The Golden Goose That Keeps on Laying: Why There Are Still Savings Opportunities for CFL Programs Even After EISA

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ABSTRACT

The implementation of the Energy Independence and Security Act of 2007 (EISA) reduces upstream lighting program savings by pushing down baseline wattages. Utilities that adjust baseline wattages when the EISA baselines take effect in 2014 will experience a significant drop in savings. Many utility programs and technical reference manuals retain some savings by delaying the implementation of these EISA baselines by six months or a year to account for persisting store inventories of incandescent bulbs. This delay can be based on thin, anecdotal data. Through this study, Cadmus refined this estimated delay by quantifying incandescent bulb availability in the Dayton Power & Light (DP&L) service territory using retail phone surveys and creating a blended baseline that shifts over time to reflect this availability. Cadmus then applied this shifting baseline to a large, current dataset of upstream lighting bulb sales to understand the overall impact of these shifting baselines and the EISA baselines to program savings in general.

We found that EISA baselines would reduce available program savings by 33% in 2014 compared to savings using pre-EISA baselines. However, by applying a blended baseline in 2014, we calculated only a 24% reduction in program savings. This shows that many programs leave nine percent of program savings on the table. Using a blended baseline for upstream lighting programs provides a more refined approach to calculating savings and a golden opportunity to claim more savings.

Introduction

As part of impact evaluation activities for DP&L's residential upstream lighting program, Cadmus has been conducting quarterly phone surveys of light bulb retailers in 2013 and 2014. Each quarter we call retail outlets in DP&L's territory to quantify the availability of incandescent bulbs for residential consumers. These lingering inventories present a choice to consumers: buy an inefficient, incandescent bulb, or opt for a more efficient LED, CFL or EISA-compliant halogen bulb. Many upstream lighting programs assume that this inefficient, incandescent option does not exist for consumers by using the EISA baseline wattages as the baseline to calculate program savings. This assumption drops upstream lighting savings, which represents a significant piece of portfolio savings for many utilities. The analysis presented here quantifies the availability of these incandescent bulbs, allowing us to adjust the baseline wattage to reflect the split between incandescent and EISA compliant bulb options available to consumers.

We compared results from the quarterly phone survey against data from four other studies to benchmark incandescent bulb availability in several regions. We then applied these results to a large, current dataset of upstream lighting bulb sales to understand the impact of EISA and shifting baselines to program savings in general. The bulbs sales data are taken from

four different utilities between 2011 and 2013, totaling over 15 million bulbs. This report presents the results of this analysis, with the permission of DP&L and TechMarket Works, Inc.

Background and Motivation

As with most evaluations, our residential lighting evaluation for DP&L uses a code baseline approach to determine the delta watts input used to calculate lighting savings. We base this approach on the premise that, when replacing light bulbs, customers choose their replacement bulb type from the options available to them on the shelves of their local retail outlet. The baseline wattage for whatever bulb they ultimately select as a replacement is the least efficient option that the consumer can find on the store shelf. This study determines the available baseline wattage by identifying what bulbs are on the shelf, rather than what bulbs federal code requires. This shelf-based availability approach provides some additional savings when compared to the pure code baseline.

As Table 1 shows, the EISA standards prohibit the production (but not the sale) of many standard incandescent bulbs, starting in 2012. Due to existing inventories, most stores continue to sell these bulbs after the new standards go into effect. The continued availability of these bulbs presents a golden opportunity for utilities that implement upstream lighting programs.

