



Northeast Residential Lighting Strategy: 2013-2014 Update

Northeast Energy Efficiency Partnerships
October 2013

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Critical Analysis & Support From:

About NEEP

NEEP was founded in 1996 as a non-profit whose mission is to serve the Northeast and Mid-Atlantic to accelerate energy efficiency in the building sector through public policy, program strategies and education. Our vision is that the region will fully embrace energy efficiency as a cornerstone of sustainable energy policy to help achieve a cleaner environment and a more reliable and affordable energy system.

ACKNOWLEDGEMENTS

The Northeast Residential Lighting Strategy was published to address the role of high efficiency lighting products in capturing all cost-effective energy efficiency in the region while also providing broad energy, economic, and environmental benefits. This document provides regional and national updates to the original document finalized in March 2012 and the 2012-2013 Update finalized in December 2012. This report reflects the invaluable contributions of multiple individuals. Claire Miziolek, NEEP's Residential Program Manager, served as the report's project manager. The content was guided by critical analysis and support from the project team:

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INTRODUCTION

Welcome to the second update to the Northeast Residential Lighting Strategy. In 2013, while thinking about the Residential Lighting needs for the Northeast and Mid-Atlantic, we realized that the market for efficient residential lighting had changed dramatically since the release of the 2012-2013 Update, and had changed tremendously since the original RLS which was based on data from 2011. With these major developments, especially with regards to the viability of LED products in the residential market, we determined that a 2013-2014 Update was necessary for the Northeast to achieve continued success in transforming the efficient lighting market. This report is meant to complement and enhance the previous iterations, not replace them.

This report is intended to provide direction and support for energy efficiency program administrators (PAs), provide insight to regulators and evaluators, and be a planning tool for policymakers. Additionally, this document is intended to push this region to reach the full potential of residential lighting efficiency and is informed by regional stakeholders, NEEP Staff, and analysis from Optimal Energy and Energy Futures Group.

With regards to our regional goal of achieving 90 percent socket saturation of high efficiency lighting by 2020, we believe this remains a prudent, albeit ambitious, goal. We realize that while the efficient technologies are advancing in our favor, progress towards higher socket saturation has stalled. We believe however that through effective implementation of the recommended strategies laid out in this RLS update, a regional push through the current stagnation is possible and that the 90 percent socket saturation goal by 2020 remains achievable. There have been several unforeseen barriers that have made it challenging to reach this goal. While the production of 100W and 75W incandescent bulbs has been barred, the availability of these products is considerable. We are still finding inefficient options on many retail shelves, and while programs have accounted for a level of lag in their disappearance from shelves, it has taken longer than initially anticipated. Additionally, halogen bulbs that meet the EISA requirements are readily available with low price points and ample marketing of their “energy saving” capabilities.

While new LED technology is being released, especially A-Lamp styles that are well suited to replace holdover incandescents, the process of getting these lamps ENERGY STAR certified is ongoing. For example, in March, 2013 Cree announced a partnership with the Home Depot for a 40W equivalent LED to be commercially available under $10.[1] However, it was not un-

1 http://www.cree.com/news-and-events/cree-news/press-releases/2013/march/bulbs

til October, 2013 that this product was certified by ENERGY STAR[2], thus ensuring the product met rigorous quality measures and could potentially enter efficiency program portfolios. Many other new LED products that have generated excitement are still in the ENERGY STAR testing phase and therefore not yet promoted via efficiency programs, though this should change considerably in the next 6-12 months.

Other pockets of sockets that require additional attention include those with dimmers and in Residential New Construction. About 12 percent of residential sockets are controlled by dimmers,[3] and while LED technology can inherently be dimmed effectively, many of the currently installed dimmers are not compatible with the new technology. This presents a potential area of increased focus that this report seeks to analyze. Additionally, stronger building codes—including the 75 percent efficient lighting provision in new construction as part of IECC-2012 compliance—are making progress toward the 90 percent socket saturation goal; while filling more sockets, into the future efficiency programs may not be able to claim much savings above and beyond compliance for efficient lighting measures in RNC.

Finally, consumer education around efficient lighting continues to be a challenge. With more CFL and LED options than ever, and the halogen marketing purporting their environmental benefits (not to mention having the look and feel of a traditional incandescent), the lighting aisle has never been so confusing. As addressed in the 2013 Northeast Residential Lighting Workshop,[4] the efficient lighting industry needs to work together to give consumers appropriate guidance to make the right choices.

Despite these additional and in some cases unexpected challenges, we think that the region can still push forward to achieve 90 percent efficient lighting socket saturation by 2020. Socket saturation continues to be measured in most of the Northeast Mid-Atlantic region, and although socket saturation appears to have stagnated in the region around 30 percent, there is evidence in California that socket saturation continues to climb, reaching 40 percent in some areas. We think that LEDs may enable greater socket saturations, as they can be closer replacements to the incumbent incandescent, however we have only begun to promote LEDs. We think that in the next few years we should have a much clearer idea of whether stagnated socket saturation is a temporary or long-term trend in this region. We will continue to closely monitor data and trends and consider changes to the RLS goal in future RLS updates.

What is Covered in this Update

In response to the changes in the residential lighting landscape, this report seeks to provide the most relevant and useful information possible. Some of the primary information includes:

2 http://ledsmagazine.com/news/10/10/6
3 DOE 2010 US Lighting Market Characterization, January 2012 http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2010-lmc-final-jan-2012.pdf
4 http://neep.org/neep-events/annual-residential-lighting-workshop/2013-res-lighting-workshop

- Recent developments in efficiency program design for residential lighting in the Northeast-Mid-Atlantic region
- Analysis of the potential impact of relevant policy, regulatory, evaluation, measurement, and verification activities
- Updates and analysis on recent key developments, events, and changes in the residential lighting industry landscape
- Updated estimates of regional lighting savings potential and the associated implications for efficiency programs
- Expansion upon and revision of the strategic recommendations from the original RLS and the 2012-2013 Update

While the analysis and critical thinking of the RLS is applicable for the entire Northeast and Mid-Atlantic region, the data for our analysis came from the following states: Connecticut, the District of Columbia, Massachusetts, New York, New Hampshire, Rhode Island, and Vermont.

To fully achieve the high levels of remaining residential lighting savings, NEEP recommended a set of comprehensive strategies and highlights specific trends, policies, and activities that the region should be considering. Overall, we have found that the residential lighting market has a long way to go towards being transformed, and efficiency programs continue to have a very meaningful role to play in accelerating the uptake of efficient residential lighting. We hope this update will be a useful tool for the region and encourage continued collaborations, conversations, and stakeholder engagement in this space.

EXECUTIVE SUMMARY

Welcome to the second update to the Northeast Residential Lighting Strategy. The market for efficient residential lighting had changed dramatically since the release of the 2012-2013 Update, and had changed tremendously since the original RLS which was based on 2011 data. This report is intended to help stakeholders navigate through these changes, provide direction and support for energy efficiency program administrators (PAs), offer insight to regulators and evaluators, and be a planning tool for policymakers. Additionally, this document intends to push the region to reach the full potential of efficient residential lighting and is informed by regional stakeholders, NEEP Staff, and analysis from Optimal Energy and Energy Futures Group. Overall, we have found that the residential lighting market has a long way to go towards being transformed, and efficiency programs continue to have a very meaningful role to play in accelerating the uptake of efficient residential lighting.

