Don't Know	14	2.1%	56	3.3%
All or part of ceiling	a province and a second of the second s	and a second		
insulated			norther or competence of the logiture of MM2000 close	
Part of ceiling	39	12.7%	82	11.2%
All of ceiling	267	87.3%	649	88.8%
Type of insulation				
Fiberglass	191	68.5%	505	71.8%
Cellulose	58	20.8%	126	17.9%
Foam	15	5.4%	38	5.4%
Other	15	5.4%	34	4.8%
Inches of thickness				
added				at the first state of the same state of the state state
1-2	21	8.2%	81	12.8%
2-4	84	32.7%	223	35.1%
5-6	81	31.5%	163	25.7%
7-8	36	14.0%	77	12.1%
9-10	21	8.2%	49	7.7%
11+	14	5.4%	42	6.6%
Inches of thickness	and allow the off a contract of the former water of			
already there				
1-2	75	34.7%	207	41.5%
2-4	66	30.6%	174	34.9%
5-6	38	17.6%	61	12.2%
7-8	18	8.3%	30	6.0%
9-10	7	3.2%	9	1.8%
11+	12	5.6%	18	3.6%

The myriad of responses in the survey regarding this recommendation (and the following recommendation of insulation of sidewalls) require a more complex table than the other measures. Those that responded are broken down into six groups:

- 1. Yes, installed attic insulation. These respondents provided full details by answering all of the four follow-up questions.
- 2. Yes, installed attic insulation, but only partial detail. These respondents answered only 2 or 3 of the follow-up questions.
- 3. Yes, installed attic insulation, but little or no detail. These respondents answered 0 or 1 of the follow-up questions.
- 4. No, but plan to install attic insulation. These respondents provided full details by answering all of the four follow-up questions.
- 5. No, but plan to install attic insulation, but only partial detail. These respondents answered only 2 or 3 of the follow-up questions.
- 6. No, but plan to install attic insulation but little or no detail. These respondents answered 0 or 1 of the follow-up questions.

The impacts for groups 2, 3, 5 and 6 are estimated using the mean value of the responses of those that provided the needed details. The impacts are presented in Table 48 below.

Table 48.	Total Impact	Estimates for	Attic Insulation
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	арал бала ула сама саман на саман кака кака кака кака кака кака кака	we between a contract and a contract term to an an and a sub-transport of both and a sub-traction of the sub-	nge oast neneved fan it belde reder af heizer a meke wier fan Afraac oer ae oakel oek kier met Afrik (sok aar ewe sêr 194
Population	Total kW	Total kWh	Total Therm
	Approximate pages a particulation of the page and a second electronic and the second of the term of the second	lander in der Seiter der Anne einer Sternerbeiten sich Marken verstern bestitten Sondertröten erner ein statt der Kann der die Nach werden	A CONTRACTOR OF

ντα ματά "ματο τη		Savings	Savings	Savings
Kentucky Kits	741			
Yes, installed attic insulation	247	25.107	15,843	267.5
Yes, installed, but only partial detail	38	1.644	3,119	57.1
Yes, installed, but little or no detail	18	0.894	1,494	27.0
No, but plan to, with full detail	5	0.098	97	3.6
No, but plan to, but only partial detail	2	0.052	51	2.8
No, but plan to, but little or no detail	57	4.465	9,367	85.1
Kentucky No Kits	1879	\$2999.599958995896495969699999999896999999998969999999999		ne on the second se
Yes, installed attic insulation	628	31.440	56,639	875.4
Yes, installed, but only partial detail	81	5.578	10,798	136.1
Yes, installed, but little or no detail	124	8.589	17,726	211.1
No, but plan to, with full detail	9	0.299	593	3.9
No, but plan to, but only partial detail	1	0.028	27	1.4
No, but plan to, but little or no detail	97	6.801	13,031	149.8

Table 49. Mean Impact Estimates for Participants Installing Attic Insulation

METER LINNER, 2014 MARK 2014 AND	Population	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Kentucky Kits	741			
Yes, installed attic insulation	247	0.10165	64.1	1.1
Yes, installed, but only partial detail	38	0.04326	82.1	1.5
Yes, installed, but little or no detail	18	0.04967	83.0	1.5
Kentucky No Kits	1879			na elektronomi Gruppingen en e
Yes, installed attic insulation	628	0.05006	90.2	1.4
Yes, installed, but only partial detail	81	0.06886	133.31	1.7
Yes, installed, but little or no detail	124	0.06927	142.95	1.7

Sidewall Insulation

Less than 10% have taken this action as a result of the PER recommendation, with another 3-5% planning on doing this. The energy savings are higher for this measure than for attic insulation, since the base assumption is that the wall is uninsulated.

Action	Kentucky Kits (n)	Kentucky Kits (%)	Kentucky No Kits (n)	Kentucky No Kits (%)
Sidewalls insulated				
Yes	34	5.0%	133	7.7%
No	606	88.5%	1,486	86.3%
No, but plan to do this	32	4.7%	57	3.3%
Don't Know	13	1.9%	45	2.6%
Number of sidewalls insulated				
1	4	14.3%	5	5.1%
2	1	3.6%	8	8.2%
3	6	21.4%	15	15.3%
4+	17	60.7%	70	71.4%
Type of insulation				
Fiberglass	12	42.9%	59	60.2%
Cellulose	3	10.7%	14	14.3%
Foam	9	32.1%	13	13.3%
Other	4	14.3%	12	12.2%
Inches of thickness added				
1-3	14	53.8%	46	50.9%
4-6	11	42.3%	34	39.3%
7-12	1	3.8%	6	8.0%
13+	0	0.0%	2	1.8%

Table 50. Frequency of Recommendation Taken: Sidewall Insulation

Table 51. Total Impact Estimates for Sidewall Insulation

field Broth and an ann ann ann ann ann ann ann ann	Population	Total kW Savings	Total kWh Savings	Total Therm Savings
Kentucky Kits	741			
Yes, installed sidewall insulation	20	6.948	2,656	61.9
Yes, installed, but only partial detail	8	1.273	752	31.0
Yes, installed, but little or no detail	62	4.509	9,232	238.1
No, but plan to, with full detail	1	.447	499	31
No, but plan to, but only partial detail	0	0	0	0
No, but plan to, but little or no detail	31	2.415	7,003	101.9
Kentucky No Kits	1879		n a seu la filia de la construction de la construction de la constructión de la constructión de la constructión	

Yes, installed sidewall insulation	76	5.746	13,714	276.3
Yes, installed, but only partial detail	16	1.284	3,503	54.6
Yes, installed, but little or no detail	199	15.919	41,563	700.9
No, but plan to, with full detail	4	0.329	1,104	3.5
No, but plan to, but only partial detail	2	0.134	500	3.9
No, but plan to, but little or no detail	51	4.084	10,591	173.3

Table 52. Mean Impact Estimates for Participants Installing Sidewall Insulation

The Construction of the Co	Population	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Kentucky Kits	741	na London ann ann ann ann ann ann ann ann ann a	nner for for an	a na konfirma na konkulen en konkulen en konkulen en konkulen i saar de die de die de en konkulen die die die k
Yes, installed sidewall insulation	20	0.34738	132.8	3.1
Yes, installed, but only partial detail	8	0.15913	94	3.9
Yes, installed, but little or no detail	62	0.07273	149	3.8
Kentucky No Kits	1879	n e den eta zon din senten en la sente dina den dina di den eta eta d	n andar finala da ana ang ang ang ang ang ang ang ang an	and de la companya d
Yes, installed sidewall insulation	76	0.07561	180.4	3.6
Yes, installed, but only partial detail	16	0.08025	218.9	3.4
Yes, installed, but little or no detail	199	0.07999	208.9	3.5

Duct Insulation/Repair

Respondents were more likely to repair the ducts than to insulate them, but many report that they plan on taking both actions. Unfortunately, over 60% of the ducts are located in heated areas of the home in which insulation or repair will not provide savings.

Table 53.	Frequency of	of Recommen	dation Taken:	Duct Ins	ulation or Repair

Action	Kentucky Kits (n)	Kentucky Kits (%)	Kentucky No Kits (n)	Kentucky No Kits (%)
Insulated ducts				
Yes	75	10.7%	202	11.7%
No	558	79.8%	1,403	81.6%
No, but plan to do this	48	6.9%	64	3.7%
Don't Know	18	2.6%	51	3.0%

Repaired holes in ducts				
Yes	77	23.2%	173	19.9%
No	230	69.3%	599	68.9%
No, but plan to do this	8	2.4%	24	2.8%
Don't Know	17	5.1%	73	8.4%
Location of ducts insulated				
Unheated area	74	26.2%	193	25.9%
Heated area	183	64.9%	462	62.0%
Don't Know	25	8.9%	90	12.1%

The tables below present the savings for the duct work, and the breakdown of how many of them repaired or insulated ducts in heated areas.

ge gestelste kanne en forde of oortuge uit werden die het stelste stelste verkenne en fiew (1) verse wurde verk	Population	Total kW Savings	Total kWh Savings	Total Therm Savings
Kentucky Kits	741			
Yes, insulated ducts	41	4.071	3,896	88.1
Yes, insulated ducts, but they were in a heated area	32	0	0	0
No, but plan to	48	1.213	2,808	45.6
Kentucky No Kits	1879		, na ta standardi na tanàn amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin Ny fisiana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'	2012-2017-2017-2017-2017-2017-2017-2017-
Yes, insulated ducts	104	6.688	16,648	210.1
Yes, insulated ducts, but they were in a heated area	96	0	0	0
No, but plan to	64	3.173	6,692	65.7

Table 54. Total Impact Estimates for Duct Insulation

Table 55. Mean Impact Estimates for Participants Installing Duct Insulation

Non-Angeler and Angeler	Population	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Kentucky Kits	741			בי (או אי 100 בי 100
Yes, insulated ducts	41	0.09928	95.0	2.1
Kentucky No Kits	1879		ан (<u>бологона на акал се не се на се н На (<u>бологона на акал се не се на се на</u></u>	
Yes, insulated ducts	104	0.06431	160.1	2.0

