211	-39.79	0.000	-19.68822	-17.83989
2 200905	-19.30963	.4632841	-41.68	0.000	-20.21765	-18.40161
2 200906	-21.57624	.4973071	-43.39	0.000	-22.55095	-20.60154
2 200907	-25.5147	.5224062	-48.84	0.000	-26.5386	-24.4908
2 200908	-22.15775	.5028924	-44.06	0.000	-23.1434	-21.1721
2 200909	-32.42633	.5261241	-61.63	0.000	-33.45752	-31.39515
2 200910	-26.44687	.5309348	-49.81	0.000	-27.48749	-25.40626
2 200911	-17.17487	.5821393	-29.50	0.000	-18.31584	-16.0339
2 200912	-6.724921	.4933693	-13.63	0.000	-7.691907	-5.757934
2 201001	-6.855386	.4941245	-13.87	0.000	-7.823853	-5.886919
2 201002	-6.499494	.5447694	-11.93	0.000	-7.567223	-5.431765
2 201003	-17.73031	.3889161	-45.59	0.000	-18.49257	-16.96805
2 201004	-21.94704	.3813565	-57.55	0.000	-22.69448	-21.19959
2 201005	-18.90678	.3822114	-49.47	0.000	-19.6559	-18.15766
2 201006	-20.29665	.3830755	-52.98	0.000	-21.04746	-19.54583
2 201007	-23.06292	.4012778	-57.47	0.000	-23.84941	-22.27643
2 201008	-26.30591	.4283165	-61.42	0.000	-27.1454	-25.46643
2 201009	-32.79776	.4488772	-73.07	0.000	-33.67755	-31.91798
2 201010	-30.52598	.4351305	-70.15	0.000	-31.37882	-29.67314
2 201011	-14.44264	.4843888	-29.82	0.000	-15.39203	-13.49325
2 201101	-10.16058	.5146035	-19.74	0.000	-11.16919	-9.151975
2 201102	-16.37198	.3964678	-41.29	0.000	-17.14905	-15.59492
2 201103	-16.2204	.4099473	-39.57	0.000	-17.02389	-15.41692
3 200901	-2.719421	.4557286	-5.97	0.000	-3.612634	-1.826209
3 200902	-4.833738	.4596333	-10.52	0.000	-5.734604	-3.932873
3 200903	-2.1202	.4586602	-4.62	0.000	-3.019158	-1.221242
3 200904	-2.482411	.4517629	-5.49	0.000	-3.367851	-1.596971
3 200905	-1.926375	.4544875	-4.24	0.000	-2.817155	-1.035595
3 200907	-.766061	.4529398	-1.69	0.091	-1.653807	.1216853
3 200908	-1.251723	.4512852	-2.77	0.006	-2.136226	-.3672193
3 200909	-1.952124	.4520576	-4.32	0.000	-2.838141	-1.066106
3 200910	-1.832651	.4513288	-4.06	0.000	-2.71724	-.9480621
3 200911	-2.673984	.451699	-5.92	0.000	-3.559298	-1.78867
3 200912	-3.951661	.4600417	-8.59	0.000	-4.853326	-3.049995
3 201001	-3.513307	.475893	-7.38	0.000	-4.446041	-2.580573
3 201002	-2.760464	.5071023	-5.44	0.000	-3.754367	-1.766561
3 201003	-1.240512	.5077624	-2.44	0.015	-2.235709	-.2453155
3 201004	-2.562118	.5029819	-5.09	0.000	-3.547946	-1.576291
3 201005	-2.735408	.5035323	-5.43	0.000	-3.722314	-1.748502
3 201006	-1.480987	.5035467	-2.94	0.003	-2.467921	-.4940523