Residential Lighting continues to play a major role for Northeast Mid-Atlantic savings beyond just the retail lighting programs, especially with low income, direct install in RNC, multifamily, and single family retrofit. Programs continue to support CFLs and are increasingly supporting LEDs with program lamp sales ranging between 0.6 and 2.6 efficient lamps per household. All PAs in the regional are now supporting LEDs at retail, ranging from 1 to 16 percent of lighting portfolios. Nearly all PAs are excluding ENERGY STAR non-standard lamps from their programs. Education continues to be a priority, with nearly all PAs using the 'FTC Lighting Facts Label' and 'lumens, not watts', to help consumers select the right lamp. Programs in this region are maturing, making long term plans, and taking alternative approaches to achieve their savings goals.

2013 Efficiency Program plans for the region average at 1.5 efficient bulbs/household. The average planned incentives are $0.94 for standard CFLs, $4.11 for specialty CFLs, and $14.88 for LEDs. Multi-year program plans for MA, RI, and CT were reviewed and demonstrate the need for an aggressive shift towards LEDs and continued creativity to achieve savings from residential lighting. As the market grows more complex, the need for efficiency programs to transform the market continues to be critical.

Beyond plans, many states recently completed evaluations and studies. Since the completion of the 2012 RLS Update, socket saturation surveys were completed in Massachusetts, New Hampshire, and New York (NYSERDA). These studies point to the trend of continued stagnation, largely considered attributable to CFLs replacing failed CFLs. Several recent HOU studies have also been done and results indicate lower estimates than most of what the Northeast Mid-Atlantic PAs are using. As such, there are many region-specific HOU studies that are ongoing. In 2014 we should have a much better understanding of appropriate HOU estimates for the Northeast and Mid-Atlantic region. In addition to HOU studies, other lighting program evaluation and market research studies have recently been completed or are

on-going. Those include a NYSERDA comprehensive evaluation of retail lighting program, several MA retail lighting evaluations, and a MA LED bulb dimmer compatibility pilot which demonstrated challenges with dimmer compatibility.

In addition to program activities, policy and codes developments were also taken into account for our analysis. The EISA manufacturing ban on 75 and 100 watt lamps has shown a lag in the remaining inventory for inefficient options. For buildings codes, all states included in the RLS analysis have adopted IECC 2009 which requires 50 percent of lighting in permanent fixtures to be high efficacy. IECC 2012, which has been adopted in MA and RI, pushes that requirement to 75 percent of the lighting in residential new construction that must be efficient.

As the industry landscape for residential lighting is rapidly evolving, we analyzed several new considerations. For lamp specifications, we considered the new ENERGY STAR Lamp Version 1.0, the California Quality LED Lamp Specification, and the CEE Advanced Lighting Initiative. While the technology neutral ENERGY STAR specification does not push the envelope of what efficacy levels LEDs can achieve, if does include many critical quality measures. The CA LED specification is limited to ENERGY STAR products with >90 CRI and only 2,700K and 3,000K lamps; this may result in challenging implementation based on limited product availability. The CEE Advanced Lighting Specification is not finished, but may help programs achieve higher savings with a potentially higher efficacy baseline.

LED products are the fastest changing factor in the residential lighting market. Some of these products are of high enough quality to replace incandescent lamps with little or no discernible difference, while others fall short on performance metrics such as lumen output, temperature, and color rendering. New products are being introduced very rapidly and more LED options exist now than ever. Analysis of the Lighting Facts database shows that LED lamp color tends to fall in the 2700K or 3000K buckets and color rendering index tends to be between 80-90 CRI. The efficacy of LEDs continues to increase and in many cases exceeds even the best CFL products. The price of LEDs is falling quickly, with forecasts projecting LED prices to be comparable to CFL as soon as 2015 and prices of all LED components are expected to drop significantly. Dimming successfully continues to be complicated for LEDs, especially when dimmable LEDs are coupled with older dimmers that are incompatible. While many products are being labeled with the dimmers they are compatible with, dimming is an area of continued interest for efficiency programs.

ENERGY STAR does not only qualify products, but also runs quality assurance tests to ensure the products on the market are meeting consumer and PA expectations. New CFL testing results have been released and disclose which products failed and why. A new LED test procedure has been completed, though results on the products tested against it are not expected until 2014. Other organizations working in the LED space include TopTen USA, which has ranking lists for LED Par30 and Par38 lamps, as well as the Department of Energy (DOE).

The DOE's Technical Information Network on Solid State Lighting (TINSSL) is a key resource on research and developments within SSL. Some recent DOE SSL developments include the new L-Lamp prize for Par38, the completed Life-Cycle Impact study, as well as research on Optical Safety of LEDs.

With all of these recent landscape changes, we have updated our regional savings and costs projections as well as adjusted some of our assumptions and emphasis. A high-level modeling analysis brings together all the latest information on CFL and LED pricing and efficacy trends, net-to-gross evaluation findings, and expectations about the number of bulbs that could move through efficiency programs. Unlike the original RLS and the 2012 Update, this latest savings forecast, shows steadily rising savings followed by a long plateau at a consistently high level of annual savings potential. The net effects of the changes to our assumptions are greater savings, both annual and lifetime, but also greater incentive spending, especially in the near term. In contrast to the initial RLS and the 2012 update, this latest forecast finds costs to attain residential lighting savings will decrease over time as measured on a per net kWh basis ($/net kWh). The lower, and steadily declining, costs per kWh reinforce the fact that efficient lighting will continue to be an important and cost efficient resource in PAs' residential portfolios.

Finally, we have revisited our original recommendations and added three new strategies to help achieve success in efficient lighting in the Northeast Mid-Atlantic Region. While NEEP's ultimate goals in residential lighting go beyond the goals of PAs, efficiency programs continue to play a crucial role to accelerating the uptake of efficient residential lighting. Through implementation of these strategies, rapidly shifting towards LED promotion, and regional collaboration, the Northeast Mid-Atlantic region can achieve success in transforming the market for residential lighting.

New Recommendation #1

- Accelerate use of ratepayer funds to support LED technology in near-term due to rapidly dropping price and superior performance over CFL. PAs should develop long-term strategies to shift away from CFLs.

New Recommendation #2

- Partner with manufacturers, retailers, and ENERGY STAR to improve marketing, messaging, and education on key issues, including dimmer compatibility, using the right lamp for the application, and the most efficient lamp choices.

New Recommendation #3

- Leverage markdown and buy-down agreements to specifically promote higher quality, and lower cost LED lamps to reduce program incentive costs, product costs, and increase consumer adoption.

Existing Recommendations to Remain:

- Consider adoption of creative or alternative program and promotional approaches and/or markets to maximize impacts while minimizing potential free-ridership.
- Support adoption and implementation of strong lighting efficiency requirements in building energy codes to help increase socket saturation of efficient lighting in new construction.
- Ensure that PA efforts are focused on promoting quality lighting products using ENERGY STAR as a key indicator of product quality.
- Develop and implement regional systems to track key product and market data to inform program design, implementation, and evaluation.
- Continue to engage regulatory bodies early to reinforce the need for continued and aggressive PA engagement in the residential lighting market and to limit regulatory uncertainty.
- Continue regional lighting engagement on an on-going basis.