Table 56. Total Impact Estimates for Duct Repair

	Propheter Processes and the second constrained and the constrained and the second second second and the second	ran ser en	per la canadica de la parciente la este de statut de tante de la constatue de la canada de la canada de recepción de
Population	Total kW	Total kWh	Total Therm
	l A service success and the service instant is instituted in the service and the service service is the service mean target is in	ence of the second s	Contractioners (en 11 de 104 des Jose des Contractioners Contraction armitistiques et sur de la sur de la sur d

		Savings	Savings	Savings
Kentucky Kits	741		(1977) 1977) 1977)	1971-1981 1987-1942 1942 1942 1971 (1971 1971 1974 1942 1971 1974 1974 1974 1974 1974 1974 1974
Yes, repaired ducts	37	7.495	4,408	58.1
Yes, repaired ducts, but they were in a heated area	36	0	0	0
No, but plan to	8	155	362	9.9
Kentucky No Kits	1879	1995 - Malander Haussen, and San Andrew State (San Andrew State (San Andrew State (San Andrew State (San Andrew 1996 - San Andrew State (San Andrew Stat		ter for de la Billion versa a poetro de la de la servicio de la forma de la defensione de la destrucción de la La defensione de la defensio
Yes, repaired ducts	92	7.754	16,255	94.1
Yes, repaired ducts, but they were in a heated area	79	0	0	0
No, but plan to	24	1.155	2,486	23.9

Table 57. Mean Impact Estimates for Participants Performing Duct Repair

	Population	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Kentucky Kits	741			
Yes, repaired ducts	37	0.20257	119.1	1.6
Kentucky No Kits	1879			
Yes, repaired ducts	92	0.08429	176.7	1.0

Installed a New Central Air Unit

Just over 20% of the respondents indicated that they have installed a new central air unit at least in part because of the PER program. Over half of the participants report that their new units are high efficiency units. Most of the respondents did not know the SEER number for their new unit, and many of the responses had to be adjusted in this analysis as a result. For example, some respondents said that they installed a high efficiency unit and also reported that it had an SEER of 12. When this occurred, we assumed the SEER number was correct and changed the efficiency to "standard". We also distributed the SEER values of the people who could report them across the values for the individuals that could not report them. This provided a way to adjust the SEER ratings for the people who reported buying a high efficiency unit, but did not know the SEER rating to account for the fraction of the participants who actually purchased a more standard SEER unit.

Close to 3% of the respondents indicated that they planned on installing a new central air unit.

Table 58. Frequency of Recommendation Taken: New Central Air Unit

Action	Kentucky Kits (n)	Kentucky Kits (%)	Kentucky No Kits (n)	Kentucky No Kits (%)
Installed a new central air unit				
Yes	154	22.1%	386	22.3%
No	519	74.6%	1,291	74.8%
No, but plan to do this	18	2.6%	43	2.5%
Don't Know	5	0.7%	6	0.4%
Efficiency of unit	1 Summarket and a 198 FT - 1 and 2 FT - 1 and 2 FT - 1 and 3 FT - 1			
High efficiency	139	52.1%	325	49.2%
Standard	65	24.3%	135	20.4%
Don't Know	63	23.6%	201	30.4%
SEER number for unit	P S. BURNING CO. C. C. Market Co. Coll C. S. Market Market C.	The second se		
=<11	14	6.0%	16	2.8%
12	12	5.2%	26	4.5%
13	21	9.1%	53	9.2%
14+	20	8.6%	33	5.7%
Don't Know	165	71.1%	451	77.9%

Only 58 respondents who also received the kits provided any details on the new central air unit they installed. The other 96 cases provided partial or no details, so we used the mean responses from the 58 cases that provided purchase details to determine impact estimates. We used this same method for the 269 cases in the "no kits" group who also were unable to provide full details about the efficiency of their units. We only calculated estimated savings for those that plan to install a new central air unit if they provided the details on the efficiency level that they planned to purchase.

Table 59. Total Impact Estimates for New Cent	ral Air Units
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nn gan amada ina antikon na tao ang pang karpanakan sa bang ang pang bang bang bang bang bang bang bang b	Population	Total kW Savings	Total kWh Savings	Total Therm Savings
Kentucky Kits	741	ישאיר איז		
Yes, installed a new central air unit	58	12.865	17,411	0
Yes, installed, but little or no detail	96	19.463	22,531	. 0
No, but plan to, with full detail	1	0.129	118	0
No, but plan to, but little or no detail	17	2.439	3,597	
Kentucky No Kits	1879	generalise von inden alle anvezen en e	na socionalisten 1942 particularez 2014/2017 (1942) Transformational Anno Martin Lagrandar	anna an fha ann an ann an ann ann ann ann ann ann
Yes, installed a new central air unit	117	26.778	34,523	0
Yes, installed, but little or no detail	269	58.680	68,558	0
No, but plan to, with full detail	7	1.545	2,244	0
No, but plan to, but little or no detail	36	4.988	4,939	0

na n	Population	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Kentucky Kits	741			
Yes, installed a new central air unit	58	0.79103	300.2	0
Yes, installed, but little or no detail	96	0.20274	234.7	0
Kentucky No Kits	1879	al construction for the later of the later of the source of the	nen en	
Yes, installed a new central air unit	117	0.22887	295.1	0
Yes, installed, but little or no detail	269	0.21814	254.9	0

Table 60. Mean Impact Estimates for Participants Installing New Central Air Units

Installed a New Heat Pump

About 7% of the respondents indicated that they installed a new heat pump, but most of them do not know the SEER of their new units. However, they indicated that more than half of them were high efficiency. Here again, we used the efficiency distributions from the participants who did report their SEER, at the same ratio for those who did not know the SEER.

Action	Kentucky Kits (n)	Kentucky Kits (%)	Kentucky No Kits (n)	Kentucky No Kits (%)
Installed a new heat				
pump				
Yes	48	7.3%	110	6.8%
No	549	83.6%	1,363	84.6%
No, but plan to do this	54	8.2%	119	7.4%
Don't Know	6	0.9%	19	1.2%
Efficiency of heat pump				
High efficiency	34	54.8%	74	50.7%
Standard	9	14.5%	20	13.7%
Don't Know	19	30.7%	52	35.6%
SEER number for heat				
pump				
=<11	4	7.4%	8	6.6%
12	1	1.9%	6	5.0%
13	6	11.1%	18	14.9%
14+	9	16.7%	15	12.4%
Don't Know	34	63.0%	74	61.2%

 Table 61. Frequency of Recommendation Taken: Installed a New Heat Pump

Table 62. Total Impact Estimates for New Heat Pumps

	nina a dia kang bang bang bang kang bang bang bang bang bang bang bang b	THE STATE AND	
Denulation	Total kW	Total kWh	Total Therm
Population	Savings	Savings	Savings
	Construction and an additional sector and an additional sector and a se	in a sector of the	And a second

Kentucky Kits	741	ANDER HANNELEN KEINEN HER EINEN HER KEINEN HE	n dan mananging kanangkan di kanangkan di manangkan di manangkan di manangkan di manangkan di manangkan di mana	naka ku normandon dizi kara kakana ku menduk kanan ku na
Yes, installed a new heat pump	16	5.126	11,288	0
Yes, installed, but little or no detail	32	9.831	18,921	0
No, but plan to, with full detail	0			
No, but plan to, but little or no detail	54	13.410	18,474	
Kentucky No Kits	1879	92999 991 WW TS NO BEELE WY TY TY WEELE VOID IN THE TY THE CENTRE OF THE TY T	an de la contract en la contracta de la contrac La contracta de la contracta de	anna an amhanachtart a mhaird an ann ann ann ann ann ann an ann an an
Yes, installed a new heat pump	33	10.626	24,289	0
Yes, installed, but little or no detail	77	25.318	48,152	0
No, but plan to, with full detail	5	1.184	1,910	0
No, but plan to, but little or no detail	114	30.079	36,313	0

Table 63. Mean Impact Estimates for Participants Installing New Heat Pumps

	Population	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Kentucky Kits	741			
Yes, installed a new heat pump	16	0.32038	705.5	линизандиналиания положила со
Yes, installed, but little or no detail	32	0.30722	591.3	
Kentucky No Kits	1879	AND PROCESSION OF THE PROPERTY OF THE CASE OF THE OFFICE AND THE CASE OF THE OFFICE AND THE OFFICE AND THE OFFIC	na sana kana kana kana kana kana kana ka	n kartenden militak elema mesina intizionarra antenzia antonen zuen kartendea estandea astronak intena
Yes, installed a new heat pump	33	0.32199	736.0	
Yes, installed, but little or no detail	77	0.32881	625.4	0

Installed a New Furnace

About 20% of the respondents indicated that they installed a new furnace at least in part because of the PER report, and about 2-3% indicated that they plan on taking this action.

Action	Kentucky Kits (n)	Kentucky Kits (%)	Kentucky No Kits (n)	Kentucky No Kits (%)
Installed a new furnace				
Yes	131	19.3%	278	16.9%
No	526	77.4%	1,323	80.6%
No, but plan to do this	18	2.6%	30	1.8%

Table 64. Frequency of Recommendation Taken: New Furnace

Don't Know	5	0.7%	11	0.7%
Exhaust/efficiency				
Plastic pipe	133	78.7%	245	62.0%
Chimney or flue	27	16.0%	94	23.8%
Don't Know	9	5.3%	56	14.2%

Most of the respondents that plan to install a new furnace did not provide details on the efficiency of the units, so only a small number of participants have impact estimates applied. The 409 respondents that did install a new furnace and who could provide information on energy efficiency are saving an estimated 61 therms annually.

Table 65. Total Impact Estimates for New Furnaces

nn utzalan Burden Kalandi kurtan antan kurta kara kara kara kara kara kara kara k	Population	Total kW Savings	Total kWh Savings	Total Therm Savings
Kentucky Kits	741			
Yes, installed a new furnace	131	-	-	381.9
No, but plan to	18	~	-	94.9
Kentucky No Kits	741	nen en	ender er beneft til storsten i den en skriftet for det	
Yes, installed a new furnace	131		-	841.3
No, but plan to	18	•	-	104.7

Table 66. Mean Impact Estimates for Participants Installing New Furnaces

	Population	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Kentucky Kits	741			
Yes, installed a new furnace	131	0.00000	0.00	2.9
Kentucky No Kits	1,879			
Yes, installed a new furnace	278	0.00000	0.00	3.0

Visited the Duke Energy Web Site

Most of the respondents have not visited the Duke Energy web site. Only about 20-30% said that they have or that they plan to visit the site. Of those that have visited the site, over half of them said that they found the web site helpful.

