

## MEMORANDUM

**To:** Massachusetts Electric PAs and EEAC Consultants

**From:** David Barclay, Lisa Wilson-Wright, and Lynn Hoefgen

**Date:** November 7, 2016

**Re:** Residential Lighting Hours-of-Use Update

---

The 2014 Northeast Residential Lighting Hours-of-Use (HOU) Study was designed to allow sponsors in the Northeast to update HOU estimates based on changes in room-by-room saturation collected as part of regular saturation studies. This memo serves as an update for the Program Administrators in Massachusetts for the upstream lighting programs. This update is not applicable to the direct-install programs which operate using a somewhat different HOU estimate. The sources of data for this memo include the following:

- [The Northeast Residential Lighting Hours-of-Use Study](#)
- [Results of the Massachusetts On-site Lighting Inventory \(2013\)](#)
- [The 2015-16 Lighting Market Assessment Consumer Survey and On-site Saturation Study](#)

## Calculating Revised HOU Estimates

### CHANGES IN SATURATION OVER TIME

The logging period for the HOU study was November 2012 through September 2013. When loggers were installed, field technicians collected detailed lighting inventory data. These inventory data serve as the base year for analysis of changes in saturation by room. More recently, the Massachusetts PAs completed a 2015-2016 on-site saturation study, which serves as the comparison year. In this memo, we examine the change in saturation over a three-year period.

- Base year data collection November 2012 – March 2013
- Comparison year data collection December 2015 – March 2016

Table 1 provides an overview of the average number of sockets and snapback-adjusted<sup>1</sup> HOU by room; socket saturation for CFLs, LEDs, and all energy-efficient bulbs (CFLs,

---

<sup>1</sup> The Northeast HOU Study found that HOU were higher for efficient bulbs compared to inefficient bulbs. While the exact reasons for this difference were not determined, the report suggests that snapback may account for one-third of the difference. Snapback or rebound effects refer to changes in patterns of usage that occur after

LEDs, and linear fluorescents) between 2013 and 2016; and changes in saturation. As the data show, with the exception of kitchens, all room types show net gains in energy-efficient bulbs. For kitchens, the gains in LED saturation were offset by losses in CFL and linear fluorescent (not shown) saturation. This is important because kitchens have the second highest HOU after exteriors.

**Table 1: Changes in Saturation by Room**

Room Type	2016 Socket Count	HOU <sup>1</sup>	CFL Saturation			LED Saturation			EE (CFL + LED + Lin. Flr.) Saturation		
			2013	2016	Delta	2013	2016	Delta	2013	2016	Delta
Bathroom	7.3	2.0	24%	31%	7%	0%	14%	14%	29%	48%	19%
Bedroom	8.4	2.3	30%	39%	9%	1%	10%	9%	34%	50%	16%
Dining Room	3.5	3.0	20%	21%	1%	0%	13%	13%	23%	35%	12%
Exterior	4.7	5.8	22%	24%	2%	1%	11%	10%	25%	35%	10%
Kitchen	6.6	4.2	33%	27%	(5%)	8%	17%	9%	55%	55%	--
Living Space	7.1	3.5	34%	35%	1%	1%	14%	13%	37%	52%	15%
Other	16.0	1.9	27%	31%	4%	1%	9%	8%	46%	58%	12%
<b>Total</b>	<b>53.6</b>	<b>2.9</b>	<b>28%</b>	<b>31%</b>	<b>3%</b>	<b>2%</b>	<b>12%</b>	<b>10%</b>	<b>39%</b>	<b>51%</b>	<b>12%</b>

<sup>1</sup> Average HOU per day for energy-efficient bulbs adjusted for snapback.

## HOU UPDATES

To estimate updated HOU, we calculated the proportion of bulbs in each room by bulb type (separately for CFLs and LEDs).

*Formula:*

$$\text{Proportion of bulbs per room} = \frac{[(\text{Room Saturation in 2016}) * (\text{2016 Socket Count})]}{(\text{Total CFL/LED Socket Count})}$$

As an example, here we provide the calculations for LEDs for bathrooms—note that 6.4 represents the average number of LEDs across all room types. The calculations for other bulb categories were carried out similarly. As the calculations show, LEDs in bathrooms account for 16% of all LEDs installed in 2016.

**Bathroom:** 14% \* 7.3 (LED saturation times socket count in bathrooms) = 1.02 (LED count in bathrooms)  
 1.02 / 6.4 (LED count in bathrooms divided by LED count in all room types) = 16% (proportion of all LEDs that are in bathrooms)

---

energy-efficient products are installed and result in reduced overall energy savings. For more details, please refer to the Northeast HOU Study.

Table 2 provides the results of these calculations for each bulb category type as well as the snapback-adjusted HOU by room and the resulting household HOU estimate. To calculate a household HOU estimate, we simply multiplied the snapback-adjusted HOU for each room by the proportion of bulb gains and summed the results. This provides us with a weighted average HOU for bulb gains.

**Table 2: Proportion of Bulbs by Room and Type**

Room Type	HOU Study	Proportion of Bulbs	
		CFLs	LEDs
Bathroom	2.0	14%	16%
Bedroom	2.3	20%	13%
Dining Room	3.0	4%	7%
Exterior	5.8	7%	8%
Kitchen	4.2	11%	18%
Living Space	3.5	15%	16%
Other	1.9	30%	23%
<b>Household HOU Estimate</b>	<b>2.9</b>	<b>2.8</b>	<b>3.0</b>

We compared the calculated household HOU estimates to those provided in the Northeast HOU Study. In the HOU study, the household snapback-adjusted HOU provided for energy-efficient bulbs was 2.9 hours per day with a 90% confidence interval of 2.8 to 3.0. This equates to 1,059 hours per year with a 90% confidence interval of 1,022 to 1,095.

Based on the calculations in this memo, we estimate that HOU for 2016 break down as follows:

- CFLs: 2.8 hours per day or 1,022 hours per year
- LEDs: 3.0 hours per day 1,095 hours per year

If we assume the confidence interval from the HOU study still applies, we would assume the 90% confidence interval for CFLs and LEDs would be as follows:

- CFLs: 2.8 (2.7 to 2.9)
- LEDs: 3.0 (2.9 to 3.1)

## Conclusions

### Upstream Lighting Programs

- CFLs
  - Estimated HOU for CFLs should be revised downward (by about 3%) for any retrospective (such as the 2016 Annual Report) or prospective CFL savings calculations. However, because the PAs plan to end supporting CFLs as part of the upstream program in 2017, there may be no prospective CFL savings calculations.
- LEDs
  - Estimated HOU for LEDs should be revised upward (by about 3%) for any retrospective (such as the 2016 Annual Report) and prospective LED savings calculations. However, we must consider the likelihood that LEDs will continue to replace CFLs and may reduce the HOU over time. We should continue to monitor LED installations for potential future shifts.

### Direct-Install Lighting Programs

- We do not recommend any changes for direct-install lighting programs. For these programs, the PAs should continue to use the all-bulb HOU estimates provided in the HOU report. For the household level, this estimate is 2.7 (see Table ES-1 in the HOU report). However, whenever possible the PAs should track installed bulbs by room type and apply the room-specific HOU estimates also found in Table ES-1.