UPDATE ON REGIONAL RESIDENTIAL LIGHTING PROGRAM ACTIVITY

Lighting Continues to Drive Savings for Program Administrators

Efficient lighting measures continue to drive savings for most program administrators' residential and low-income portfolios. As in the past, efficient lighting continues to contribute a disproportionate amount of savings relative to its share of residential electricity usage. As an example, Tables 1 and 2 show the planned 2013 annual savings coming from both retail lighting programs and from all lighting activity in Massachusetts and Rhode Island. Of note is that lighting plays a critical role in non-retail lighting programs, including low income/income eligible programs. In Massachusetts lighting from all programs represents 59 percent of the PAs' 2013 residential annual saving goals and 63 percent of their low income goals. Direct install lighting efforts in the MA PAs' new construction, multifamily, and single family retrofit (Home Energy Services) programs represent 71 to 79 percent of the planned annual savings for those programs.

Table 1: 2013 Massachusetts Residential and Low Income Lighting Annual Savings

2013 Savings	Annual MWh	Lighting MWh	Lighting % of Total Savings	Lighting % of Total Non-Behavioral
A: Residential	**311,994**	**182,538**	**59%**	**86%**
Residential New Construction	4,603	3,589	78%	
Residential Cooling & Heating Equipment	5,152	0	0%	
Residential Home Energy Services	28,677	22,797	79%	
Residential Multi-Family Retrofit	14,844	10,548	71%	
Residential Behavior/Feedback	99,551	0	0%	
Residential Lighting	145,604	145,604	100%	
Residential Consumer Products	13,564	0	0%	
Low Income	**27,228**	**17,257**	**63%**	
Low-Income New Construction	1,144	1,020	89%	
Low-Income Single Family Retrofit	12,079	6,893	57%	
Low-Income Multi-Family Retrofit	14,005	9,344	67%	

For Rhode Island, lighting savings from all program activities represents 59 percent of 2013 non-income eligible residential savings and 60 percent of income eligible savings. Direct install lighting efforts in the Rhode Island's new construction, multifamily, and single family retrofit (EnergyWise) programs represent 63 to 83 percent of the planned electricity savings for those programs.

Note that for both Massachusetts and Rhode Island that when behavioral program savings – which currently have a one year measure life – are excluded, lighting represents 86 percent

of Massachusetts residential sector annual savings and 82 percent of Rhode Island non-income eligible annual savings.

Table 2: 2013 Rhode Island Residential and Low Income Lighting Savings

2013 Savings	Total Sector/ Initiative Annual MWh	Lighting MWh	Lighting % of Total Savings	Lighting % of Total Non-Behavioral
Residential New Construction	883	557	63%	
ENERGY STAR HVAC	513	0	0%	
EnergyWise	7,059	5,893	83%	
EnergyWise Multi-Family	2,129	1,662	78%	
Behavior Feedback	15,325	0	0%	
ENERGY STAR Lighting	24,757	24,757	100%	
ENERGY STAR Appliances	4,872	0	0%	
Non-Income Eligible Residential Total	**55,538**	**32,868**	**59%**	**82%**
Single Family - Income Eligible	4,131	2,171	53%	
Income Eligible Multifamily	2,057	1,539	75%	
Income Eligible Residential Total	**6,188**	**3,710**	**60%**	

Continued Program Support for CFLs and Growing Support for LEDs

Efficient lighting program efforts continue to expand throughout the region, subject to budget constraints in some states. 2013 program administrator (PA) activity highlights include the inclusion of LEDs in all PAs' retail lighting programs and in many low income, multifamily, existing home retrofit, and new construction programs. Additionally, Market Lift and Revenue Neutral program models work to address the problem of high CFL free-ridership rates and the difficulty of calculating those rates.

There is an enormous amount of activity in the lighting programs throughout the Northeast Mid-Atlantic region. In PA's 2013 planned and on-going program efforts and in 2012 reported programs, we have found a wide range of promotion. The 2013 support on all efficient lighting products at retail varies from 0.6 units/household (New Hampshire) to 2.6 units/household (Efficiency Vermont) based on PAs' filed plans. 2012 retail lighting support for Massachusetts and Connecticut was at 2.3 units/household, and 1.9 units/household for Rhode Island.

In LED promotion and lamp retail support, the DC Sustainable Energy Utility (DC SEU) added LEDs to its retail lighting program for 2013; now all PAs' in the region are supporting LEDs at retail. LEDs represent about four percent or the region's projected retail lighting program activity in 2013. On a state or PA basis, the share of LEDs in varies from 16 percent (Long

Island Power Authority, LIPA) to one percent (DC SEU and NYSERDA). Beyond retail, many PAs will offer LEDs as a direct install option as part of their low income, existing home, or residential new construction programs. National Grid RI is currently installing about three LEDs per participant in its EnergyWise existing home retrofit program. Connecticut PAs are offering LEDs as an option — with a customer co-pay — under their Home Energy Solutions (HES) existing homes retrofit program. Offering LEDs is currently an option for HES vendors. In late July, Connecticut Light and Power agreed to rebate the full LED co-pay for HES participants that installed vendor recommended insulation upgrades. This promotion, effective through September 30, was good for up to $500 of installed LEDs.

For education and promotion consistency, nearly all PAs have continued to exclude ENERGY STAR non-standard lamps from incentive eligibility. Nearly all PAs have educational materials helping consumers interpret and use the Federal Trade Commission's Lighting Facts Label and to use lumens, rather than watts, as the primary means to select the right lamp. Several PAs provide, or plan to provide, consumer point-of-sale information on LED dimming and dimmer compatibility. Massachusetts and LIPA PAs have also started to use a Light Bulb Finder App to help consumers find the right product for their application (more information in Appendix B).

Many Northeast Mid-Atlantic programs are maturing and taking alternative approaches to achieve their savings goals. Connecticut's first Three Year C&LM Plan includes two different budget and savings scenarios. For 2013 the level of proposed retail lighting program activity varies nearly two-fold between the two scenarios (more information in Multi-year Program Plans). Efficiency Vermont, which had previously been promoting CFL distribution at food banks, now has a defined hard to reach lamp category for planning and reporting purposes. Various market-lift type efforts continue in several states, including NY (NYSERDA), and pilot projects in Vermont (Efficiency Vermont) and the Massachusetts programs administrators. The pilots have generally proven to be more difficult to implement than initially anticipated. The Efficiency Vermont Pilot with one retailer and the Massachusetts pilot with another retailer are ongoing through spring of 2014. A report on results of these pilots is expected in June 2014. NYSERDA, in response to regulatory direction to cease continued support for standard CFLs, is in the process of developing and implementing a Sales Performance Program which would function similarly to Market lift. NYSERDA issued an RFP[5] for this model in June 2013.

A comprehensive listing of 2013 Northeast Residential Lighting Efficiency Program Elements can be found in Appendix A.