	Kentucky Kits	Kentucky Kits	Kentucky No	Kentucky No
Action	(n)	(%)	Kits (n)	Kits (%)

Visited Duke web site				
Yes	96	13.6%	155	8.6%
No	498	70.6%	1,427	79.6%
No, but plan to do this	107	15.2%	191	10.7%
Don't Know	4	0.6%	19	1.1%
Web site was helpful				
Yes	53	55.2%	70	53.8%
Somewhat	40	41.7%	54	41.5%
Don't Know	3	3.1%	6	4.6%

All Recommendations

The following tables summarize the number of recommendations taken and the savings estimates based on those recommendations. These tables do not include the savings estimates of those that plan to take the recommendation.

Those customers who received the kits followed about 21.7% of the recommendations overall, and were able to save 406 kW, over 2 million kilowatt hours, and almost 47,000 therms. If the information they provided on their survey is accurate. The following table summarizes the savings achieved.

Kits						
	Population	Percent Installed	Total kW Savings	Total kWh Savings	Total Therm Savings	
Lowered the temperature in winter	608	82.1%				
Daytime savings				121,733	2,727	
Nighttime savings			-	56,733	1,080	
Purchased and installed CFLs	393	53.0%	25.255	151,396	-67	
Switched to cold water	386	52.1%	5.582	27,404	3,876	
Replaced furnace filter	143	19.3%	-2.24	-3,934	-21	
Closed off fireplace	191	25.8%	0.642	1,103	21	
Stopped heating unused rooms	405	54.7%	86.488	35,061	437	
Window Shrink	68	9.2%	2.127	1,018	19	
Insulated water heater	102	13.8%	1.134	3,282	354	
Manages draperies	589	79.5%	-	36,371	1,641	
Cleaned baseboards	5	0.7%	-	40	-	
Installed attic insulation	247	33.3%	25.107	15,843	268	
Installed, but only partial detail	38	5.1%	1.644	3,119	57	
Installed, but little or no detail	18	2.4%	0.894	1,494	27	
Installed sidewall insulation	20	2.7%	6.948	2,656	62	
Installed, but only partial detail	8	1.1%	1.273	752	31	
Installed, but little or no detail	62	8.4%	4.509	9,232	238	
Insulated ducts	41	5.5%	4.071	3,896	88	
Repaired ducts	37	5.0%	7.495	4,408	58	
Installed a new central air unit	58	7.8%	12.865	17,411	-	
Installed a central air unit, but	96	13.0%	19.463	22,531	-	
little or no detail						
Installed a new furnace	131	17.7%	-	-	382	
Installed a new heat pump	16	2.2%	5.126	11,288		

Table 67.	Summary of	Total Savings f	or All Recomm	endations T	`aken by T	hose Receivi	ng
Kits							

Installed heat pump, but little or	32	4.3%	9.831	18,921	
no detail					
Total			180.6	485,709	10,925

Those that did not receive the kits also followed 21.7% of the recommendations, but had much higher total savings due to the number of participants providing the survey.

Table 68. Summary of Total Savings for All Recommendations Taken by Those NotReceiving Kits

	Population	Percent Installed	Total kW Savings	Total kWh Savings	Total Therm Savings
Lowered the temperature in winter	1559	83.0%			
Daytime savings			-	464,354	7,255
Nighttime savings			-	96,373	2,778
Purchased and installed CFLs	899	47.8%	5.503	45,864	-136
Switched to cold water	987	52.5%	7.159	62,702	10,211
Replaced furnace filter	458	24.4%	-0.880	-4617	41
Closed off fireplace	509	27.1%	0.340	1,201	23
Stopped heating unused rooms	1032	54.9%	81.334	123,535	1,270
Window Shrink	166	8.8%	2.147	3,516	49
Insulated water heater	265	14.1%	1.288	11,278	901
Manages draperies	1,446	77.0%	-	96,373	4,372
Cleaned baseboards	7	0.4%		51	-
Installed attic insulation	628	33.4%	31.440	56,639	857
Installed, but only partial detail	81	4.3%	5.578	10,798	136
Installed, but little or no detail	124	6.6%	8.589	17,726	211
Installed sidewall insulation	76	4.0%	5.746	13,714	276
Installed, but only partial detail	16	0.9%	1.284	3,503	55
Installed, but little or no detail	199	10.6%	15.919	41,563	701
Insulated ducts	104	5.5%	6.688	16,648	210
Repaired ducts	92	4.9%	7.754	16,255	94
Installed a new central air unit	117	6.2%	26.778	34,523	-
Installed a central air unit, but					
little or no detail	269	14.3%	56.590	68,558	
Installed a new furnace	278	14.8%	-	-	841
Installed a new heat pump	33	1.8%	10.626	24,289	-
Installed heat pump, but little or no detail	77	4.1%	25.318	48,152	-
Total			185.923	1,062,698	29,042

The following two tables show the mean savings for the recommendation based on the total savings and the number of respondents following the recommendation.

Table 69. Summary of Mean Savings for All Recommendations Taken by Those Receiving Kits

	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Lowered the temperature in winter			
Daytime savings	-	200.2	4.5
Nighttime savings	-	93.3	1.8

Purchased and installed CFLs	0.06426	385.2	-0.2
Switched to cold water	0.01446	71.0	10.0
Replaced furnace filter	-0.01779	-36.06	-0.12
Closed off fireplace	0.00336	5.8	0.1
Stopped heating unused rooms	0.21345	86.6	1.1
Window Shrink	0.03128	15.0	0.3
Insulated water heater	0.01112	32.2	3.5
Manages draperies	-	61.8	2.8
Cleaned baseboards	15	8.0	
Installed attic insulation	0.10165	64.1	1.1
Installed, but only partial detail	0.04326	82.1	1.5
Installed, but little or no detail	0.04967	83.0	1.5
Installed sidewall insulation	0.34738	132.8	3.1
Installed, but only partial detail	0.15913	94	3.9
Installed, but little or no detail	0.07273	149	3.8
Insulated ducts	0.09928	95.0	2.1
Repaired ducts	0.20257	119.1	1.6
Installed a new central air unit	0.79103	300.2	T
Installed a central air unit, but little or no detail	0.020274	234.7	-
Installed a new furnace		-	2.9
Installed a new heat pump	0.32038	705.5	-
Installed heat pump, but little or no detail	0.30722	591.36	-
Mean Total Savings, if all measures installed	2.18243	2,339.7	34.58

Table 70. Summary of Mean Savings for All Recommendations Taken by Those Not Receiving Kits

nuonuonetto en on on ta individualesta dividualeste presentada en on la vara a ortinenta en en esta dividualesc	Mean kW Savings	Mean kWh Savings	Mean Therm Savings
Lowered the temperature in winter	antan pengenan pakan pengenan pengan pengan pengan pengan pengenan pengenan pengenan pengenan pengenan pengan p	n a chann a bhann a mar an an ann an ann ann an ann ann ann a	an la angla di la ang ang 1960 kang ang ang ang ang ang ang ang ang ang
Daytime savings		297.9	4.7
Nighttime savings	***	138.1	1.8
Purchased and installed CFLs	0.00612	51	-0.2
Switched to cold water	0.00725	63.5	10.3
Replaced furnace filter	-0.01885	-41.18	-0.01
Closed off fireplace	0.00067	2.4	0.0
Stopped heating unused rooms	0.07881	119.7	1.2
Window Shrink	0.01293	21.2	0.3
Insulated water heater	0.00486	42.6	3.4
Manages draperies	-	66.6	3.0
Cleaned baseboards	-	7.2	-
Installed attic insulation	0.05006	90.2	1.4
Installed, but only partial detail	0.06886	133.31	1.7
Installed, but little or no detail	0.06927	142.95	1.7
Installed sidewall insulation	0.07561	90.2	3.6
Installed, but only partial detail	0.08025	218.9	3.4
Installed, but little or no detail	0.07999	208.9	3.5
Insulated ducts	0.06431	160.1	2.0

Repaired ducts	0.08429	176.7	1.0
Installed a new central air unit	1.22887	295.1	
Installed a central air unit, but little or no detail	0.21814	254.9	**
Installed a new furnace	-		3.0
Installed a new heat pump	1.32199	736.0	
Installed heat pump, but little or no detail	0.32881	625.4	
Mean Total Savings, if all measures installed	2.91692	2,317.32	35.49

Savings Distributions

There are substantial risks associated with relying on self-reported behavioral changes, because the foundation of the savings estimates are based solely on the participant's responses, with no means to verify that the respondent has installed the kit's measures or has actually taken the recommendation provided in the Personalized Energy Report. There are two main sources of bias with these types of surveys that directly impact the conclusions drawn from the responses. These sources of bias are Self-Selection Bias and False Response Bias. There is also an issue regarding the accuracy of the baseline energy use conditions used by the evaluation contractor to estimate savings in that many of these conditions need to be based on assumptions rather than on measurements. These three conditions significantly impact the evaluation contractor's ability to provide accurate estimates of energy impact. These issues are discussed in more detail in the following paragraphs.

Self-Selection Bias

The survey was sent to 5,401 PER Program participants -3,562 customers that did not receive the kit, and 1,839 customers that did receive the Energy Efficiency Starter Kit. The data collection efforts resulted in 1,879 responses from PER participants who only received the PER (response rate = 52.8%), and 741 responses (response rate = 40.3%) from Kentucky PER participants who received the Energy Efficiency Kit. The people that filled out and returned the survey are the participants that are more likely to install measures from the Energy Efficiency Kit and consider taking actions based on the recommendations from the Personalized Energy Report. That is, they self-selected themselves to return the survey because they have a higher interest in the subject matter than the people who did not. These individuals also will often respond to a survey in order to let it be known that they did the right thing, and that they are taking steps to be more energy efficient. The customers that did not return the survey are more likely to have a lower interest in the subject matter, and are less likely to take actions. Thus, the people who returned the survey are not the typical participant, but rather are the participant that is more likely to take actions. With 47.2% of the PER group and 59.7% of the Kit group not responding, we are setting the self-selection bias used to estimate the potential range of impacts at half of the non-response rate. As a result, all estimated energy impact estimates will be discounted 29.9% for customers that received the Energy Efficiency Kit and the Personalized Energy Report, and 23.6% for those that only received the Personalized Energy Report. All impact estimates will be discounted by this percentage in order to calculate the low end of the range of savings estimates for each measure and recommendation. This adjustment approach is subjective, and is not based on the evaluation literature or on completed research within the energy program evaluation field. Within the energy program evaluation field there is a substantial lack of research indicating the range of self-selection bias associated with energy efficiency programs. As a result, the authors of this study elected to apply a significant selfselection bias factor in order to be conservative in our estimates of program impacts. Setting the factor at half of the non-response rate is based on professional conservative judgment from conducting surveys and metering studies of energy efficiency programs for over 28 years and interacting with the evaluation community regarding these rates,

but we can point to no research that objectively assesses if this level of self-selection bias is too high or too low.