Table 1. EISA efficiency standards

Lumens bin	Equivalent incandescent wattage	EISA required wattage	EISA impact date
310-749	100	72	January 1, 2012
750-1049	75	53	January 1, 2013
1050-1489	60	43	January 1, 2014
1490-2600	40	29	January 1, 2014

This study is especially pertinent in 2014, given the impact of EISA on 60 watt incandescent bulbs and the prevalence of these equivalent bulbs in most upstream lighting programs. We analyzed a dataset of over 15 million bulbs from four utilities to understand the impact of this analysis on lighting programs in general. The distribution of the 15 million program bulbs in Figure 1 shows that 60 watt equivalent compact fluorescent lights (CFLs) and light emitting diodes (LEDs) make up the majority of bulb sales in upstream lighting programs. The “Not impacted by EISA” category represents the 54,438 (0.36% of total) program bulbs that are EISA-exempt, either because they fall outside the EISA lumens range (less than 310 lumens or greater than 2600 lumens) shown in Table 1 or because they are three-way type bulbs. Figure 1 also separates reflector type bulbs because EISA does not directly affect these bulbs either. In the case of the four utilities in the dataset, 60 watt equivalent bulbs represent between 46% and 70% of all bulbs sold, 62% on average.

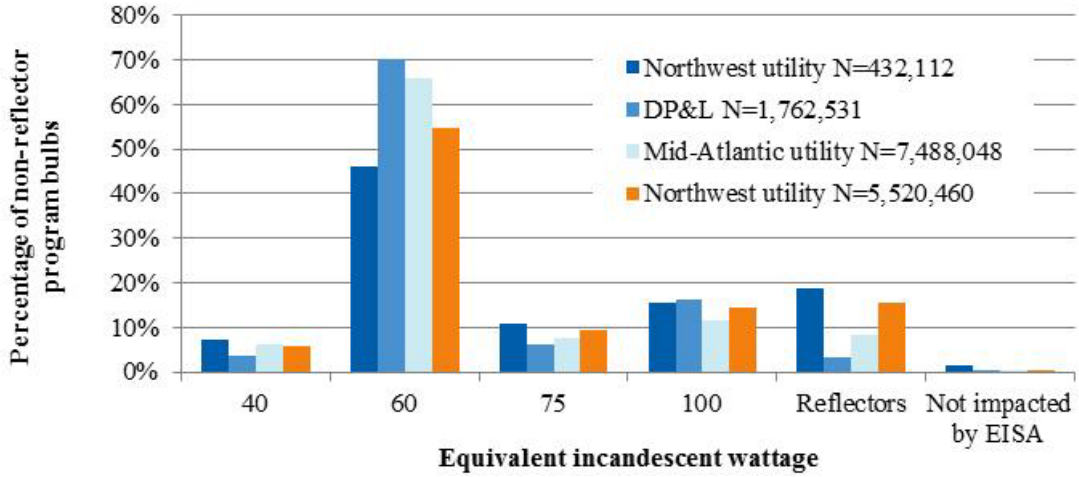

Figure 1. Distribution of upstream lighting bulb sales across four utilities. *Source*: Cadmus 2014b.

While this study does affect savings from 2012 and 2013, the implications for 2014 program savings are far greater. In 2012 and 2013 the EISA standards impacted just 100 and 75 watt incandescent bulbs respectively. As Figure 1 shows, 100 and 75 watt bulbs together represent just 19%-26% of program sales, suggesting that only about a quarter of bulbs sold in these years are impacted by EISA. Whereas the EISA standards for 60 and 40 watt bulbs that take effect in 2014 will impact 53%-74% of program sales. Given that the EISA standards begin affecting up to a three-quarters of programs bulbs in 2014, this analysis provides significantly more savings for upstream lighting programs in 2014 compared to 2013 and 2012.

Methodology and Sample

To quantify the availability of the EISA-affected bulbs, we adopted an approach from a survey that TechMarket Works implemented in Indiana (TechMarket 2014). TechMarket Works called about 100 stores in January 2013, and then called the same stores again in January 2014, asking if the stores had 100 and 75 watt incandescent bulbs available. Our survey had similar questions, but we implemented the survey quarterly. We also adopted a similar approach to the TechMarket Works survey by having the caller pose as a customer shopping for light bulbs. This method was quicker than explaining our survey and most likely achieved less biased results because the sales people believed they were speaking with a customer rather than taking a survey.

We also used a dataset of over 15 million upstream lighting bulbs to help quantify the impact of EISA and the availability of certain bulbs on program savings in general. As mentioned above, the bulb dataset comprises both CFLs and LEDs and comes from four recent utility evaluations.