5 http://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities/PON-2700-CFL-Sales-Performance-Program.aspx

Planned 2013 PA Retail Lighting Program Activity

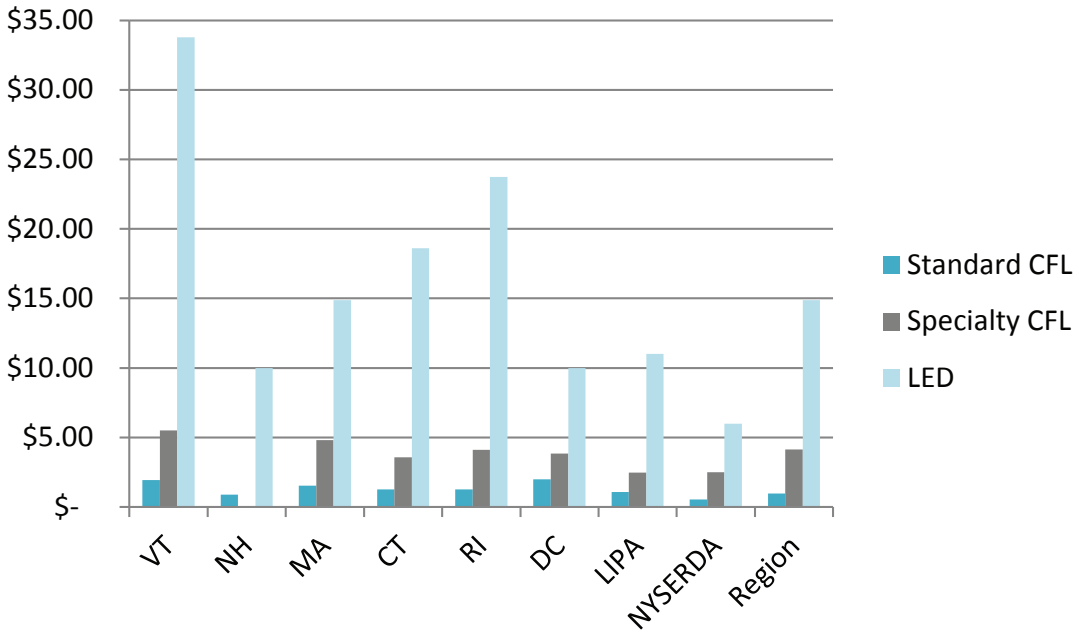
For 2013, there are considerable variations in planned PA program activity based on a comparison of the number of efficient lighting units per household (units/HH) that the PAs in each state plan to incent (Table 3). Region wide, PAs plan to promote 1.5 units/HH in 2013. Program activity varies from 0.6 units/HH (New Hampshire) to 2.6 units/HH in Vermont. In addition to Vermont, PAs in Rhode Island and Massachusetts plan to incent more than two units per household in 2013. Note that the projections for Connecticut reflect the lower, Base spending scenario filed by the CT PAs. The August 23 draft decision on the CT PAs' Three-year Plan indicates initial regulatory direction towards a more aggressive retail lighting program generally consistent with the Companies' expanded budget scenario, though with a greater emphasis on LEDs (see the review of Multi-year Program Plans for additional detail on the draft decision).

Table 3: Planned Program Administrator Retail Lighting Goals

State	CFL Units	LED Units	Total Units	Units/ HH
CT	1,934,787	74,683	2,009,470	1.5
DC	280,000	3,000	283,000	1.1
MA	5,297,669	257,508	5,555,177	2.2
NH	321,521	12,896	334,417	0.6
NY-LIPA	1,555,000	300,000	1,855,000	2.0
NY-NYSERDA	7,595,032	100,000	7,695,032	1.2
RI	885,300	16,000	901,300	2.2
VT	576,990	91,800	668,790	2.6
Region	**18,446,299**	**855,887**	**19,302,186**	**1.5**

Similarly, there was significant variation in the PAs' proposed incentive levels (Figure 1) for LEDs, standard CFLs, and specialty CFLs. On a region wide basis the average planned incentives for LEDs is $14.88. For CFLs the average planned incentive is $0.94 for standard CFLs and $4.11 for specialty CFLs. Note that the actual PA average incentive amounts paid typically tend to be lower than PAs' planning assumptions.

Figure 1: Planned 2013 Program Administrator Retail Lighting Incentive Levels



Multi-year Program Plans

Multi-year program plans were reviewed for Massachusetts, Rhode Island, and Connecticut for any additional information to inform the RLS analysis. For both Massachusetts (2013-2015) and Rhode Island (2012-2014), the level of activity shown in their plan generally aligns with RLS projections, but more weighted to CFLs than proposed in this RLS update. It is important to note that these plans were written in 2011-2012 while it was still unclear as to how quickly LEDs would become a viable technology for programs. We have since confirmed with both Massachusetts and Rhode Island PAs that they intend to shift their promotions much more towards LEDs than is indicated by their Three Year Plans.

The proposed Connecticut Energy Plan continues to be reviewed and has not yet been approved. As a possible harbinger of things to come, the Connecticut Department of Energy and Environmental Protection (DEEP) released its draft decision on the Companies' Three-year Plan (2013-2015) on August 23, 2013. The retail lighting program received considerable scrutiny and comment from DEEP staff and it explicitly notes a greater interest by regulators in promoting LEDs. Key comments and Conditions of Approval included:

- Possible reduction in lighting program support starting in 2016 depending on the degree of "market movement". This would allow a re-allocation of budget to other measures
- Increased focus on LEDs, including higher 2013 program budget
- Cessation of program support for dimmable CFLs
- Increased need for customer marketing and education to target customer segments that have not been installing efficient lighting

- Request that Companies propose an alternative to energy savings for the Efficient Products program for the purpose of determining shareholder incentive payments

All state plans will continue to be reviewed closely for their implications in the Residential Lighting Strategy analysis, but at present point to the need for an aggressive shift towards LEDs and continued creativity to achieve savings from residential lighting. As the market grows more complex, the need for efficiency programs to transform the market continues to be critical.

RECENT AND PLANNED PROGRAM EVALUATION AND MARKET RESEARCH ACTIVITY

Regional PAs continue to devote significant resources to the evaluation of their retail lighting programs. Several studies have been completed in the past year and several key studies are ongoing. Of particular note is a multi-state hours of use (HOU) study that will be completed early 2014. The results of this study will inform gross savings estimates in several Northeast Mid-Atlantic states. We have summarized recently completed as well as planned program evaluation and market research studies that impact this reports recommendations and analysis.

Socket Saturation Surveys

Since the completion of the 2012 RLS Update, socket saturation surveys were completed in Massachusetts [6], New Hampshire[7], and New York (NYSERDA)[8]. The Massachusetts study is noteworthy as CFL socket saturation has remained statistically unchanged over four years, despite the success of the MA PAs in promoting the sale of approximately 20 million CFLs in that time frame. The evaluation team concluded that[9]:

> *Based on the onsite analysis, the Team concludes that most households in Massachusetts use CFLs, even if some of them are dissatisfied with the products or are not aware that they are using them. Despite high rates of penetration (i.e., households using CFLs), the number of CFLs in use and the percentage of sockets in which they are installed appears to have leveled over the past three years, and there is evidence that recently purchased CFLs are largely being used to replace installed CFLs that have burned out. Between 2009 and 2010, statistically significant gains were made in increasing the number of specialty CFLs in homes, but this increase was not repeated between 2010 and 2013. LEDs remain an emerging technology in Massachusetts, with very few homes using any LEDs bulbs; most of the LED bulbs in use do not adhere to the A-line profile and are installed in track lighting or under cabinets. When considering the most energy-efficient bulbs types—CFLs, LEDs, and fluorescent tubes—saturation currently stands at around 40 percent. Most sockets in the state could still be converted to CFLs and LEDs using bulb shapes and sizes already available—and often program supported—at stores where consumers buy most light bulbs.*

Similarly, CFL socket saturations in NYSERDA's jurisdiction also appear to be stalled. While

6 Results of the Massachusetts Onsite Lighting Inventory. Final. Submitted to: Cape Light Compact, NSTAR, National Grid, Unitil, Western Massachusetts Electric, and Energy Efficiency Advisory Council Consultants. NMR Group, Inc. July 7, 2013. http://www.ma-eeac.org/Docs/8.1_EMV%20Page/2013/Residential%20Program%20Studies/Onsite%20Lighting%20Inventory%20-%20Results%20Final%20Report%206-7-13.pdf

7 New Hampshire CORE Residential ENERGY STAR® Lighting Program. Impact and Process Evaluation Report. Prepared for the New Hampshire Utilities. Prepared by DNV KEMA Energy and Sustainability. June 22, 2012 (http://www.puc.state.nh.us/Electric/Monitoring%20and%20Evaluation%20Reports/NH-RESLFinal%20Delivered%2010252012.pdf)

8 Summary of Preliminary Findings from the Residential Lighting POS Program Evaluation Study. To: Victoria Engel- Fowles, NYSERDA. From: Monica Nevius and David Barclay, NMR Group. July 23, 2013.