False Response Bias

False Response Bias is a problem with many self-reporting surveys. The participants respond not with the truth, but with the socially acceptable response. In short, they give the answer that they think is the *right answer* about what measures they installed or what actions they have taken as a result of the Personalized Energy Report. False response bias is typically not a large adjustment, depending on the controversy around the subject being discussed. False response bias adjustments typically range from a low of two or three percent to a high of 15 percent depending on the topic and the population being tested. The False Response Bias for this assessment was set at from a low of 10% to a high of 50% because of a specific rational relating to the conditions that act to increase or decrease this estimated average rate. A 10 % to 50% discount is be applied to each PER recommended measure impact estimate to calculate the low-end of the range of savings estimates for each measure and recommendation.

Baseline Energy Use Assumptions

When a mail survey is used to conduct an evaluation, the evaluation contractors are unsure of the actual conditions in the home that have experienced a change. For example, while a new showerhead may have been installed, it is impossible to estimate precise savings unless the flow rates and use conditions associated with the previous showerhead are well understood. For this study we established our baseline assumptions based on the survey results and our past research and experience with programs and program evaluations that have taken measurement of baseline conditions. We have also used housing-type computer models to estimate baseline conditions and behaviors. As a result, we are not adjusting the baseline conditions applied in this study, but rather using the survey results, the literature, our past research and field experience to set baseline conditions. However, because these are not program-participant measured baseline conditions, it is important to let the reader know that the baselines used in this study are estimated.

Methodology

The level of discounting used to determine the ranges for each of the measures and recommendations can be found in the table below. The self-selection bias discount factor for all measures and recommendations for the Kentucky PER is 29.9% for customers that received the Energy Efficiency Kit and the Personalized Energy Report, and 23.6% for those that only received the Personalized Energy Report.

Measure	False	Other Discounting and Notes	
	Response Bias		
CFLs	10%	Used ranges for wattage of bulb removed (as opposed to most common wattage in range) and hours of use for the lamp (as opposed to the mean of the range).	
Weatherstripping	10%		
Outlet gaskets	10%		
Window shrink kit	10%	Adjusted square footage of window: if customer	

		indicated "small" window, sq ft reduced by 1/3; if "average" or "large", sq ft reduced by ½.
Showerhead	20%	Used 2.75 gpm for base showerhead (as opposed to 3.1 gpm) to get the low range.
Aerators	20%	Removed the savings from cases in which there was already an aerator installed for the low estimates.

Recommendation	False	Other Discounting and Notes		
	Response Bias			
CFLs	50%	Used ranges for wattage of bulb removed (as opposed to most common wattage in range) and hours of use for the lamp (as opposed to the mean of the range). Used ranges for wattage of CFL installed. For high range, used 15 CFL replacements when respondent indicated they replaced 10+ bulbs.		
Clean baseboards	50%			
Close off fireplace	50%			
Install new central air unit	50%	Low end of savings obtained by further cutting savings by half under the assumption that half of new installations were normal replacement instead of early replacement.		
Install new furnace	50%	Low end of savings obtained by further cutting savings by half under the assumption that half of new installations were normal replacement instead of early replacement.		
Install a new refrigerator	50%	Used 1700 for base.		
Install a new heat pump	50%	Low end of savings obtained by further cutting savings by half under the assumption that half of new installations were normal replacement instead of early replacement.		
Install attic insulation	50%	For partial installation, used a range of 25% coverage instead of 50%. Used a low range of 225 square feet per room.		
Install sidewall insulation	50%	Removed savings for those that indicated that they installed 7-12" or 13"+ of sidewall insulation. Used a low range of 225 square feet per room. Halved the fraction used in calculating wall area as a fraction of floor area.		
Install window shrink kits	50%	Adjusted square footage of window: if customer indicated "small" window, sq ft reduced by 1/3; if "average" or "large", sq ft reduced by ½.		
Insulate or repair ducts	50%	Savings cut in half based on having less insulation than before and lower leakage rates.		
Insulate water heater	50%	UA table modified to reflect a 1" blanket. Also used a lower set point of 120 degrees.		
Lower temperature in winter	50%			
Manage draperies	50%	Reduced the savings by ½ for 2/3 of the windows to account for direction of window.		
Replace furnace filter	50%			
Stop heating unused rooms	50%	Further reduced savings by 20% because of the inability to completely shut off a room, and the conductive losses through the uninsulated walls.		

Switch to cold water	50%	
for laundry		

Savings Estimates

Each of the Kit measures and PER recommendations are recalculated here in order to provide reasonable ranges of energy savings associated with each item. The tables below provide the low and high estimates for each of the measures and recommendations provided to the Indiana participants. Savings estimates are provided for only those participants who indicated that they installed the measure. For recommendations, savings are provided for only those who indicated that they took the action, and provided full details on follow-up questions on the survey.

Measure	Total kW	Savings	Mean kW Savings (per install)	
weasure	Low	High	Low	High
15-watt CFL	1.928	5.243	0.00295	0.00802
20-watt CFL	1.867	5.166	0.00316	0.00876
Weatherstripping	0.327	0.683	0.00126	0.00264
Outlet gaskets	0.768	1.850	0.00210	0.00505
Window shrink kit	0.737	2.286	0.00730	0.02263
Showerhead	1.759	4.053	0.00377	0.00868
Bathroom aerator	0.020	0.035	0.00005	0.00009
Kitchen aerator	0.014	0.025	0.00004	0.00007

Table 71. Kentucky Kit Participants' Range of Kilowatt Savings

Table 72. Kentucky Kit Participants' Range of Kilowatt-Hour Savings

Measuro	Total kWh	n Savings	Mean kWh Savii	ngs (per install)
measure	Low	High	Low	High
15-watt CFL	19,966	88,829	30.5	135.8
20-watt CFL	18,737	82,917	31.8	140.5
Weatherstripping	853	2,231	3.3	8.6
Outlet gaskets	2,629	6,351	7.2	17.4
Window shrink kit	1,279	3,957	12.7	39.2
Showerhead	16,048	36,983	34.4	79.2
Bathroom aerator	1,513	2,651	3.8	6.7
Kitchen aerator	1,168	2,083	3.2	5.7

Table 73. Kentucky Kit Participants' Range of Therm Savings

Measure	Total Ther	m Savings	Mean Therm Savings (per insta	
weasure	Low	High	Low	High
15-watt CFL	-31.7	-141.3	0.0	-0.2
20-watt CFL	-29.5	-130.8	-0.1	-0.2
Weatherstripping	19.7	51.3	0.1	0.2
Outlet gaskets	533.3	126.4	1.5	0.3
Window shrink kit	14.5	44.9	0.1	0.4
Showerhead	1,624.4	3,724.6	3.5	8.0
Bathroom aerator	85.7	149.5	0.2	0.4

Kitchen aerator	75.5	134.6	0.2	0.4

Table 74. Kentucky Kit Participants' Range of Kilowatt Savings for Recommendations

Pacammandation	Total kW	Savings	Mean kW Savings (per install)	
Recommendation	Low	High	Low	High
CFLs	25.255	45.505	0.06426	0.11579
Clean baseboards	-	-	-	-
Close off fireplace	0.642	0.898	0.00336	0.00470
Install new central air unit	12.865	73.408	0.79103	1.26566
Install new furnace	-	-	-	-
Install a new heat pump	5.126	29.242	0.32038	1.82763
Install attic insulation	25.107	40.171	0.10165	0.16264
Install sidewall insulation	6.948	11.116	0.34738	0.55580
Install window shrink kits	2.127	3.832	0.03128	0.05635
Insulate ducts	4.071	6.513	0.09928	0.15885
Repair ducts	7.495	11.992	0.20257	0.32411
Insulate water heater	1.134	2.044	0.01112	0.02004
Lower temp in winter - day	-	u n	-	-
Lower temp in winter - night	-	-	-	-
Manage draperies		-	-	-
Replace furnace filter	-2.240	-2.240	-0.01779	-0.01779
Stop heating unused rooms	86.448	86.448	0.21345	0.21345
Switch to cold water for laundry	5.582	8.931	0.01446	0.02314

Table 75. Kentucky Kit Participants' Range of Kilowatt-Hour Savings for Recommendations

Recommendation	Total kWh S	Savings	Mean kWh Savings (per install)						
Recommendation	Low	High	Low	High					
CFLs	151396	640,140	385.2	1628.9					
Clean baseboards	40	115	8.0	23.0					
Close off fireplace	1103	3,277	5.8	17.2					
Install new central air unit	17411	99,349	300.2	1712.9					
Install new furnace	-	-	-	-					
Install a new heat pump	11288	64,407	705.5	4025.4					
Install attic insulation	15843	67,490	64.1	273.2					
Install sidewall insulation	2656	22,796	132.8	1139.8					
Install window shrink kits	1018	5,795	15.0	85.2					
Insulate ducts	3896	22,228	95.0	542.1					
Repair ducts	4408	25,155	119.1	679.9					
Insulate water heater	3282	17,904	32.2	175.5					
Lower temp in winter - day	121733	347,312	200.2	571.2					
Lower temp in winter - night	56733	161,864	93.3	266.2					
Manage draperies	36371	43,960	61.8	74.6					
Replace furnace filter	-3,934	-3,934	-36.1	-36.1					

Stop heating unused rooms	35061	125,041	86.6	308.7
Switch to cold water for		78 186	71.0	202.6
laundry	27404	70,100		

