
Subject Focus on Energy Evaluation

2009 CFL Savings Analysis

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This memo presents estimates of compact fluorescent light bulb (CFL) gross and net energy savings for the residential 2009 Focus on Energy (Focus) ENERGY STAR Lighting program. First, we discuss how annual energy savings are calculated and present the estimated gross and net annual energy savings for the 2009 program year. Next, we present the assumptions and calculations used to determine lifetime energy savings and then present the estimated gross and net lifetime energy savings.

Annual Energy Savings

During the 2009 program year, CFL rewards were paid through one of three methods: buydowns, instant lighting coupons, and mail-in rebates. Because some of the savings assumptions vary by the type of reward, we analyze and present the savings by reward type.



Annual Calculations and Assumptions

Gross annual energy savings, potential gross demand savings, and gross summer peak savings¹ were calculated using the following formulas:

$$\text{Gross Annual Savings (kWh)} = \frac{\# \text{ of CFLs} \times \text{Installation Rate} \times \Delta \text{ Watts} \times \text{Daily Use} \times 365}{1000}$$

$$\text{Potential Gross Demand Savings (kW)} = \frac{\# \text{ of CFLs} \times \text{Installation Rate} \times \Delta \text{ Watts}}{1000}$$

$$\text{Gross Summer Peak Savings (kW)} = \text{Potential Gross Demand Savings} \times \text{Summer Coincidence Factor}$$

Net annual energy savings and net summer peak savings were calculated using the following formulas:

$$\text{Net Annual Savings (kWh)} = \text{NTG ratio} \times \text{Gross Annual Savings}$$

$$\text{Net Summer Peak Savings (kW)} = \text{NTG ratio} \times \text{Gross Summer Peak Savings}$$

¹ Potential gross demand savings assumes that all installed CFLs are turned on at the same time. The summer coincidence peak factor is an estimate of the percent of installed CFLs turned on during on-peak summer hours.

Table 1 displays the assumptions that feed into the gross energy savings calculations for each of the three types of rewards. From the program's CFL rewards database, we determined that a total of 1,490,407 CFLs were rewarded to residential customers during 2009. The installation rates and delta watts values were determined from previous Focus evaluation reports.^{2,3} We assume that the installation rate and delta watts for buydown CFLs is the same as for instant coupon CFLs. CFLs were assumed to be in use an average of 2.77 hours per day, according to an evaluation conducted in New England.⁴ Finally, CFLs were assumed to have an on-peak coincidence factor of 0.108 in the summer.⁵

Table 1. Gross Energy Savings Assumptions, 2009

	Buydown	Instant	Mail-in
Number of CFLs	1,256,692	214,608	19,107
Installation rate	81%	81%	88%
Delta watts (W)	53.3	53.3	55
Daily hours of use	2.77	2.77	2.77
Summer coincidence factor on-peak	0.108	0.108	0.108

² Rick Winch and Tom Talerico, Glacier Consulting, Group, LLC. *Compact Fluorescent Lighting Installation Rate Study*. December 27, 2007.

³ Rick Winch and Tom Talerico, Glacier Consulting, Group, LLC. *Analysis of Delta Watts Values for CFLs Rewarded through the Residential Lighting Program during FY07*. March 6, 2008.

⁴ Nexus Market Research, Inc. and RLW, Inc. *Residential Lighting Markdown Impact Evaluation*. Markdown and Buydown Program Sponsors in Connecticut, Massachusetts, Rhode Island, and Vermont. January 20, 2009.

⁵ Nexus Market Research, Inc. and RLW, Inc. *Residential Lighting Markdown Impact Evaluation*. Markdown and Buydown Program Sponsors in Connecticut, Massachusetts, Rhode Island, and Vermont. January 20, 2009. ISO New England defines summer peak periods as non-holiday weekdays between 1 pm–5 pm during the months of June, July, and August. Wisconsin's definition of summer peak periods is the same except the time is 1 pm to 4 pm.

Gross and Net Annual Energy Savings

We calculate that the CFLs rewarded during 2009 yield gross annual energy savings of over 65 million kWh. Using the on-peak summer coincidence factor of 0.108, we calculate gross summer peak demand savings of 6,960 kW (Table 2).

Table 2. Gross Annual Energy Savings, 2009

	Buydown	Instant	Mail-in	Total
Gross annual kWh savings per CFL	43.7	43.7	48.9	n/a
Gross annual kWh savings	54,854,683	9,367,652	934,998	65,157,333
Potential gross kW savings	54,255	9,265	925	64,445
Gross summer peak kW savings	5,860	1,001	100	6,960
Gross summer peak kW savings per CFL	0.0047	0.0047	0.0052	n/a

Table 3 shows the net annual energy savings, as well as the net summer peak demand savings. Net annual energy savings were calculated using the net-to-gross ratio of 0.62 from the 2008 program evaluation.⁶ In 2009, the program achieved net annual energy savings of 40 million kWh and net summer peak savings of 4,315 kW.

Table 3. Net Annual Energy Savings, 2009

	Buydown	Instant	Mail-in	Total
Net annual kWh savings per CFL	27.1	27.1	30.3	n/a
Net annual kWh savings	34,009,904	5,807,945	579,699	40,397,547
Net summer peak kW savings	3,633	620	62	4,315
Net summer peak kW savings per CFL	0.0029	0.0029	0.0032	n/a

⁶ Lisa Wilson-Wright, Chris Russell, and Lynn Hoefgen, NMR Group. *Results of the Multistate CFL Modeling Effort (Revised Draft Report)*. February 16, 2010.