9 p 57. Results of the Massachusetts Onsite Lighting Inventory.2013 op. cit.

these findings are still preliminary and are subject to revision, the initial analysis of the onsite lighting inventory data found:

> *CFL socket saturation remained statistically unchanged between 2011 and 2013. CFL socket saturation among Upstate households was 25 percent in 2013, the same as in 2011*[10]

The 2012 RLS Update noted similar stalled socket saturations in Connecticut but not in Vermont. The 2012 Update posited a number of reasons as to why saturations may have stalled. Based on the most recent results from MA, CFLs replacing CFLs appears to be the single largest contributing factor to observed stalled CFL saturations as noted in the highlighted text above.

The small increases in socket saturation in Massachusetts and Connecticut may raise some questions as to how best to use socket saturation as a metric of residential lighting program performance. Conversely, system planners at the various regional and state level Independent System Operators (ISO) may need to reconsider how they assign savings for efficient residential lighting product. For example, ISO-New England assumes that once an efficient measure is installed that it will not revert to its previous inefficient state and that all new measure installations generate incremental increases in savings.

Hours of Use Surveys

While HOU estimates vary by state, several recent and ongoing HOU studies are working to identify accurate HOU estimates. As mentioned, there is a considerable amount of attention being paid to the multi-state hours of use (HOU) study that will be completed early 2014 which will inform gross savings estimates in several Northeast Mid-Atlantic states, however there have been several other studies looking at this issue.

New Hampshire Retail Lighting Evaluation: As part of a comprehensive process and impact evaluation of its CORE Lighting Program, the New Hampshire utilities completed an HOU study of 75 sites. Note that only program products, i.e., efficient lighting, was metered. The study yielded an estimate of 719 hours of annual usage (2.0 hours per day), considerably below the utilities' previous planning assumption of 1,241 annual hours (3.4 hours per day).

DOE Residential Lighting Usage Estimation Study: In late 2012 DOE completed a study that developed state-by-state estimates of per household residential lighting energy use[11]. The study leveraged a large 2009-2010 California HOU study and a number of regional and state-level lighting inventory studies. For the NEEP region, DOE's contractor DNV KEMA estimated

10 P iv Summary of Preliminary Findings from the Residential Lighting POS Program Evaluation Study. To: Victoria Engel-Fowles, NYSERDA. From: Monica Nevius and David Barclay, NMR Group. July 23, 2013.

11 Residential Lighting End-Use Consumption Study: Estimation Framework and Initial Estimates. Prepared for: Solid Sate Lighting Program, Building Technologies Program, Office of Energy Efficiency and Renewable Energy. U.S. Department of Energy. Prepared by DNV KEMA Energy and Sustainability and Pacific Northwest National Laboratory. December 2012.

1.5-1.6 hours of use per day for all installed lighting and 1.9 hours for CFLs. This compares to current retail lighting HOU planning values in the range of approximately 2.8 to 3.2 hours per day for most PAs with the exception of New Hampshire (2.0 hours cited above) and EVT which assumes 1.9 hours for CFLs and 3.4 hours for LEDs. The findings of this study, however, are pulled largely from a CA HOU analysis and may not be fully transferable to the Northeast Mid-Atlantic region. As such, there are several geographically specific studies that are ongoing and should help better determine the regional implications.

New England Regional Study: Program Administrators in New York (not including LIPA's service territory), Massachusetts, Connecticut, and Rhode Island are sponsoring a regional HOU study. A total of 587 sites were metered. As of the end of July meter extraction was almost complete. For this study all lighting, not just efficient lighting, was metered. This study also included a New York City multifamily high rise sample. The program contractor NMR will investigate the impact of building shading on lighting HOU in these buildings. Results should be available in January 2014.

MA Low-Income Study: The Massachusetts PAs are completing a lighting HOU study of low income residences. Preliminary results were being reviewed in late July and final results will be available later in 2013.

DOE Mid-Atlantic Study: DNV KEMA, funded by the DOE, is currently completing a residential lighting hours of use (HOU) study in New York, New Jersey and Pennsylvania. Data are currently being analyzed, and DNV KEMA continues to seek funding from others to integrate additional data into the DOE analysis.[12]

Overall, the range of findings points to a reliance on the ongoing geographically targeted studies to determine what is an appropriate HOU estimate for this region.

Other Studies and Evaluations

In addition to the above cited studies, other lighting program evaluation and market research studies have recently been completed or are on-going.

NYSERDA: NYSERDA is undertaking a comprehensive evaluation of its retail lighting program efforts. This includes onsite home inventories with estimation of socket saturations noted above, retailer and manufacturer interviews, net to gross estimation, store manager surveys, and consumer surveys in NYSERDA and Comparison areas. A final report is expected in January 2014.

Massachusetts Retail Lighting Evaluation: Several MA lighting studies were completed in 2013[13]:

12 DOE op. cit..
13 http://www.ma-eeac.org/EMV.html

- Lighting Early Impacts of EISA Final Report 6-12-13
- Residential Lighting Retailer Supplier Perspectives Final Report June 2013
- Residential Lighting Shelf Survey and Pricing Analysis Final Report 6-8-13

Massachusetts LED Bulb Dimmer Compatibility Pilot:[14] While LEDs generally dim better than their CFL counterparts, not all LEDs dim well, in large part due to lamp/dimmer compatibility issues. The Cape Light Compact (CLC) completed a limited (16 sites) Residential Lighting Controls Initiative field study that entailed pre-and post-metering of homes that had LEDs installed in dimming circuits with LED compatible dimmers installed. The field work was supported by laboratory testing that measured the relationship between power and illuminance and the dimming switch setting.

The impact findings were largely inconclusive as usable metered data could only be obtained from eight of the 16 sites and the metered energy savings were not disaggregated between the efficient lamp installation and the use of a dimmer. The CLC's evaluation contractor also fielded a short customer satisfaction and behavior survey. Key findings included:

- The majority of participants were satisfied with the new bulbs (14 of 16 participants) and the new dimmer controls (8 of 12 participants) installed through the initiative.
- Half of the participants noted behavior changes due to installation of the new bulbs, most notably that they used the dimmer at a lower setting because the lights are brighter.
- Feedback from interviews with the CLC manager and RISE staff substantiated that this technology is challenging to implement as a program at this time. The CLC manager noted the compatibility and logistics issues associated with implementation. RISE staff detailed the iterations necessary to achieve customer satisfaction with lamp color, lamp appearance, dimmer switch mechanism, and flickering issues resulting from certain product combinations.