Table 76. Kentucky Kit Participants' Range of Therm Savings for Recommendations

Becommendation	Total Ther	m Savings	Mean Therm Sav	avings (per install)				
Recommendation	Low	High	Low	High				
CFLs	-67.2	-980	-0.2	-2.5				
Clean baseboards	-	-	-	-				
Close off fireplace	20.7	68	0.1	0.4				
Install new central air unit	-	-	-	-				
Install new furnace	381.9	2,178	2.9	16.6				
Install a new heat pump	_		-	-				
Install attic insulation	267.5	1,159	1.1	4.7				
Install sidewall insulation	61.9	554	3.1	27.7				
Install window shrink kits	18.9	106	0.3	1.6				
Insulate ducts	88.1	504	2.1	12.3				
Repair ducts	58.1	333	1.6	9.0				
Insulate water heater	354.1	1,868	3.5	18.3				
Lower temp in winter - day	2727.0	7,781	4.5	12.8				
Lower temp in winter - night	1080.0	3,080	1.8	5.1				
Manage draperies	1641.0	2,145	2.8	3.6				
Replace furnace filter	-21	-21	-0.1	-0.1				
Stop heating unused rooms	437.0	1,560	1.1	3.9				
Switch to cold water for laundry	3875.6	11,057	10.0	28.6				

Table 77. Kentucky No Kit Participants' Range of Kilowatt Savings for Recommendations

Pasammandation	Total kW	Savings	Mean kW Savings (per install)					
Recommendation	Low	High	Low	High				
CFLs	5.503	47.649	0.00612	0.05300				
Clean baseboards	~	-	-					
Close off fireplace	0.340	0.891	0.00067	0.00175				
Install new central air unit	26.778	140.328	0.22887	1.19938				
Install new furnace	-	97		-				
Install a new heat pump	10.626	55.632	0.32199	1.68582				
Install attic insulation	31.440	123.745	0.05006	0.19705				
Install sidewall insulation	5.746	50.692	0.07561	0.66700				
Install window shrink kits	2.147	11.163	0.01293	0.06725				
Insulate ducts	6.688	35.017	0.06431	0.33670				
Repair ducts	7.754	40.600	0.08429	0.44130				
Insulate water heater	1.288	6.303	0.00486	0.02378				
Lower temp in winter - day	-	-	-	-				
Lower temp in winter - night	-	-	-	-				
Manage draperies	-	-	-	-				
Replace furnace filter	-0.880	-1.520	-0.0185	-0.00332				
Stop heating unused rooms	81.334	266.144	0.07881	0.25789				
Switch to cold water for laundry	7.159	18.741	0.00725	0.01899				

Table 78. Kentucky No Kit Participants' Range of Kilowatt-Hour Savings for Recommendations

Decommendation	Total kWh	Savings	Mean kWh Savings (per install)					
Recommendation	Low	High	Low	High				
CFLs	45,864	1,132,047	51	1259.2				
Clean baseboards	51	133	7.2	19.0				
Close off fireplace	1201	3,142	2.4	6.2				
Install new central air unit	34523	180,749	295.1	1544.9				
Install new furnace			-	_				
Install a new heat pump	24289	127,167	736.0	3853.5				
Install attic insulation	56639	222,542	90.2	354.4				
Install sidewall insulation	13714	105,277	180.4	1385.2				
Install window shrink kits	3516	18,294	21.2	110.2				
Insulate ducts	16648	87,162	160.1	838.1				
Repair ducts	16255	85,106	<u>17</u> 6.7	925.1				
Insulate water heater	11278	55,215	42.6	208.4				
Lower temp in winter - day	464354	1,215,587	297.9	779.7				
Lower temp in winter - night	96373	563,414	138.1	361.4				
Manage draperies	96373	756,481	<u>66.6</u>	523.2				
Replace furnace filter	-4594	-4,594	-3.4	-10.0				
Stop heating unused rooms	123535	404,237	119.7	391.7				
Switch to cold water for laundry	62702	164,141	63.5	166.3				

Table 79. Kentucky No Kit Participants' Range of Therm Savings for Recommendations

Becommendation	Total Thern	n Savings	Mean Therm Savings (per install)					
Recommendation	Low	High	Low	High				
CFLs	-136.0	-1,852.9	-0.2	-2.1				
Clean baseboards	-	-	-	_				
Close off fireplace	22.5	58.9	0.0	0.1				
Install new central air unit		-		-				
Install new furnace	841.3	4,404.8	3.0	15.8				
Install a new heat pump	-	-	-					
Install attic insulation	857.4	3,389.7	1.4	5.4				
Install sidewall insulation	276.3	2,121.1	3.6	27.9				
Install window shrink kits	48.9	253.6	0.3	1.5				
Insulate ducts	210.1	1,100.1	2.0	10.6				
Repair ducts	94.1	492.7	1.0	5.4				
Insulate water heater	901.4	4,358.4	3.4	16.4				
Lower temp in winter - day	7255.2	18,992.8	4.7	12.2				
Lower temp in winter - night	2778.1	7,272.6	1.8	4.7				
Manage draperies	4371.6	34,315.0	3.0	23.7				
Replace furnace filter	5.5	16.0	0.0	0.0				
Stop heating unused rooms	1270.4	4,157.0	1.2	4.0				
Switch to cold water for laundry	10210.6	26,729.3	10.3	27.1				

Appendix A: PER and Energy Efficiency Kit Survey

Here shows he questions in this survey by astheting the children and to the experimentation of the model with each question using the problem that is the problem C is surveiled in whet it lowes the this \oplus



QUESTIONS FOR KIT MATERIAL USE

The first set of questions ask assertide meanals yet reserved in the Energy Enforcempt Nit males to you from Dake Energy. This Astimutated a number of owns asset as a shown hear, unitaries, compart forescent sign burbs and other learns. Hearse private your exposite to each of the internal questions about the materials your received in the bit.

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1 years												
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\$ ¥43												
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3. En average, daw many deers per day do gae use tils belb?	Ó	-:1	0	1-2	0)4	0	5-13	0	11-12	0	15-24
CLOGED GELL WEATHER-STRIPPING - 17 FIET												
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2. Have you desert of a sected the frequence to reduce the Year West $O \gg$ 🔿 Səbəlşimu dərdis O 181 O CONTRAIN INSULATED OR REPAIRED HEATING OR KIR ODIDITIONING DUCTS 1. Have you included any of your descriptor config datas that deliver air to the norms of the home? O % 🔿 Sətən planın dərədi. O 81 O GARAN YPES. 2. Are these decisions and the next of united part of the home? C Unexerates 🔿 भवसंबन C DITITION 3. Have you repared or flood acles in any of your bearing of cooking doors chardednet at no the scores of the forme? 🔿 Kətaipları dirtik 🔿 () Bi O SOUTH 0.8 INSTALLED NEW CENTRAL & ROCH DITIONING 1. Exempless a new condist under inger inte? 0 % 🔿 Səbaşınan də dir. O 81 O BRITIN 11782.... 2. To the printed former a suggestive state of the second and entering with (<15 SEES)? O SHIGH O DITING O Bgrendery 3. While the SEER output for you wild 0 - 41 - 0 - 12 OB O He O DOUDDAY INSTALLED & HEW HATORAL GAS OR FROPAHE FUFNACE 1. Have you inscalled a new macroligas or program formation your forme? 🔿 Sətərpilan də tris () Bi O GODIN $O \gg$ 2. Y jes, is the further a high efficiency until which the estinated in a plant upper certing through the sole of the further, or dress the estimation of the similar to a standard efficiency arist O Renorgise C dinneyor fue O COLINA INSTALLED NEW HEAT PUMP 1. Have yna installed a niw hear pung in ywr hanel 👘 🔿 😒 O Mibit par feins 0 10 O DEFISION 1751... 2. Is the best pump a high efficiency with (> 13 SEEP or a standard efficiency with (> 12 $\beta=0$. Aga efficiency O SHEERE O ECCENTRY $O = \mathbb{P}$ 3. What is the SEER rear bet for year sale. O still 0.12 O DOMINON O 14a INSTALLED NEW REFRIGERATOR 1. Rove yra parchased a new refrigerator? ्र ४ O Reber pan to its in 0 16 O DIFISION 1785.... 2. In the retrigenour Energy Star compliant? OW 0 81 O ROOM). Are posseding your old redigenery progred in as a consupt 0 % O NI O Issidary THE DOKE ENERGY WEBSITE 1. Hive he denesting bela Centry Neb all characteria rear Personalized Georg Report a licensity to Social ways to sold reacy in your time? O 81 $O \gg$ O Botalina and O KOTKHY 2. Yyes, dia yee Tota als Web site telph? ं ल C Statemat O N

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Appendix B: PER Survey

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REPORT RECOMMENDATIONS

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Appendix C: Impact Algorithms Used

CFLs

General Algorithm

Gross Summer Coincident Demand Savings

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

Gross Annual Energy Savings

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

$$\Delta therm = \Delta kWh \times HVAC_{g}$$

where:

∆kW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
∆therm	= gross annual therm interaction
units	= number of units installed under the program
Wattsee	= connected (nameplate) load of energy-efficient unit
Wattsbase	= 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
HVACd	= HVAC system interaction factor for demand
HVACg	= HVAC system interaction factor for annual gas consumption

15 W CFL Measure

Watts_{ee} = 15, which is the input power of program supplied CFL Watts_{base} - calculated from survey responses as shown below:

Wattage of	Watts _{base}	Notes
bulb removed		
<= 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

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

FLH - calculated from survey responses as shown below:

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.