For the retail store sample, Cadmus called the retail stores that participated in DP&L's upstream lighting program and sold the most bulbs. To determine bulb availability with respect to the upstream program participants, we called participating stores that represent at least 90% of 2012 program bulb sales (between 53 and 57 stores).

Retail phone surveys are not a perfect method for collecting bulb availability data. One shortcoming of this approach is that retail salespeople are not always motivated to provide accurate responses to survey questions and are not, therefore, the most reliable source of this information. We did see the responses of some stores flip-flop between quarters. It is difficult to say if this is due to inconsistent staff responses or inventory shifting around to different stores within the same retail chain. Stores that flip-flopped responses represented a small portion of total responses and in some cases canceled each other out.

Results

The results in Table 2 present the Cadmus DP&L phone survey results. The availability shown in the last row reflects the availability weighted by program bulb sales.

Table 2. Cadmus DP&L phone survey results: percentage of stores with incandescent for sale

	100 watt incandescent bulbs					75 watt incandescent bulbs				
	2013				2014	2013				2014
	Q1	Q2	Q3	Q4	Q1	Q1	Q2	Q3	Q4	Q1
Number of stores called	53	53	55	57	50	53	53	55	57	50
Stores with inventory: any amount	43%	43%	24%	30%	30%	77%	73%	33%	36%	40%
Stores with inventory: any amount; weighted by bulb sales	28%	24%	10%	14%	16%	47%	45%	15%	18%	21%

The values in Table 2 represent the percentage of stores with any amount of inventory of the given bulb. One hundred percent conveys that all the stores studied have bulb inventory, while 0% means that none of the stores have inventory. The quarters reflect calendar year quarters.

The trends in Figure 2 and Figure 3 benchmark other studies against the Cadmus phone survey. These trends do not weight the results by bulb sales, so each stores' response is represented equally, regardless of the number of bulbs the store sold.

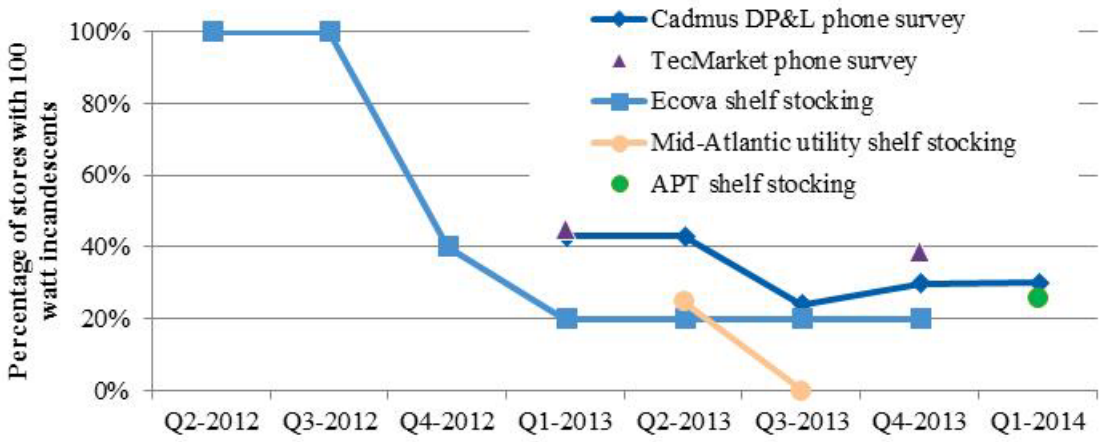

Figure 2. Benchmarking the unweighted availability of 100 watt equivalent incandescent bulbs.