3 201007	-1.120872	.6074386	-1.85	0.065	-2.311431	.0696869
3 201008	-1.706594	.6428559	-2.65	0.008	-2.966569	-.4466181
3 201009	-1.13282	.6485791	-1.75	0.081	-2.404013	.1383728
3 201010	-1.975442	.6502539	-3.04	0.002	-3.249918	-.7009671
3 201011	-2.949383	.6507419	-4.53	0.000	-4.224815	-1.673952
3 201012	-4.499843	.6508389	-6.91	0.000	-5.775465	-3.224221
3 201101	-2.329826	.6518026	-3.57	0.000	-3.607337	-1.052316
3 201102	-1.289736	.653429	-1.97	0.048	-2.570434	-.0090371
3 201103	-1.724363	.6534582	-2.64	0.008	-3.005119	-.4436076

OHEC

Variable	Coefficient	Std. Err.	t-value	P>|t|	[95% Conf.	Interval]
Ohio OHEC	-.4752078	.1598156	-2.97	0.003	-.7884415	-.161974
Carolina OHEC	-1.639313	.1361068	-12.04	0.000	-1.906078	-1.372548
Kentucky OHEC	-1.156848	.4252654	-2.72	0.007	-1.990355	-.3233405
yearmonth- monthly indicators						
200902	6.1028	2.63925	2.31	0.021	.9299511	11.27565
200903	-2.973926	2.777778	-1.07	0.284	-8.418285	2.470433
200904	-28.67183	3.50644	-8.18	0.000	-35.54434	-21.79931
200905	-63.87458	3.371306	-18.95	0.000	-70.48224	-57.26693
200906	-178.4931	4.596679	-38.83	0.000	-187.5024	-169.4837
200907	-209.5281	7.25564	-28.88	0.000	-223.749	-195.3073
200908	-204.5421	6.464157	-31.64	0.000	-217.2117	-191.8726
200909	-174.9807	5.025815	-34.82	0.000	-184.8312	-165.1303
200910	-84.71277	3.19882	-26.48	0.000	-90.98236	-78.44318
200911	-45.71389	4.606562	-9.92	0.000	-54.74261	-36.68517
200912	16.12113	2.6609	6.06	0.000	10.90585	21.33641
201001	41.3951	3.073435	13.47	0.000	35.37126	47.41894
201002	27.33586	3.155435	8.66	0.000	21.15131	33.52042
201003	29.78945	2.51837	11.83	0.000	24.85352	34.72538
201004	-18.48318	2.952863	-6.26	0.000	-24.2707	-12.69566
201005	-136.32	4.33229	-31.47	0.000	-144.8111	-127.8288
201006	-194.0864	4.130382	-46.99	0.000	-202.1818	-185.9909
201007	-236.1339	7.18788	-32.85	0.000	-250.2219	-222.0458
201008	-211.5787	7.275538	-29.08	0.000	-225.8386	-197.3189
201009	-164.2715	5.105585	-32.17	0.000	-174.2783	-154.2647
201010	-120.3567	3.197601	-37.64	0.000	-126.6239	-114.0895
201011	-22.80084	3.209117	-7.11	0.000	-29.09062	-16.51107
201012	25.30604	2.464515	10.27	0.000	20.47567	30.13642
201101	66.20788	3.775215	17.54	0.000	58.80857	73.60718
201102	36.66786	2.833697	12.94	0.000	31.1139	42.22182
201103	9.462914	3.180452	2.98	0.003	3.229326	15.6965
temperature interacted with monthly indicator						