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

Covington, KY

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 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

Wattsbase - calculated from survey responses as shown below:

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

Weatherstripping, Outlet Gaskets, and Fireplace Closure

Gross Summer Coincident Demand Savings

 $\Delta kW_{S} = units \times (\Delta cfm/unit) \times (kW / cfm) \times DF_{S} \times CF_{S}$

Gross Annual Energy Savings

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

 Δ therm = units × (Δ cfm / unit) × (therm / cfm)

where:

ΔkW	=	gross coincident demand savings	5
∆kWh	=	gross annual energy savings	

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

Unit cfm savings per measure

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

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

where:

А	= stack coefficient ($ft^3/min-in^{4-o}F$)
	= 0.015 for one-story house
ΔΤ	<pre>= average indoor/outdoor temperature difference over the time interval of interest (°F)</pre>
В	= wind coefficient (ft ³ /min-in ⁴ -mph ²) = 0.0065 (moderate shielding)
V	= average wind speed over the time interval of interest measured at a local weather station at a height of 20 ft (mph)

The location specific data are shown below:

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

Measure ELA impact and cfm reductions are as follows:

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

Unit energy and demand savings

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

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

Window Shrink Kit

Gross Summer Coincident Demand Savings $\Delta kW_s = no. windows \times SF/window \times (\Delta kW/SF) \times DF_s \times CF_s$

Gross Annual Energy Savings $\Delta kWh = no. windows \times SF/window \times (\Delta kWh/SF)$

 Δ therm = no. windows ×SF/window × (Δ therm/SF)

where:

∆kW	= gross coincident demand savings
∆kWh	= gross annual energy savings
No windows	= quantity of windows treated with window film from survey

SF/window	= window square feet based on window size
DF	= demand diversity factor
CF	= coincidence factor
∆kW/SF	`= electricity demand savings per square foot of window treated
∆kWh/SF	`= electricity consumption savings per square foot of window treated
∆therm/SF	`= gas consumption savings per square foot of window treated

Coincidence and Diversity Factors:

DF = 0.8CF = 1.0

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

Window area assumptions (per window):

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

Unit energy and demand savings data

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

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

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

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

Window	ΔkWh/SF	ΔkW/SF	∆therm/SF

type			
All	0	0	0

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

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

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

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

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

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

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

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

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

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

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

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

Low-Flow Showerhead

Gross Summer Coincident Demand Savings

$$\Delta kW_{s} = units \times \frac{(GPD_{base} - GPD_{ee}) \times 8.33 \times \overline{\Delta T}}{3413_{s}} \times DF_{s} \times CF_{s}$$

Gross Annual Energy Savings

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

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

where:

ΔkW	= gross coincident demand savings
∆kWh	= gross annual energy savings
units	= number of units installed under the program

GPDbase	= daily hot water consumption before installation
GPD _{ee}	= daily hot water consumption after flow reducing measure installation
ΔT	= average difference between entering cold water temperature and the shower use temperature
DF	= demand diversity factor for electric water heating
CF	= coincidence factor
8.33	= conversion factor (Btu/gal-°F)
3413	= conversion factor (Btu/kWh)
24	= conversion factor (hr/day)
365	= conversion factor (days/yr)
100000	= conversion factor (Btu/therm)

Showerhead

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

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

 ΔT

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

Water heater efficiency

Combustion efficiency for residential gas water heater = 0.70

Demand diversity factor = 0.1

Coincidence factor = 0.4

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

Faucet Aerators

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

Demand Savings

 $\Delta kW = 0.0171 \ kW \ x \ \Delta T / \Delta T_{VT} \ x \ DF \ x \ CF$

Energy Savings

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

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

Demand diversity factor = 0.1

Coincidence factor = 0.4

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

Lowering the Temperature in Winter

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

 Δ therm = (Δ therm/unit

where:

$\Delta \mathrm{kW}$	= gross coincident demand savings
∆kWh	= gross annual energy savings
DF	= demand diversity factor
CF	= coincidence factor
∆kWunit	`= electricity demand savings per dwelling
∆kWh/SF	`= electricity consumption savings per dwelling
∆therm/SF	`= gas consumption savings dwelling

Unit energy savings data

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

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

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

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

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

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

Setback strategy	∆kWh/unit	∆therm/unit
All	0	0

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

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

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

Setback strategy	ΔkWh/unit	∆therm/unit
Night 1-3	386	0.0
Night 4-6	1,114	0.0
Night 7-10	2,080	0.0
Night 11+	2,767	0.0

Day 1-3	951	0.0
Day 4-6	2,518	0.0
Day 7-10	4,394	0.0
Day 11+	5,715	0.0

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

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

Heating Fuel
Heating System
Cooling System

Gas, propane or oil Any except Heat Pump Room/Window or Central AC

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

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

Setback strategy	ΔkWh/unit	Δtherm/unit
Night 1-3	918	0.0
Night 4-6	2,164	0.0
Night 7-10	3,390	0.0
Night 11+	4,095	0.0

Day 1-3	1,863	0.0
Day 4-6	4,419	0.0
Day 7-10	7,030	0.0
Day 11+	8,615	0.0

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

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

Using Cold Water for Laundry

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

	Gas	Electric	
Loads/wk	therm/yr	kWh/yr	kW
1-2	13.2	166	0.019
3-4	30.8	388	0.044
5-6	48.3	609	0.070
7-8	65.9	830	0.095
9-10	83.5	1052	0.120
11-12	101.0	1273	0.145
13+	114.2	1439	0.164

Replacing Furnace Filter

Gross Summer Coincident Demand Savings $\Delta kW_{s} = (kW/unit_{pre} - kW/unit_{post}) \times DF_{s} \times CF_{s}$

Gross Annual Energy Savings

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

 Δ therm = (therm/unit_{pre} - therm/unit_{post})

where:

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

Coincidence and Diversity Factors:

DF = 0.8CF = 1.0

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

Unit energy and demand data

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

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

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

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

Filter change			
frequency	kWh	kW	therm
all	0	0	0

Heating Fuel	
Heating System	
Cooling System	

Other Any except Heat Pump Central AC

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

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

Filter change			
frequency	kWh	kW	therm
< 1/yr	21,793	11.7	0
lx / yr	21,410	11.5	0
2x / yr	21,054	11.3	0
> 2x / yr	20,704	11.1	0

Heating Fuel	
Heating System	
Cooling System	

Gas, propane or oil Furnace None

Filter					
change		1			
frequency	kWh		kW		therm
< 1/yr		0		0	148

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1x/yr	0	0	146
2x / yr	0	0	143
> 2x / yr	0	0	141

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

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

Heating Fuel	Electricity
Heating System	Furnace
Cooling System	None

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

Heating Fuel	Electricity
Heating System	Furnace
Cooling System	Central AC

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

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Stopping Heating Unused Rooms

Gross Summer Coincident Demand Savings $\Delta kW_{s} = (\Delta kW/unit) \times DF_{s} \times CF_{s}$

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

 Δ therm = (Δ therm/unit

where:

$\Delta \mathrm{kW}$	= gross coincident demand savings
∆kWh	= gross annual energy savings
DF	= demand diversity factor
CF	= coincidence factor
∆kWunit	`= electricity demand savings per dwelling
∆kWh/SF	`= electricity consumption savings per dwelling
∆therm/SF	`= gas consumption savings dwelling

Coincidence and Diversity Factors:

DF = 0.8CF = 1.0

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

Unit energy and demand savings data

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

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

Number of rooms	∆kWh/unit	∆kW/unit	∆therm/unit
All	0	0	0

Heating Fuel Other

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Heating System	Any except Heat Pump
Cooling System	Central AC

Number of

rooms	∆kWh/unit	∆kW/unit	∆therm/unit
1	80	0.09	0
2	161	0.19	0
3	241	0.28	0
4	321	0.37	0
5	401	0.47	0
6+	482	0.56	0

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

Number

of rooms	∆kWh/unit	∆kW/unit	∆therm/unit
1	393	0.21	0
2	786	0.42	0
3	1,179	0.63	0
4	1,571	0.84	0
5	1,964	1.05	0
6+	2,357	1.26	0

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

Number

ot rooms	∆kWh/unit	∆kW/unit	∆therm/unit
1	0	0	3
2	0	0	5
3	0	0	8
4	0	0	11
5	0	0	13
6+	0	0	16

Heating Fuel	Gas, propane or oil
Heating System	Furnace

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Cooling System Centr

Cen	tral	AC

Number	
of	

rooms	∆kWh/unit	∆kW/unit	∆therm/unit
1	80	0.09	3
2	161	0.19	5
3	241	0.28	8
4	321	0.37	11
5	401	0.47	13
6+	482	0.56	16

Heating Fuel	Electricity
Heating System	Furnace
Cooling System	None

Number

or rooms	∆kWh/unit	∆kW/unit	∆therm/unit
1	560	0.35	0
2	1,120	0.70	0
3	1,680	1.05	0
4	2,241	1.41	0
5	2,801	1.76	0
6+	3,361	2.11	0
Heatino	Fuel	Electricity	

i i u oi	Dieenieny
Heating System	Furnace
Cooling System	Central AC

Number

of			
rooms	∆kWh/unit	∆kW/unit	∆therm/unit
1	630	0.44	0
2	1,260	0.88	0
3	1,889	1.31	0
4	2,519	1.75	0
5	3,149	2.19	0
6+	3,779	2.63	0

Insulated Water Heater

Gross Summer Coincident Demand Savings $\Delta kW_{s} = units \times \frac{(UA_{base} - UA_{ee}) \times \Delta T_{s}}{3413} \times DF_{s} \times CF_{s}$

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Gross Annual Energy Savings

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

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

where:

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

Water heater tank UA

Water heater	Elec	tric	(Gas
size (gal)	UAbase	UAee	UAbase	UAee
30	3.84	1.69	4.21	1.76
50	4.67	1.83	5.13	1.91
60	4.13	2.06	4.54	2.14
75	5.00	2.42	5.50	2.52
80+	5.72	2.53	6.28	2.64

 $\Delta T = 140^{\circ}F$ water setpoint temp – 65°F room temp = 75°F

 $\begin{array}{l} DF = 1.0\\ CF = 1.0\\ \eta_{waterheater} = 0.7 \end{array}$

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

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Manage Draperies

Gross Summer Coincident Demand Savings $\Delta kW_s = windows \times (\Delta kW/window) \times DF_s \times CF_s$

Gross Annual Energy Savings $\Delta kWh = windows \times (\Delta kWh/window)$

 Δ therm = windows × (Δ therm/ window)

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
Windows	= number of windows managed
DF	= demand diversity factor
CF	= coincidence factor
$\Delta kW/$ window	`= electricity demand savings per window
∆kWh/window	`= electricity consumption savings per window
∆therm/window	`= gas consumption savings per window

Coincidence and Diversity Factors:

DF = 0.8 CF = 1.0

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

Unit energy and demand savings data

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

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

Number of windows	∆kWh/unit	∆kW/unit	∆therm/unit
All	0	0	0

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Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