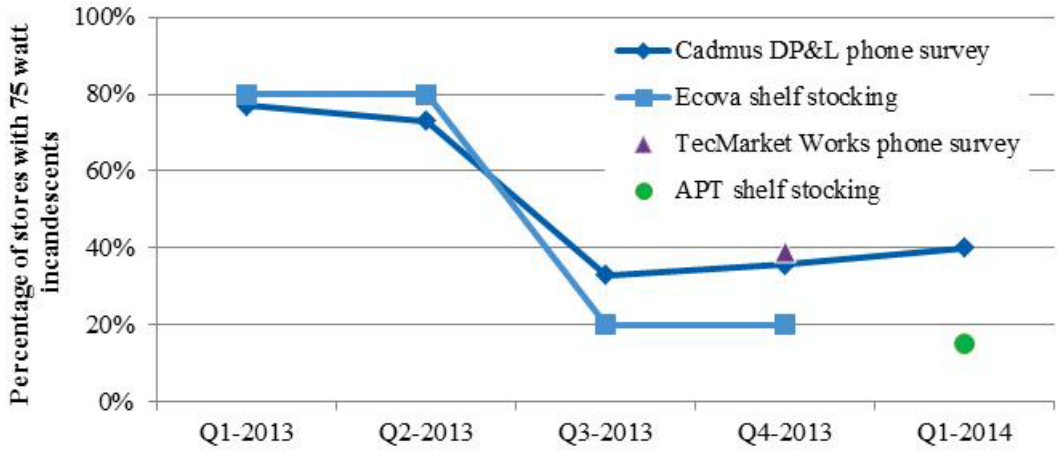

Figure 3. Benchmarking the unweighted availability of 75 watt equivalent incandescent bulbs

These two figures present unweighted results so that all the results can be compared directly with one another. Ecova implemented DP&L's 2013 upstream lighting program. The Ecova shelf-stocking study, performed in DP&L service territory, looked at the availability of 100 and 75 watt bulbs in the same five stores each quarter (Ecova 2013). Cadmus performed a shelf-stocking study for a Mid-Atlantic utility in 2013. This study looked at 100 watt incandescent bulbs in 12 stores during the second and third quarters of 2013. Lastly, APT is implementing DP&L's 2014 upstream lighting program. APT visited 34 stores in DP&L's territory in the first quarter of 2014 to determine incandescent availability (APT 2014).

Cadmus used the weighted results in Table 2 to calculate quarterly baseline wattages for 100 and 75 watt equivalent bulbs in 2013. Table 3 presents these averaged results in the "Cadmus average in 2013" column. Figure 4 in the Conclusions section shows the

disaggregated results. The column "Cadmus average in 2014" shows the calculated baseline wattages for 2014. Since phone survey data is not available for all of 2014, the 2014 baselines use assumptions that are discussed in more detail in the "2014 Baseline Assumptions" section below. The analysis assumes baseline wattages for 100 and 75 watt bulbs reach EISA baselines of 72 and 53 watts respectively in 2014. For the 2014 60 and 40 watt baselines, the analysis averages 60 and 40 watt weighted results from the first quarter of 2014 with 75 watt bulb availability results from the second, third and fourth quarters of 2013. As 2014 quarterly results become available, the analysis will incorporate these into the average 2014 baseline values.

Table 3. Average annual baseline wattages per EISA and Cadmus

Equivalent baseline wattage					Average efficient wattage*	Program sales distribution
Pre-EISA	EISA in 2013	EISA in 2014	Cadmus average in 2013	Cadmus assumed average in 2014		
40	40	29	40	33	11.3	6%
60	60	43	60	49	13.5	62%
75	53	53	60	53	19.0	8%
100	72	72	78	72	23.9	13%
Reflectors					-	11%
Not impacted by EISA					-	0%

Sources: EISA standard, Cadmus DP&L phone survey results, and upstream lighting dataset.
* The upstream lighting dataset was used to calculate the weighted average of efficient wattages.

To determine the impact of these different baselines on program savings in general, we compared baseline wattages across 2013 and 2014, using baselines from three sources: baselines before EISA, baselines reflecting EISA's implementation dates, and Cadmus baselines calculated using retail phone-survey data. Table 3 shows these different sets of baselines. This table provides the average efficient wattage and distribution that correspond to each equivalent wattage bin, based on our upstream lighting dataset. Although EISA indirectly affects reflector-type bulbs, this analysis does not address this impact.