200901	-.7920264	.0458513	-17.27	0.000	-.8818935	-.7021594
200902	-.9218201	.0403026	-22.87	0.000	-1.000812	-.8428284
200903	-.760226	.0405027	-18.77	0.000	-.8396102	-.6808419
200904	-.338051	.0521215	-6.49	0.000	-.4402076	-.2358944
200905	.2580965	.0411678	6.27	0.000	.1774089	.3387841
200906	1.960164	.0577431	33.95	0.000	1.84699	2.073339
200907	2.356975	.0917796	25.68	0.000	2.17709	2.53686
200908	2.271226	.0791544	28.69	0.000	2.116085	2.426366
200909	1.881162	.0619722	30.35	0.000	1.759698	2.002625
200910	.5869888	.0384341	15.27	0.000	.5116592	.6623184
200911	-.0439493	.0737773	-0.60	0.551	-.1885505	.1006519
200912	-1.150471	.0367928	-31.27	0.000	-1.222583	-1.078358
201001	-1.783806	.0638012	-27.96	0.000	-1.908854	-1.658757
201002	-1.41811	.0645008	-21.99	0.000	-1.544529	-1.29169
201003	-1.490099	.0347189	-42.92	0.000	-1.558147	-1.422051
201004	-.4821425	.0367939	-13.10	0.000	-.5542573	-.4100276
201005	1.399267	.0585345	23.91	0.000	1.284541	1.513993
201006	2.172885	.0485893	44.72	0.000	2.077651	2.268118
201007	2.68543	.0865505	31.03	0.000	2.515793	2.855066
201008	2.35579	.0868163	27.14	0.000	2.185633	2.525947
201009	1.754277	.0611546	28.69	0.000	1.634416	1.874138
201010	1.134476	.0368492	30.79	0.000	1.062252	1.206699
201011	-.4310716	.0441303	-9.77	0.000	-.5175655	-.3445776
201012	-1.370989	.0326091	-42.04	0.000	-1.434902	-1.307076
201101	-2.537856	.0913773	-27.77	0.000	-2.716953	-2.358759
201102	-1.684399	.0496296	-33.94	0.000	-1.781671	-1.587126
201103	-1.039596	.0489464	-21.24	0.000	-1.135529	-.9436622
state interacted with monthly indicator						
2 200902	.7458418	.557853	1.34	0.181	-.3475329	1.839217
2 200903	-.8121234	.5531857	-1.47	0.142	-1.89635	.2721036
2 200904	-2.801436	.5491054	-5.10	0.000	-3.877666	-1.725206
2 200905	-3.36511	.546365	-6.16	0.000	-4.435969	-2.294251
2 200906	-4.325335	.5482618	-7.89	0.000	-5.399911	-3.250759
2 200907	-3.913752	.5729119	-6.83	0.000	-5.036641	-2.790862

2	200908	-3.161915	.5460493	-5.79	0.000	-4.232155	-2.091675
2	200909	-3.237897	.5430086	-5.96	0.000	-4.302177	-2.173616
2	200910	-2.628921	.5400286	-4.87	0.000	-3.687361	-1.570482
2	200911	-3.476591	.5446731	-6.38	0.000	-4.544134	-2.409049
2	200912	.024264	.5376477	0.05	0.964	-1.029509	1.078037
2	201001	4.398478	.5457061	8.06	0.000	3.328911	5.468045
2	201002	3.588498	.5471063	6.56	0.000	2.516187	4.66081
2	201003	2.051405	.5331268	3.85	0.000	1.006493	3.096318