Residential controls were also discussed at the 2013 Northeast Residential Lighting Workshop with many states around the region expressing potential interest in exploring this topic further.[15]

Regulation: EISA and Residential Building Codes

On the regulatory front, PAs are now contending with the second year of EISA. On January 1, 2013 the domestic manufacture and foreign import of 75 watt equivalent general service incandescent lamps was prohibited under EISA. Note that EISA is a manufacturing/import, not sales, prohibition. As noted in previous RLS documents, industry has responded by producing 28 -30 percent more efficient halogen incandescent lamps to meet the EISA wattage

14 Residential Lighting Controls Initiative Evaluation Final Report
15 http://neep.org/neep-events/annual-residential-lighting-workshop/2013-res-lighting-workshop

limits. Further, evidence from both shelf and consumer surveys (such as the MA study: Lighting Early Impacts of EISA Final Report 6-12-13) shows that non-complying 100 watt incandescents have remained in stock or on the shelf for nearly a year at some retailers. Several PAs have incorporated this inventory lag into their baseline and savings assumptions; in some cases by directly citing the original RLS study assumptions. The long-term implications of EISA are discussed more fully in the conclusion section and in Appendix E.

On the building code front, all of the states included in this analysis have adopted the 2009 version of the International Energy Conservation Code (IECC 2009). This code requires that 50 percent of lighting in permanent fixtures be "high efficacy" when the dwelling is complying under the Code's prescriptive requirements. However, these requirements do not apply if the dwelling is complying under a performance approach such as REScheck. The definition of high efficacy varies based on the lamp wattage, but is a minimum of 30 lm/watt.

Of potentially greater significance for PA program efforts, particularly their residential new construction (RNC) activities, is the projected impact of IECC 2012. This code requires that all low rise residential dwellings, regardless of the compliance approach chosen, must have 75 percent of lamps in permanent fixtures or 75 percent of fixtures be high efficacy. Given the contribution of lighting to overall RNC electric savings, this code requirement, once in effect and assuming proper enforcement, could have a large effect on future RNC program electric savings. Currently, Massachusetts and Rhode Island have adopted IECC 2012, though it is now concurrent with IECC 2009 until next July in Massachusetts.

RESIDENTIAL LIGHTING LANDSCAPE CHANGES

The Residential Lighting landscape is rapidly evolving; in addition to the advanced in LED technology, there are also new specifications, new products, and new partners to move the efficiency of residential lighting forward. We summarized and analyzed the most relevant new information that impacts that residential lighting landscape and helped influence the projections for the Northeast Mid-Atlantic.

Lamp Specifications

ENERGY STAR Lamps Specification Version 1.0

In August 2013, EPA released the final version of a new technology-neutral ENERGY STAR Lamps Specification Version 1.0.[16] The new specification will replace and merge the current Compact Fluorescent Lamps (V4.3) and Integral LED Lamp (V1.4) specifications. The new specification also creates new requirements for GU-24 base lamps. The final version specifies an effective date of 9/30/2014. Key changes/updates to the specification include:

- The new specification is largely technology neutral and requires the same efficacy levels for both LED and CFL lamps. These new efficacy levels represent nominal increases from those required in the previous ENERGY STAR LED and CFL specifications.
- The new specification increases the minimum rated life of CFLs to 10,000 hours for all CFL lamps types. The minimum rated life of LED remains the same as with the previous specification: 15,000 hours for decorative lamps and 25,000 hours for all other lamps.
- The new specification provides requirements for LED dimming and flicker.

California Quality LED Lamp Specification

In December, 2012 the California Energy Commission (CEC) published the Voluntary California Quality LED Lamp Specification[17]. While the California specification retains several ENERGY STAR requirements, there are key differences in requirements for color rendering and color temperature. The California specification requires >90 CRI and allows only 2,700K and 3,000K color temperature lamps. To coincide with the specification, the California Public Utilities Commission (CPUC) directed the state's largest utilities to "design a transition period of less than one year, in consultation with the CEC and Commission staff, after which they shall only offer incentives to LED bulbs that meet the California quality specification." According to this directive, California utilities may only offer incentives for lamps that meet the California Quality specification beginning in 2014. As of the writing of this report, there are two A-lamps available that qualify for the specification and questions as to whether the CA spec may be reconsidered.

16 https://www.energystar.gov/products/specs/lamps_specification_version_1_0_pd
17 http://www.energy.ca.gov/2012publications/CEC-400-2012-016/CEC-400-2012-016-SF.pdf

CEE Initiative: Advanced Lighting

In response to their member requests for a specification with higher performance requirements than the new ENERGY STAR Lamp Specification, The Consortium for Energy Efficiency (CEE) has begun work on a new Advanced Lighting Specification.[18] This new specification is under development but will initially apply only to lamps. It is not intended to replace the ENERGY STAR Lamps specification, but rather set higher performing criteria that can be used to identify lamp products that meet a higher level of performance. While the advanced performance metrics are yet to be finalized, the Advanced Lighting Specification may include higher efficacy requirements than ENERGY STAR. If so, energy efficiency programs may be able to realize higher energy savings by promoting products that meet the CEE Advanced Lighting Specification.

Product Developments and Trends

New Products

The residential lighting market continues to see many new LED products. Some of these are of high enough quality to replace incandescent lamps with little or no discernible difference, while others fall short on certain performance metrics such as lumen output, temperature, and color rendering. In addition to an evolution in performance characteristics, LED lamps continue to make inroads into new product categories. The following is a summary of some of the key product developments:

- 100 watt equivalent LED bulbs have finally entered the marketplace. As of October 2013, the LED Lighting Facts database currently lists fourteen different omnidirectional A-lamps with light output over 1600 lumens.[19] Furthermore, Philips (March), Feit Electric (July), GE (August), and Switch (October) have achieved ENERGY STAR qualification for their 100 watt equivalent LED bulbs. Notably, Switch's product produces 1755 lumens at only 20 watts.[20]
- The number of 75 watt equivalent ENERGY STAR LED bulbs is also increasing from the last RLS update. As of October 2013, there are 21 different omnidirectional A-lamps listed in the Lighting Facts database, and 13 that have achieved ENERGY STAR qualification.
- Both TCP, Inc. and SWITCH Lighting have recently released 3-way compatible LED A-Lamps, though neither has yet attained ENERGY STAR qualification.
- Recently, the first GU-24 base LED light engine appeared on ENERGY STAR's Certified Components Database (CSD)[21]. The product, from MaxLite, will make it easier and quicker to certify ENERGY STAR LED fixtures since many fixtures use the GU-24 base.