We then compared the EISA and Cadmus baselines in 2013 and 2014 against the pre-EISA baselines. We calculated the impact to program savings by applying the different baselines and the average efficient wattages in Table 3 to calculate how the delta watts change. These new baselines negatively affect delta watts, an input which correlates directly to program savings. Table 4 shows these impacts.

Table 4. EISA impact to program savings using different baselines

Incandescent wattage	2013 impact to program savings		2014 impact to program savings	
	Cadmus baseline	EISA baseline	Cadmus baseline	EISA baseline
40	0%	0%	-1%	-2%
60	0%	0%	-15%	-23%
75	-2%	-3%	-3%	-3%
100	-4%	-5%	-5%	-5%
Total program impact:	-6%	-8%	-24%	-33%

2014 Baseline Assumptions

In order to determine 2014 baseline values for this analysis, we made several assumptions, which are explored in the following discussion.

Before calculating an average 2014 baseline, we had to ask a few questions: How will 60 and 40 watt availability play out in 2014? Will stores stockpile 60 and 40 watt incandescent bulbs leading up to 2014? Or will retailers forego large inventories as consumers transition quickly to the many efficient options available? How long will 100 and 75 watt availability linger?

Because EISA standards have been rolled out in stages, we have two precedents for how consumers will react to the standard affecting 60 and 40 watt bulbs: the 100 watt rollout in 2012 and the 75 watt rollout in 2013. The 100 watt incandescent bulb inventories have persisted two years after the EISA standards took effect, while 75 watt incandescent inventories have dropped almost to match 100 watt incandescent inventories in just one year.

The factors driving the different availability trends point to 60 and 40 watt bulbs mirroring the 75 watt availability trend more than the 100 watt availability trend. The persistent inventories of 100 watt incandescent bulbs may remain because this general-purpose bulb type was the first that EISA standards affected. When EISA took effect in 2012, retailers didn't know how consumers would react. There was hype in the news and in advertising about incandescent bulbs being "banned," so retailers reacted by ensuring that they wouldn't be the first store to run out of 100 watt bulbs. Results from this study suggest that retailers may have overestimated the demand for these bulbs, as they most likely did not anticipate stocking 100 watt bulbs for two years. Cadmus interviewed several bulb manufacturers as part of DP&L's 2013 residential lighting evaluation (Cadmus 2014a). In general, these interview responses support the claim that bulb retailers overstocked 100 watt bulbs. One manufacturer said he saw that several retailers "got burned" by stockpiling 100 watt bulbs, and another said there was "a lot of PR for 100 watt" bulbs but "less PR for 75 watt" bulbs. The quicker drop in 75 watt incandescent availability seems to show that retailers learned their lesson after overstocking 100 watt bulbs.

One precedent that supports this first year overstocking phenomenon is Austria's efficient lighting program, implemented in 2009 (DNV KEMA 2013). Austria implemented a lighting standard similar to EISA, but instead of phasing in the standards for different bulb types over several years, as in the United States, the law affected all bulb types at the same time in 2009. The result was massive stockpiling of all incandescent bulb types. The 100 watt inventories in

the United States seem to reflect this first-year reaction to such a standard. Given that the efficiency requirements for the 75 watt bulbs went into effect the second year of EISA and availabilities dropped quicker than the 100 watt bulbs, we assumed that 60 and 40 watt inventories would reflect this second year trend more than the first year trend.

Another factor that may influence stores to not stockpile 60 and 40 watt bulbs and lead to diminished inventories quicker is the increased availability and affordability of LEDs. One large reason stores stockpile incandescent bulbs is because of demand from entrenched incandescent users who dislike CFLs. LEDs provide these CFL loathing consumers with at least one additional alternative to CFLs and may reduce the need to stockpile incandescent bulbs. Previously, the cost of general purpose, omnidirectional LEDs was prohibitive. Price wars and utility incentives have driven down the cost of LEDs dramatically, with the most affordable options replacing 60 and 40 watt incandescent bulbs. The lower cost of these LEDs still does not rival that of an incandescent bulb or even a CFL. It may be low enough, however, to convince a customer who would normally avoid a CFL by purchasing an incandescent to try out an LED.