Number of windows	∆kWh/unit	∆kW/un <u>it</u>	∆therm/unit
1-3	99	0	0
4-7	274	0	0
8-12	497	0	0
13+	647	0	0

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

Number			
of			
windows	∆kWh/unit	∆kW/unit	Δtherm/unit
1-3	0	0	3
4-7	0	0	5
8-12	0	0	8
13+	0	0	11

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

Number of windows	∆kWh/unit	∆kW/unit	∆therm/unit
1-3	164	0	0
4-7	451	0	0
8-12	821	0	0
13+	1067	0	0

Cleaned Electric Baseboards

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

Attic Insulation

Gross Summer Coincident Demand Savings $\Delta kW_{S} = SF \times (kW/SF_{base} - kW/SF_{ee}) \times DF_{S} \times CF_{S}$

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

 Δ therm = SF × (therm/SF_{base} - therm/SF_{ee})

where:

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

Coincidence and Diversity Factors:

DF = 0.8CF = 1.0

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

Insulation square foot assumptions:

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

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

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Average ceiling area = house size / 1.2

If partial insulation, then reduce ceiling area by 50%

R value assumptions

Rbase:

Base thickness	R _{base}
2	7
4	14
6	21
8	28
10	35

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

Ree

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

	Added	Ree	
Base thickness	thickness	fiberglass, cellulose or other	Foam
	2	14.00	18.20
	4	21.00	29.40
	6	28.00	40.60
	8	35.00	51.80
	10	42.00	63.00
2	12	49.00	74.20
	2	21.00	25.20
	4	28.00	36.40
	6	35.00	47.60
	8	42.00	58.80
	10	49.00	70.00
4	12	56.00	81.20
6	2	28.00	32.20
	4	35.00	43.40
	6	42.00	54.60

	8	49.00	65.80
	10	56.00	77.00
	12	63.00	88.20
	2	35.00	39.20
	4	42.00	50.40
	6	49.00	61.60
	8	56.00	72.80
	10	63.00	84.00
8	12	70.00	95.20
	2	42.00	46.20
	4	49.00	57.40
	6	56.00	68.60
	8	63.00	79.80
	10	70.00	91.00
10	12	77.00	102.20
	2	49.00	53.20
	4	56.00	64.40
	6	63.00	75.60
	8	70.00	86.80
	10	77.00	98.00
12	12	84.00	109.20

Unit energy and demand data

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

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

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

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

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

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				_									
0	0	0	0	0	0	0	0	0	0	0	0	0	
0.00157	0.00149	0.00145	0.00143	0.00142	0.00141	0.00141	0.00140	0.00140	0.00140	0.00140	0.00139	0.00139	
1 330	1.272	1.245	1.231	1.220	1.214	1.210	1.206	1.203	1.201	1.200	1.196	1.194	
Г	14	21	28	35	42	49	56	63	70	LL	84	109	

	u	n	
ating Fuel	ating System	oling System	
He	He	Õ	

Any	Heat Pump	Heat Pump	
4	يطبر	يسلم	

7 14 21 21	6.550		
14 21 20		0.00387	0.00000
21	6.121	0.00378	0.00000
	5.937	0.00374	0.00000
207	5.833	0.00371	0.00000
35	5.768	0.00370	0.00000
42	5.724	0.00368	0.00000
49	5.689	0.00368	0.00000
56	5.665	0.00367	0.00000
63	5.644	0.00366	0.00000
70	5.628	0.00366	0.00000
77	5.616	0.00366	0.00000
84	5.605	0.00366	0.00000
109	5.576	0.00365	0.00000

Gas, propane or oil Any except Heat Pump None

therm/SF	0.04418	0.04058	0.03908	0.03828	0.03768	
kW/SF	0	0	0	0	0	
kWh/SF	0	0	0	0	0	
R-value	L	14	21	28	35	

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42	0	0	0.03738
49	0	0	0.03708
56	0	0	0.03688
63	0	0	0.03668
70	0	0	0.03658
77	0	0	0.03648
84	0	0	0.03638
109	0	0	0.03618

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

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

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

R-value	kWh/SF	kW/SF	therm/SF
7	9.063	0.00501	0.00000
14	8.254	0.00463	0.00000
21	7.915	0.00447	0.00000
28	7.728	0.00439	0.00000
35	7.610	0.00432	0.00000
42	7.528	0.00429	0.00000
49	7.468	0.00426	0.00000

56	7.423	0.00424	0.00000
63	7.387	0.00422	0.00000
70	7.358	0.00421	0.00000
77	7.334	0.00420	0.00000
84	7.313	0.00419	0.00000
109	7.262	0.00417	0.00000

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

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

Sidewall Insulation

Gross Summer Coincident Demand Savings $\Delta kW_{s} = SF \times (kW/SF_{base} - kW/SF_{ee}) \times DF_{s} \times CF_{s}$

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

 Δ therm = SF × (therm/SF_{base} - therm/SF_{ee})

where:

ΔkW	=	gross	coincid	lent der	nand saving	ζS
∆kWh	==	gross	annual	energy	savings	

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SF	= insulation square feet installed
DF	= demand diversity factor
CF	= coincidence factor
kW/SF = elec	tricity demand per square foot of insulation installed
kWh/SF	`= electricity consumption per square foot of insulation installed
therm/SF	`= gas consumption per square foot of insulation installed

Coincidence and Diversity Factors:

DF = 0.8CF = 1.0

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

Insulation square foot assumptions:

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

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

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

R value assumptions

Rbase:

Base thickness	R _{base}
0	0.91

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

Ree

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

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

Unit energy and demand data

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

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

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

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

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

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

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

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0.91	12.078	0.00655	0.00000
7.9	9.865	0.00605	0.00000
18.4	9.160	0.00588	0.00000
30.7	8.892	0.00581	0.00000
46.4	8.734	0.00578	0.00000
12.1	9.477	0.00597	0.00000
28.9	8.918	0.00583	0.00000
48.5	8.721	0.00578	0.00000
73.7	8.620	0.00575	0.00000

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

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

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

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

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

R-value	kWh/SF	kW/SF	therm/SF
0.91	17.807	0.00963	0
7.9	13.354	0.00749	0
18.4	12.045	0.00685	0
30.7	11.552	0.00663	0
46.4	11.277	0.00650	0
12.1	12.616	0.00712	0
28.9	11.599	0.00665	0
48.5	11.254	0.00649	0
73.7	11.075	0.00641	0

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

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

Duct Insulation and Repair

Gross Summer Coincident Demand Savings $\Delta kW_{s} = (\Delta kW/unit) \times DF_{s} \times CF_{s} \times LF$

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

 Δ therm = (Δ therm/unit) × LF

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where:

∆kW	= gross coincident demand savings
∆kWh	= gross annual energy savings
DF	= demand diversity factor
CF	= coincidence factor
LF	= location factor
∆kWunit	`= electricity demand savings per dwelling
∆kWh/SF	`= electricity consumption savings per dwelling
∆therm/SF	`= gas consumption savings dwelling

Coincidence and Diversity Factors:

DF = 0.8 CF = 1.0

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

The location factors used are as follows:

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

Unit energy and demand savings data

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

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

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

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

Duct treatment	∆kWh/unit	ΔkW/unit	∆therm/unit
All	0	0	0

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

Duct treatment	ΔkWh/unit	∆kW/unit	∆therm/unit
Insulate	384	0.10	0
Seal	466	0.25	0

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

Duct treatment	ΔkWh/unit	ΔkW/unit	∆therm/unit
Insulate	1,520	0.48	0.0
Seal	2,422	0.78	0.0

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

Duct treatment	∆kWh/unit	∆kW/unit	∆therm/unit
Insulate	0.0	0.0	17.3
Seal	0.0	0.0	16.5

Heating FuelGas, propane or oilHeating SystemFurnaceCooling SystemCentral AC

Duct treatment	ΔkWh/unit	ΔkW/unit	∆therm/unit
Insulate	384	0.10	17.3
Seal	466	0.25	16.5

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Heating Fuel	Electricity
Heating System	Furnace
Cooling System	None

Duct treatment	ΔkWh/unit	∆kW/unit	∆therm/unit
Insulate	3,917	3.13	0.0
Seal	3,798	2.98	0.0

Heating Fuel	Electricity
Heating System	Furnace
Cooling System	Central AC

Duct treatment	∆kWh/unit	∆kW/unit	∆therm/unit
Insulate	4,285	3.18	0.0
Seal	4,211	3.18	0.0

Installed a New AC or Heat Pump

Gross Summer Coincident Demand Savings $\Delta kW_{s} = (\Delta kW/unit) \times DF_{s} \times CF_{s}$

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

 Δ therm = (Δ therm/unit

where:

ΔkW	= gross coincident demand savings
∆kWh	= gross annual energy savings
DF	= demand diversity factor
CF	= coincidence factor
∆kWunit	`= electricity demand savings per dwelling
∆kWh/SF	`= electricity consumption savings per dwelling
∆therm/SF	`= gas consumption savings dwelling

Coincidence and Diversity Factors:

DF = 0.8CF = 1.0 The diversity and coincidence factors were taken from *Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2* (EPRI, 1993). These values are typical for residential air conditioners and heat pumps in summer peaking utilities.

Unit energy and demand savings data

The unit energy and demand savings were taken from DOE-2 simulations of the residential prototype building described at the end of this Appendix. Unit energy savings are based on replacement of an existing SEER 8.5 air conditioner or heat pump. The unit energy and demand savings depend on the heating fuel, heating system, cooling system and replacement efficiency.