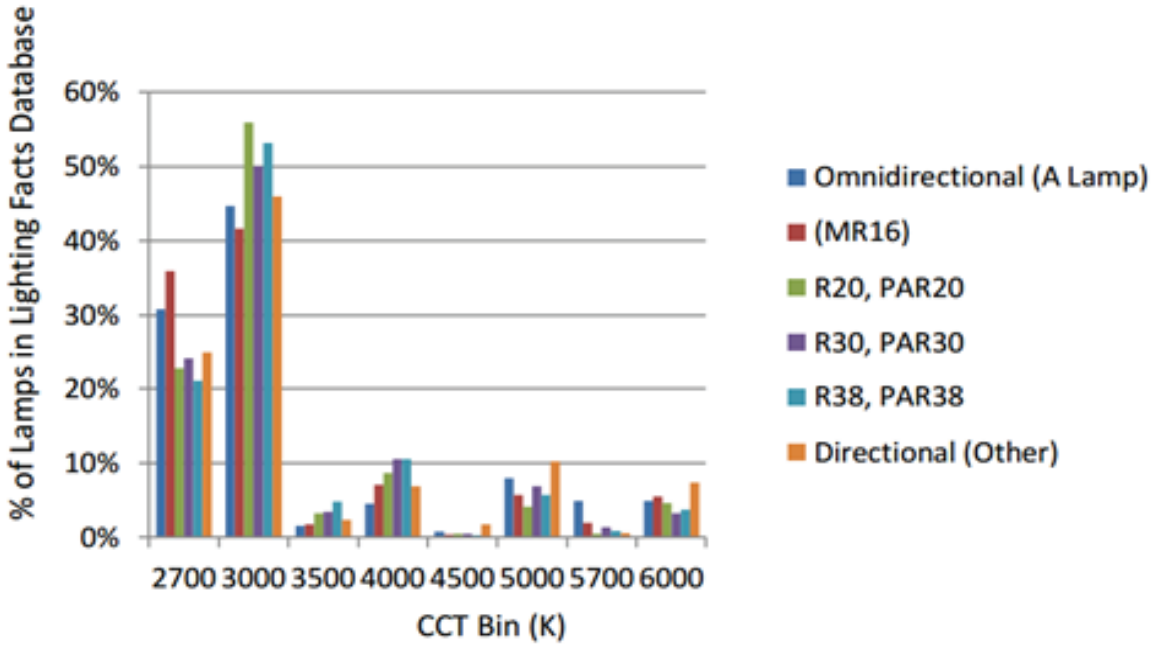
18 Information on the CEE Advanced Lighting Specification is available online to CEE Members in the CEE Member Forum
19 http://www.lightingfacts.com/download/products/all
20 http://downloads.energystar.gov/bi/qplist/Lamps_Qualified_Product_List.xls
21 The Certified Subcomponent Database (CSD) supports qualification of ENERGY STAR Luminaires by providing certified performance data for lighting subcomponents. The CSD is available online at:
http://downloads.energystar.gov/bi/qplist/certified_subcomponent_database.xls?da0f-3cdb

- New decorative LED lamps continue to offer aesthetic improvements to more closely mimic the filaments of the incandescent lamps they are intended to replace. This will allow for greater penetration of efficient lighting in applications where lamp aesthetics are important, such as chandeliers and decorative wall sconces.
- Many companies are debuting products with networking and wireless control features. The Philips Hue, with its smartphone-enabled color tuning, may be the most prominent.

LED Lamp Color

The trend in LED replacement lamps continues to be warm color temperature (2700k – 3000k). This is important as customers looking to replace their incandescent lamps expect a similar color of light. Figure 2 shows that most lamps in the Lighting Facts Database fall into the 2700k – 3000k range.

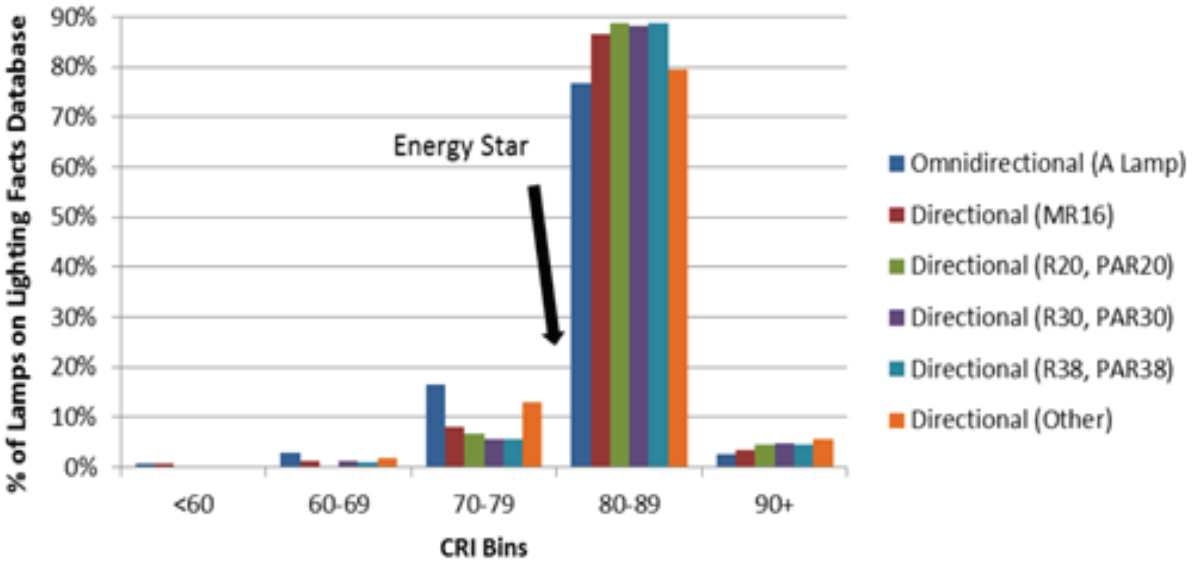
Figure 2: Distribution of LED Replacement Lamps across CCT Bins, by Lamp Type[22]



As Figure 3 shows, the majority of LED replacement lamps have a CRI between 80 and 90, above the minimum 80 CRI required by ENERGY STAR. Residential consumers in particular are accustomed to high CRI sources, as incandescent lamps (with 100 CRI) are still the predominant lamps.

22 Energy Solutions. May 2013. LED Replacement Lamps – Response to California Energy Commission 2013 Pre-Rulemaking Appliance Efficiency Invitation to Participate. pp 15 http://www.energy.ca.gov/appliances/2013rulemaking/documents/responses/Lighting_12-AAER-2B/California_IOUs_Response_to_the_Invitation_to_Participate_for_LED_Lamps.pdf

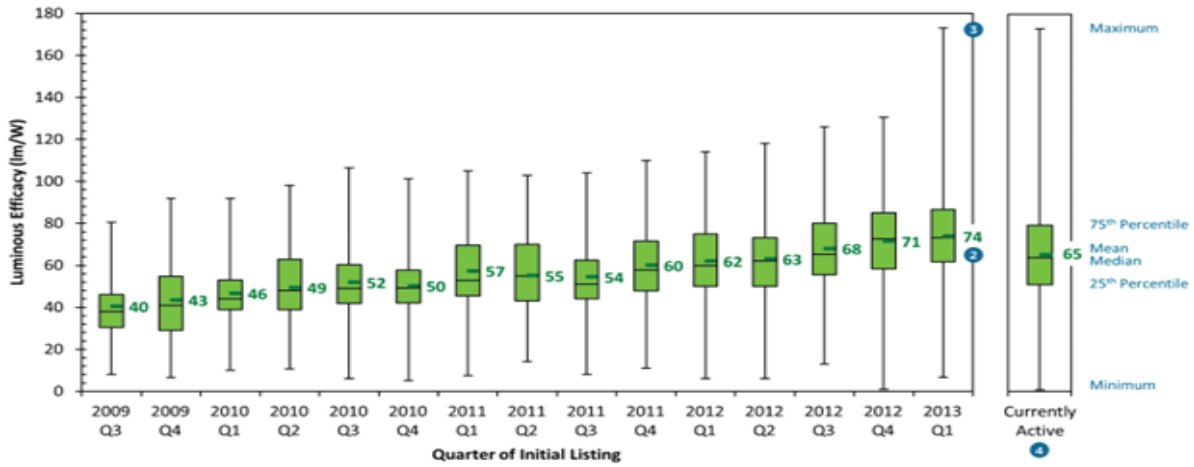
Figure 3: Distribution of Replacement Lamps across CRI Bins, by Lamp Type[23]



LED Efficacy Trends

The efficacy of LED lamps varies widely, depending both on the LED package itself as well as the lamp design. Despite that range, average efficacy continues to rise, while the efficacy of premium products continues to track, and in some cases outpace, the most optimistic forecasts. Many LED products already exceed the efficacy of the best CFLs. Figure 4 plots the range of efficacies for products listed in the Lighting Facts Database, by the date that they were added. Though the listed products include those for both residential as well as commercial applications, the general upward trend is indicative of the rising efficacy of residential lamps and luminaires.