Overall, the smaller amount of hype and new replacement options available to consumers point to 60 and 40 watt bulb inventories aligning more with the 75 watt availability trend than the 100 watt trend. Given that this is the third round of EISA standards taking effect, a large PR blitz is unlikely. The lack of hype and the availability of reasonably priced LEDs to replace these incandescent bulbs may lead to smaller inventories of 60 watt bulbs and less availability. For these reasons, we based the second, third and fourth quarter availability of 60 and 40 watts on the 75 watt availability trend.

Areas for Additional Research

This analysis points to several areas where additional research could clarify calculated baseline drivers. The first area is around primary data for the remaining quarters of 2014. As Cadmus continues to implement retail phone surveys each quarter, we will determine the availability for different bulb types in the second, third and fourth quarters of 2014. APT also plans to continue performing shelf-stocking studies in the DP&L territory throughout 2014, providing another data point to benchmark availability.

Another area for further research relates to the trend seen in the data in the third and fourth quarters of 2013. The availability of 100 and 75 watt bulbs flattens out after the third quarter of 2013, as shown in Table 2. Then going forward the availability of these bulbs actually rises slightly; a trend we would not expect in the presence of a discontinued bulb supply. If this trend of plateauing or even rising availability continues, it would be important for evaluations to understand the factors driving this.

Several simple reasons may explain this trend. Store chains could be spreading out incandescent inventories to multiple stores, driving up the availability seen at different locations. The slight rise may also be within the error of the survey or due to salespeople providing inconsistent responses between surveys. Small stores that don't move many bulbs and have small, lingering inventories could also be driving the trend. This explanation manifests itself most in the unweighted results seen in Figure 2 and Figure 3, which are blind to the quantity of bulbs sold, so many stores that sell only a few bulbs may prop up the unweighted availability. The last, simple explanation is that salespeople at the stores may be confusing EISA compliant halogen bulbs with incandescent bulbs. These compliant bulbs have become more available in

the last year and the packaging conveys the incandescent equivalent wattage in a way that can lead many to believe the bulb is actually an incandescent bulb.

A less simple and perhaps less likely explanation of the plateauing availability of 100 and 75 watt incandescent bulbs is that some manufacturers are still importing these bulbs into the United States. Interviews with major manufacturers suggest that these companies have transitioned to manufacturing only EISA compliant bulbs. It is possible, however, that smaller bulb brands are pursuing this incandescent bulb market.

The factors driving this trend could influence many facets of upstream lighting programs. The plateauing availability could impact program marketing, incentives and goals. In all likelihood, the factors are several, but a deeper understanding of them could help programs and portfolios perform better in the short-term.

Conclusions

Cadmus found that the unweighted availability of 100 watt incandescent bulbs falls off gradually, reaching 24% availability seven quarters after the EISA standard for 100 watt equivalent bulbs took effect. The availability of 75 watt incandescent bulbs appears to be falling more quickly than 100 watt incandescent bulbs, reaching 33% after just three quarters of the EISA standard being in place. Comparing the Cadmus phone survey with the other studies in Figure 2 and Figure 3 shows strong agreement between results. Cadmus used the weighted results in Table 2 to calculate quarterly baseline wattages for each equivalent bulb type used in DP&L's 2013 year-long evaluation, as shown in Figure 4. The dashed EISA lines show the baseline wattage adjusted to EISA standard levels of 72 and 53 watts for 100 and 75 watt equivalent bulbs respectively.