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

Replacement			
efficiency	∆kWh/unit	∆kW/unit	∆therm/unit
All	0	0	0

Heating Fuel
Heating System
Cooling System

Other Any except Heat Pump Central AC

Replacement efficiency	∆kWh/unit	ΔkW/unit	∆therm/unit
<11	674	0.92	0
12	944	1.28	0
13	1,213	1.65	0
14+	1,346	1.80	0

Heating Fuel	Any
Heating System	Heat Pump
Cooling System	Heat Pump

Replacement efficiency	∆kWh/unit	ΔkW/unit	∆therm/unit
<11	2,941	1.36	0
12	2,941	1.36	0
13	5,294	2.45	0
14+	6,496	2.98	0

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

Replacement			
efficiency	∆kWh/unit	∆kW/unit	∆therm/unit
All	0.0	0.0	0

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

Replacement efficiency	∆kWh/unit	ΔkW/unit	∆therm/unit
<11	674	0.92	0
12	944	1.28	0
13	1,213	1.65	0
14+	1,346	1.80	0

0

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

Replacement efficiency	∆kWh/unit	∆kW/unit	∆therm/unit
All	0.0	0.0	0

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

Replacement efficiency	∆kWh/unit	ΔkW/unit	Δtherm/unit
<11	674	0.92	0
12	944	1.28	0
13	1,213	1.65	0
14+	1,346	1.80	0

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Installed a New Furnace

Gross Annual Energy Savings Δ therm = (Δ therm/unit)

where:

 Δ therm/SF `= gas consumption savings dwelling

Unit energy and demand savings data

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

Furnace Type	AFUE
Baseline	0.78
Standard efficiency (metal flue pipe) replacement	0.80
Condensing furnace (plastic flue pipe) replacement	0.90

The unit energy and demand savings depend on the heating fuel, heating system type, and replacement furnace type:

Heating FuelGas, propane or oilHeating SystemFurnace

Replacement efficiency	∆therm/unit
Standard (metal pipe)	3.0
Condensing (plastic pipe)	18.8

Otherwise 0

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 1.



Figure 1. Computer Rendering of Residential Building Prototype Model

The general characteristics of the residential building prototype model are summarized below:

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

Residential Building Prototype Description

Characteristic	Value
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
Duct location	Attic (unconditioned space)
Duct surface area	Single story house: 390 SF supply, 72 SF return
	Two story house: 505 SF supply, 290 SF return
Duct insulation	Uninsulated
Duct leakage	26%; evenly distributed between supply and return
Cooling season	Charlotte – April 17 to October 6
	Covington
Natural ventilation	Allowed during cooling season when cooling
	setpoint exceeded and outdoor temperature <
	65°F. 3 air changes per hour

References

ASHRAE, 2001. <u>ASHRAE Handbook of Fundamentals</u>, American Society of Heating, Refrigeration and Airconditioning Engineers, Atlanta, GA, 2001.

Efficiency Vermont, 2003. <u>Technical Reference Manual, Master Manual Number 4</u>, <u>Measure Savings Algorithms and Cost Assumptions</u>, Efficiency Vermont, Burlington, VT. 2003.

EPRI, 1993. Engineering Methods for Estimating the Impacts of DSM Programs, Volume 2: Fundamental Equations for Residential and Commercial End-Uses, EPRI TR-100984 V2., Electric Power Research Institute, Palo Alto, CA. 1993.

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 D: Housing Characteristics

Type of home		Kentucky Kits			Kentucky No Kits		
		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
	Detached single-family	654	88.26%	88.26%	1681	89.46%	89.46%
	Manufactured/Modular home	23	3.10%	3.10%	56	2.98%	2.98%
	Condominium	41	5.53%	5.53%	111	5.91%	5,91%
	Duplex/2-family	14	1.89%	1.89%	23	1.22%	1.22%
	Multi-family (3 or more units)	9	1.21%	1.21%	8	0.43%	0.43%
Total		741	100.00%	100.00%	1879	100.00%	100.00%

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Year home was built

		Frequency	Percent	Valid Percent	Frequency	Porcont	Volid Porcont
		riequency	reicent	valu reiterit	riequency	Feiceni	vallu Feicent
	Don't Know	5	0.67%	0.67%	16	0.85%	0.85%
	Before 1959	227	30.63%	30.63%	548	29.16%	29.16%
	1960-1979	177	23.89%	23.89%	514	27.35%	27.35%
	1980-1989	83	11.20%	11.20%	183	9.74%	9.74%
	1990-1997	103	13.90%	13.90%	269	14.32%	14.32%
	1998-2000	65	8.77%	8.77%	157	8.36%	8.36%
	2001-2006	81	10.93%	10.93%	192	10.22%	10.22%
Total		741	100.00%	100.00%	1879	100.00%	100.00%

Number of rooms in home (excluding bathrooms)

		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
Don't	Know	3	0.40%	0.40%	8	0.43%	0.43%
1-3		11	1.48%	1.48%	34	1.81%	1.81%
4		40	5.40%	5.40%	91	4.84%	4.84%
5		111	14.98%	14.98%	279	14.85%	14.85%
6		145	19.57%	19.57%	377	20.06%	20.06%
7		158	21.32%	21.32%	426	22.67%	22.67%
8		131	17.68%	17.68%	305	16.23%	16.23%
9		68	9.18%	9.18%	156	8.30%	8.30%
10+		74	9.99%	9.99%	203	10.80%	10.80%
Total		741	100.00%	100.00%	1879	100.00%	100.00%

Number of occupants

	Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
Don't Know	1	0.13%	0.13%	4	0.21%	0.21%
1	131	17.68%	17.68%	387	20.60%	20.60%
2	359	48.45%	48.45%	928	49.39%	49.39%
3	114	15.38%	15.38%	256	13.62%	13.62%
4	86	11.61%	11.61%	205	10.91%	10.91%
5	35	4.72%	4.72%	62	3.30%	3.30%
6	11	1.48%	1.48%	29	1.54%	1.54%
7	2	0.27%	0.27%	5	0.27%	0.27%
8+	2	0.27%	0.27%	3	0.16%	0.16%
Total	741	100.00%	100.00%	1879	100.00%	100.00%

Heating fuel

		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
	electric	139	18.76%	18.86%	415	22.09%	22.12%
	natural gas	524	70.72%	71.10%	1312	69.82%	69.94%
	oil	2	0.27%	0.27%	4	0.21%	0.21%
	propane	4	0.54%	0.54%	5	0.27%	0.27%
	other	68	9.18%	9.23%	140	7.45%	7.46%
	Total	737	99.46%	100.00%	1876	99.84%	100.00%
	No Response	4	0.54%		3	0.16%	
Total		741	100.00%		1879	100.00%	

Heat	ing system	K	entucky ł	Kits	Kentucky No Kits		
		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
	Central furnace	600	80.97%	81.74%	1555	82.76%	83.11%
	Electric baseboard	7	0.94%	0.95%	11	0.59%	0.59%
	Other	49	6.61%	6.68%	114	6.07%	6.09%
	Heat pump	78	10.53%	10.63%	191	10.16%	10.21%
	Total	734	99.06%	100.00%	1871	99.57%	100.00%
	No Response	7	0.94%		8	0.43%	
Total		741	100.00%		1879	100.00%	

Age of furnace

		Frequen	y Percen	t Valid Percent	Frequency	Percent	Valid Percent
	Don't Know		1 2.83%	2.83%	68	3.62%	3.62%
	0-4	21	3 28.74%	28.74%	491	26.13%	26.13%
	5-9	22	29.69%	29.69%	548	29.16%	29.16%
	10-14	12	4 16.73%	16.73%	383	20.38%	20.38%
	15+	16	3 22.00%	22.00%	389	20.70%	20.70%
Total		74	1 100.00%	100.00%	1879	100.00%	100.00%

Type of cooling system

1960	or cooring system						
		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
	Central air conditioning	595	80.30%	80.84%	1524	81.11%	81.45%
	Room window unit	43	5.80%	5.84%	107	5.69%	5.72%
	Central and room	12	1.62%	1.63%	22	1.17%	1.18%
	Heat pump	78	10.53%	10.60%	191	10.16%	10.21%
	None	8	1.08%	1.09%	27	1.44%	1.44%
	Total	736	99.33%	100.00%	1871	99.57%	100.00%
	No Response	5	0.67%		8	0.43%	
Total		741	100.00%		1879	100.00%	

Age of cooling system

		Frequenc	y Percent	Valid Percent	Frequency	Percent	Valid Percent
	Don't Know	3	0 4.05%	4.05%	104	5.53%	5.53%
	0-4	23	5 31.71%	31.71%	517	27.51%	27.51%
	5-9	24	3 32.79%	32.79%	607	32.30%	32.30%
	10-14	12	7 17.14%	17.14%	382	20.33%	20.33%
	15+	10	6 14.30%	14.30%	269	14.32%	14.32%
Total		74	1 100.00%	100.00%	1879	100.00%	100.00%

Water heater fuel

		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
	Electric	246	33.20%	33.47%	596	31.72%	31.92%
	Natural gas	482	65.05%	65.58%	1252	66.63%	67.06%
	Other	7	0.94%	0.95%	19	1.01%	1.02%
	Total	735	99.19%	100.00%	1867	99.36%	100.00%
	No Response	6	0.81%	}	12	0.64%	}
Total		741	100.00%		1879	100.00%	

Water heater age

	-		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
	Don't Know	-	7	0.94%	0.94%	20	1.06%	1.06%
	0-4		291	39.27%	39.27%	704	37.47%	37.47%
	5-9		305	41.16%	41.16%	746	39.70%	39.70%
	10-14		112	15.11%	15.11%	321	17.08%	17.08%
	15+		26	3.51%	3.51%	88	4.68%	4.68%
Total		-	741	100.00%	100.00%	1879	100.00%	100.00%

Stove fuel	Ke	Kentucky Kits			Kentucky No Kits		
	Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent	
Electric	556	75.03%	75.75%	1437	76.48%	76.76%	
Natural gas	165	22.27%	22.48%	410	21.82%	21.90%	
Other	13	1.75%	1.77%	25	1.33%	1.34%	
Total	734	99.06%	100.00%	1872	99.63%	100.00%	
No Response	7	0.94%		7	0.37%		
	741	100.00%		1879	100.00%		

Oven fuel

		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
	Electric	513	69.23%	78.20%	1315	69.98%	79.12%
	Natural gas	135	18.22%	20.58%	324	17.24%	19.49%
	Other	8	1.08%	1.22%	23	1.22%	1.38%
	Total	656	88.53%	100.00%	1662	88.45%	100.00%
	No Response	85	11.47%		217	11.55%	
Total		741	100.00%		1879	100.00%	

Dryer fuel

		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
	Electric	604	81.51%	82.18%	1504	80.04%	80.38%
	Natural gas	114	15.38%	15.51%	336	17.88%	17.96%
	No clothes dryer	17	2.29%	2.31%	31	1.65%	1.66%
	Total	735	99.19%	100.00%	1871	99.57%	100.00%
	No Response	6	0.81%		8	0.43%	
Total		741	100.00%		1879	100.00%	