Lifetime Energy Savings

In order to determine the lifetime energy savings of CFLs, we took into account the impacts of the Federal Energy Independence and Security Act of 2007 (EISA). EISA effectively calls for a phase out of inefficient incandescent light bulbs beginning in 2012. EISA's statutory language is based on lumens rather than wattage. In order to determine the wattage of inefficient incandescent bulbs that will be phased out beginning in 2012, we assume that incandescent efficacy is about 15 lumens per watt. After calculating the incandescent wattages to be phased out, we determined the CFL equivalent for these incandescents in order to calculate the lifetime energy savings of program CFLs. We assume that incandescent bulbs, on average, have wattages that are 3.9 times higher than equivalent CFLs, based on several common CFL wattages (Table 4).⁷

Table 4. EISA Phase-out Schedule

Effective Date	Lumen Range	Estimated Incandescent Wattage	CFL Equivalent Wattage
1/1/2012	1490–2600	99–173	25.4–44.3
1/1/2013	1050–1489	70–99	17.9–25.3
1/1/2014	310–1049	21–70	5.3–17.9

EISA exempts a number of bulb types from the phase-out. Among other bulb types, EISA exempts the following: reflector bulbs, globe shaped bulbs, 3-way bulbs, candelabra shaped bulbs, and bug lights.

⁷ Rick Winch and Tom Talerico, Glacier Consulting, Group, LLC. *Analysis of Delta Watts Values for CFLs Rewarded through the Residential Lighting Program during FY07*. March 6, 2008.

Lifetime Calculations and Assumptions

Based on the EISA phase-out schedule, we assume that non-specialty CFL bulbs that are 25 watts or more will not accrue any savings after 2012. Likewise, non-specialty CFLs between 18 and 24 watts will not accrue any savings after 2013, and non-specialty CFLs of 18 watts or less will not accrue any savings after 2014. Therefore, after 2014 the only CFLs that accrue energy savings are specialty CFLs.⁸ The following calculation was used to determine gross lifetime savings:

$$\text{Gross Lifetime Savings (kWh)} = \text{Gross Annual Savings} \times \text{Measure Life}$$

Table 5 shows the assumptions used to calculate the gross lifetime energy savings from CFLs rewarded during 2009. To the extent possible, we categorized program CFLs by wattage, bulb shape, and specialty feature. While the instant coupon and mail-in records included wattage, bulb shape, and specialty feature in the tracking database, the buydown CFLs, which represent 84 percent of all rewarded CFLs in 2009, did not have this information. WECC was able to provide the wattages for about 56 percent and the model information for about 42 percent of the 2009 buydown CFLs. For two retailers without this information available but with a sufficient number of instant coupon and mail-in records in 2009, we applied the proportion of specialty CFLs and standard CFLs in each wattage category from the instant and mail-in reward data to the buydown data; this assumes that buydowns incentivize similar types of CFLs as the instant and mail-in rewards. For a few other retailers, we assumed all CFLs were standard based on the type of store and the wattage and package sizes of the CFLs rewarded. Lastly, in a few cases, we allocated the CFLs to the wattage and specialty categories based on the average proportion of CFLs in each category from all other retailers.

Overall, we estimated there were a total of 312,354 non-specialty CFLs of 25 watts or more, 302,202 non-specialty CFLs between 18 watts and 24 watts, 809,642 non-specialty CFLs less than 18 watts, and 66,209 specialty CFLs.

We assume a lifetime installation rate of 97 percent for the buydown CFLs and 99 percent for both the instant and mail-in CFLs.^{9,10} We assume a maximum measure life of 6.8 years for the buydown CFLs and 5.5 years for both the instant and mail-in CFLs.¹¹ Assuming that CFLs

⁸ For the purposes of the lifetime energy savings calculations, specialty CFLs include the following: reflectors/floods, globes, 3-ways, candelabras, and bug lights.

⁹ Nexus Market Research, Inc. and RLW, Inc. *Residential Lighting Markdown Impact Evaluation*. Markdown and Buydown Program Sponsors in Connecticut, Massachusetts, Rhode Island, and Vermont. January 20, 2009.

¹⁰ Nexus Market Research, Inc. and RLW, Inc., *Residential Lighting Measure Life Study*. New England Residential Lighting Program Sponsors. June 4, 2008.

¹¹ Ibid.

were installed in mid-2009, we calculate the actual measure life as the difference between mid-2009 and the middle of the EISA phase-out year.¹²

Table 5. Lifetime Energy Savings Assumptions, 2009

	Buydown	Instant	Mail-In
Number of CFLs 25W or more (2012 EISA phase-out)	253,803	57,316	1,235
Number of CFLs 18W–24W (2013 EISA phase-out)	246,919	51,641	3,642
Number of CFLs <18W (2014 EISA phase-out)	701,371	98,525	9,746
Number of specialty CFLs	54,599	7,126	4,484
Lifetime installation rate	97%	99%	99%
Daily hours of use	2.77	2.77	2.77
2012 EISA phase-out measure life (years)	3	3	3
2013 EISA phase-out measure life (years)	4	4	4
2014 EISA phase-out measure life (years)	5	5	5
Specialty CFL measure life	6.8	5.5	5.5

Gross and Net Lifetime Energy Savings

Table 6 presents the lifetime energy savings for CFLs purchased through the Focus program during 2009. The gross lifetime savings for these CFLs is estimated to be over 349 million kWh. The net lifetime savings, based on a net-to-gross ratio of 0.62, is estimated to be 216 million kWh.

Table 6. Lifetime Energy Savings, 2009

	Buydown	Instant	Mail-in	Total
Gross lifetime savings (kWh)	295,360,369	48,615,231	5,051,409	349,027,009
Net lifetime savings (kWh)	183,123,429	30,141,443	3,131,873	216,396,745

¹² While the EISA ban takes effect on January 1 of each year, we assume that incandescent bulbs will remain available until retailers sell out of existing stock, likely the middle of each year.