2	201004	-1.954602	.5313711	-3.68	0.000	-2.996073	-.9131306
2	201005	-5.299274	.5384854	-9.84	0.000	-6.354689	-4.24386
2	201006	-4.655693	.5372707	-8.67	0.000	-5.708727	-3.602658
2	201007	-3.277058	.5478108	-5.98	0.000	-4.35075	-2.203366
2	201008	-1.67269	.5542155	-3.02	0.003	-2.758936	-.5864449
2	201009	-2.576074	.5475517	-4.70	0.000	-3.649259	-1.50289
2	201010	-3.263574	.5436797	-6.00	0.000	-4.32917	-2.197979
2	201011	-2.284696	.5407137	-4.23	0.000	-3.344478	-1.224913
2	201012	1.47561	.5432829	2.72	0.007	.4107921	2.540428
2	201101	6.170112	.5845433	10.56	0.000	5.024425	7.315799
2	201102	2.751435	.5495114	5.01	0.000	1.674409	3.82846
2	201103	-.9954718	.5540261	-1.80	0.072	-2.081346	.0904025
3	200901	-4.800005	.7892656	-6.08	0.000	-6.346941	-3.253068
3	200902	-8.255436	.6843585	-12.06	0.000	-9.596758	-6.914114
3	200903	-3.943258	.5398597	-7.30	0.000	-5.001367	-2.88515
3	200904	-.4013229	.5583763	-0.72	0.472	-1.495723	.6930776
3	200905	-.4390306	.5442348	-0.81	0.420	-1.505714	.6276529
3	200907	9.189895	.7675322	11.97	0.000	7.685555	10.69423
3	200908	4.292691	.6842789	6.27	0.000	2.951525	5.633857
3	200909	13.25935	.7441734	17.82	0.000	11.80079	14.71791
3	200910	7.464784	.7450409	10.02	0.000	6.004527	8.925041
3	200911	1.000552	.8762154	1.14	0.253	-.716803	2.717908
3	200912	-14.33377	.7421614	-19.31	0.000	-15.78838	-12.87915
3	201001	-18.37087	.7794767	-23.57	0.000	-19.89862	-16.84312
3	201002	-18.46548	.8850422	-20.86	0.000	-20.20014	-16.73083
3	201003	-2.171681	.5440646	-3.99	0.000	-3.238031	-1.105331
3	201004	-.1378551	.5283282	-0.26	0.794	-1.173362	.897652
3	201005	-5.336617	.532192	-10.03	0.000	-6.379697	-4.293537
3	201006	-3.836876	.538338	-7.13	0.000	-4.892002	-2.78175
3	201007	3.055561	.591153	5.17	0.000	1.89692	4.214203
3	201008	6.893369	.6588577	10.46	0.000	5.602028	8.184709
3	201009	11.38975	.7299049	15.60	0.000	9.959162	12.82034
3	201010	9.956821	.6898606	14.43	0.000	8.604716	11.30893
3	201011	-5.695116	.8066483	-7.06	0.000	-7.276122	-4.11411
3	201012	-21.35183	.7486924	-28.52	0.000	-22.81925	-19.88442
3	201101	-23.79701	.8934698	-26.63	0.000	-25.54819	-22.04584
3	201102	-6.114855	.5659414	-10.80	0.000	-7.224083	-5.005627
3	201103	-5.505351	.6004264	-9.17	0.000	-6.682168	-4.328533
4	200901	-5.861322	1.231562	-4.76	0.000	-8.275146	-3.447499
4	200902	-10.38068	1.172296	-8.86	0.000	-12.67834	-8.083015
4	200903	-3.243827	1.101798	-2.94	0.003	-5.403318	-1.084337