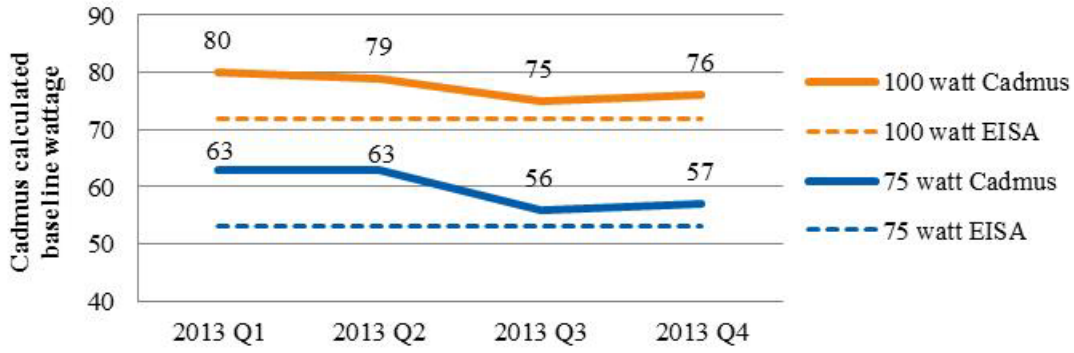

Figure 4. DP&L 2013 quarterly baseline wattages. *Source*: Cadmus DP&L phone survey results.

Figure 5 graphically depicts the results from Table 4. The negative percentages reflect the drop in program savings with respect to pre-EISA baselines. These results reflect upstream lighting program savings in general, as sales data comes from bulb sales across four different utilities.

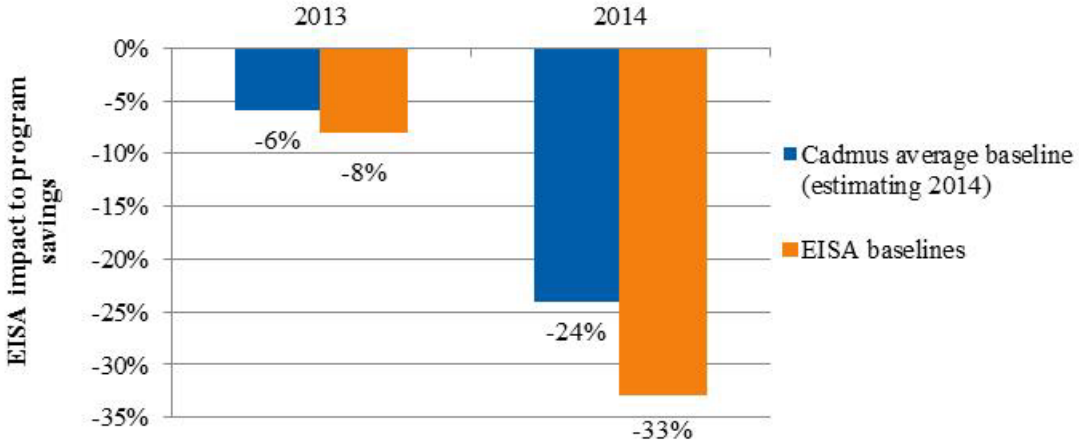

Figure 5. Impact of EISA on program savings based on different baselines. *Source*: EISA, Cadmus calculated, and Cadmus estimated.

As Figure 5 shows, the EISA baselines reduce program savings by 33% in 2014 over pre-EISA baselines. By applying baselines that reflect incandescent bulb availability in stores, savings decline by just 24%. The 9% discrepancy between these two drops represents savings that many utilities are not claiming because they are using strict EISA baselines. The large dip in impact to savings between 2013 and 2014 is the result of EISA standards that affect 60 and 40 watt equivalent bulbs. The smaller savings reductions in 2013 reflect EISA standards that affect 100 and 75 watt equivalent bulbs. Since these bulbs types represent a smaller share of upstream lighting programs, overall savings are less affected. Cadmus will continue to collect data from retail phone surveys in 2014 to refine baseline wattage calculations for all equivalent bulb types and, by extension, the impact that these shifting baselines have on program savings.

Overall, utilities that use strict EISA baselines to determine 2014 upstream lighting savings will be leaving an estimated 9% of program savings on the table. By using the 2014 average Cadmus baselines in Table 3, utilities can claim more savings using baselines that accurately reflect incandescent availability.

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