4	200904	-2.183546	1.08875	-2.01	0.045	-4.317463	-.0496286
4	200905	-2.393892	1.095938	-2.18	0.029	-4.541897	-.2458867
4	200907	6.828609	1.208247	5.65	0.000	4.460481	9.196737
4	200908	2.304797	1.158839	1.99	0.047	.0335076	4.576086
4	200909	9.570243	1.180024	8.11	0.000	7.257431	11.88305
4	200910	5.484633	1.198249	4.58	0.000	3.136101	7.833164
4	200911	-1.093537	1.264058	-0.87	0.387	-3.571052	1.383977
4	200912	-15.95889	1.191173	-13.40	0.000	-18.29355	-13.62423
4	201001	-19.01027	1.212553	-15.68	0.000	-21.38684	-16.6337
4	201002	-17.01281	1.278598	-13.31	0.000	-19.51882	-14.5068
4	201003	-1.210361	1.092289	-1.11	0.268	-3.351214	.9304931
4	201004	-1.443451	1.074951	-1.34	0.179	-3.550321	.6634191
4	201005	-7.14515	1.080256	-6.61	0.000	-9.262419	-5.02788
4	201006	-5.166153	1.085197	-4.76	0.000	-7.293106	-3.0392
4	201007	.5834876	1.106336	0.53	0.598	-1.584898	2.751873
4	201008	3.672043	1.124906	3.26	0.001	1.467262	5.876824
4	201009	9.13512	1.172299	7.79	0.000	6.837449	11.43279
4	201010	7.968857	1.160437	6.87	0.000	5.694436	10.24328
4	201011	-6.880328	1.225462	-5.61	0.000	-9.282195	-4.478461
4	201012	-22.25081	1.216083	-18.30	0.000	-24.6343	-19.86733
4	201101	-21.61695	1.289504	-16.76	0.000	-24.14434	-19.08957
4	201102	-3.931399	1.114829	-3.53	0.000	-6.11643	-1.746368

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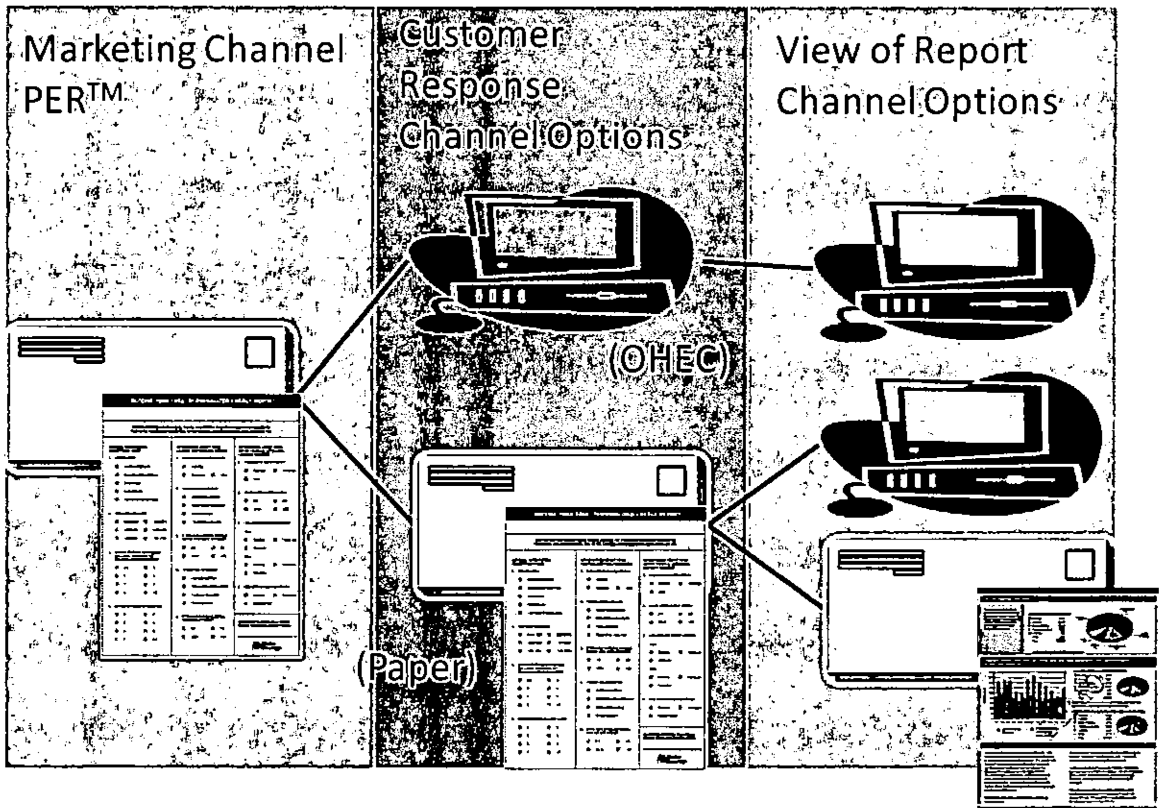
4 201103  |  -5.299288   1.130323    -4.69   0.000    -7.514686    -3.08389
```

Appendix E: PER Channel Process



Appendix F: DSMore Table

Per Measure Impacts Summary for PER Carolinas													
Impacts ⇨ / Technology ⇩	Product code	State	EM&V gross savings (kWh/unit)	EM&V gross kW (customer peak/unit)	EM&V gross kW (coincident peak/unit)	Unit of measure	Combined spillover less freeridership and bias adjustment	EM&V net savings (kWh/unit)	EM&V net kW (customer peak/unit)	EM&V net kW (coincident peak/unit)	EM&V load shape (yes/no)	EUL (whole number)
CFLs		Carolinas	240.4	0.1951	0.0195	customer	14.4%	205.8	0.1670	0.0167	no	5
Double Pane Windows		Carolinas	7.3	0.0025	0.0025	customer	0.0%	7.3	0.0025	0.0025	no	20
14 SEER Central AC		Carolinas	6.0	0.0053	0.0053	customer	0.0%	6.0	0.0053	0.0053	no	15
Energy Star Doors		Carolinas	1.5	0.0005	0.0005	customer	0.0%	1.5	0.0005	0.0005	no	20
Program wide			**255**	**0.2033**	**0.0278**		**13.6%**	**221**	**0.1753**	**0.0250**		**6**