Figure 4: Lighting Facts Efficacy Gains, All Products[24]



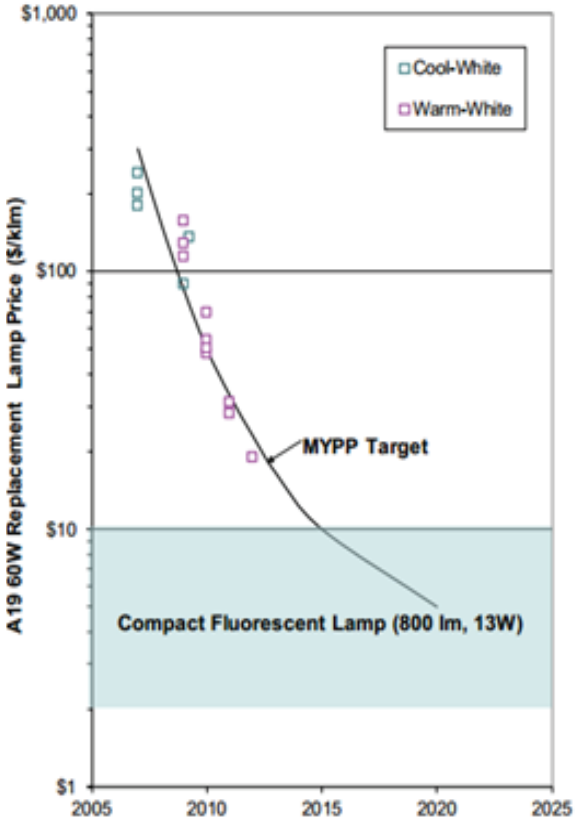
23 Ibid. pp19

24 http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/royer_lightingfactscaliper_lightfair2013.pdf

LED Lamp Pricing Trends

LED lamp prices are falling quickly due to improvements in luminous efficacy, increased production efficiency, and lower material costs. Figure 5 below shows the total cost per kilolumen, measured and projected, for white LED lamps. This forecast comes from the U.S. DOE's Solid State Lighting Research and Development Multi-Year Program Plan (MYPP), an annual publication which forecasts the rate of LED cost decline over time. Figure 6 suggests that if the price of LED replacement lamps continue to track closely to the MYPP forecast, LED lamps could become less expensive than some types of CFLs as soon as 2015. In fact, several new LED lamps have been recently introduced with price points approaching $10-15.[25],[26]

Figure 5: A19 Replacement Lamp Price Projection (60W Equivalent)[27]



While the price of LED replacement lamps has dropped considerably over the past few years, they remain significantly higher than alternative light sources as shown in Table 4.

25 http://ledsmagazine.com/news/10/3/9
26 http://www.technologyreview.com/view/512236/once-pricey-led-bulbs-to-dip-under-10/
27 DOE. April 2013. Solid-State Lighting Research and Development Multi-Year Program Plan. http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_mypp2013_web.pdf

Table 4: Comparison of Typical Market Prices for Various Light Sources[28]

Lighting Source	Price ($/klm)
Halogen Lamp (A19, 43W; 750 lumens)	$2.5
CFL (13W; 800 lumens)	$2
CFL (13W; 800 lumens dimmable)	$10
Fluorescent Lamp and Ballast System (F32T8)	$4
LED Lamp (A19, 12W; 800 lumens dimmable)	$19
CFL 6" Downlight (13W; T4; ~500 lumens)	$10
LED 6" Downlight (10.5W; 575 lumens)	$50
OLED Panel	$800
OLED Luminaire	$2,400

The pricing of LED A-type lamps has been reducing more rapidly compared to other LED replacement lamp types. A May 2013 statistical study by the California utilities found that the price of some ENERGY STAR PAR, BR, and decorative LED replacement remains significantly higher than many A-lamps. Table 5 provides the overall results of the pricing study:

Table 5: May 2013 Price Comparison of LED Lamps[29]

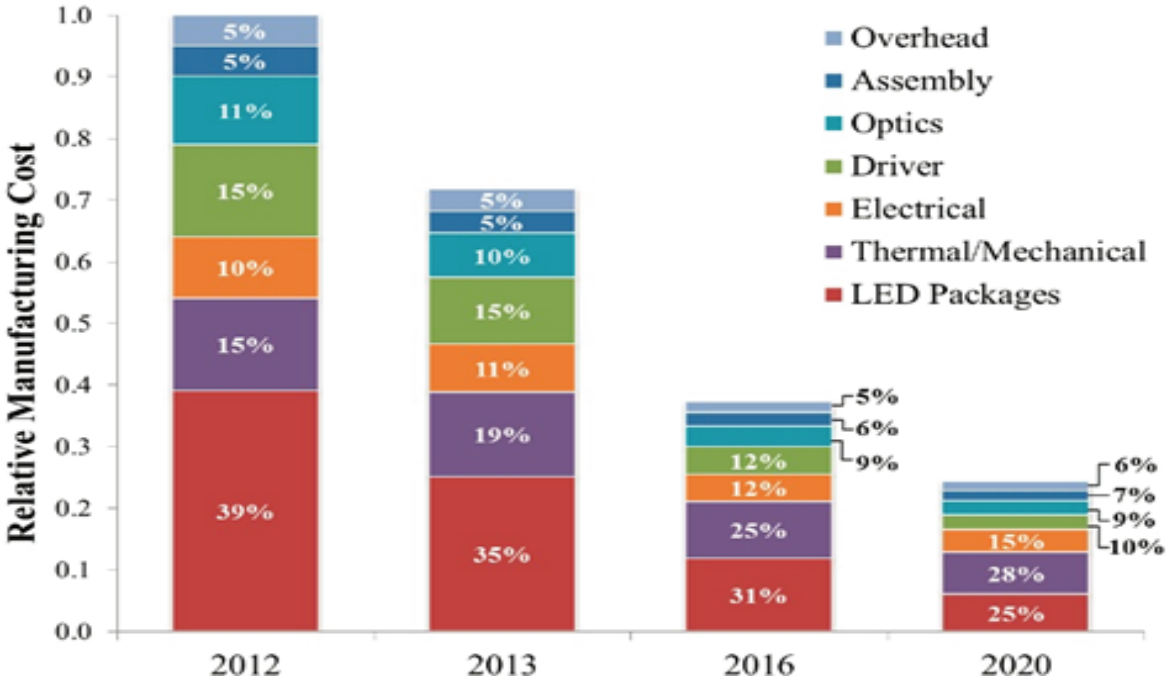
Shape	N (Number of Products)	Minimum Price ($)	Maximum Price ($)	Mean Price ($)	SE (% Mean)
PAR	247	$10.17	$114.01	$53.61	2%
A	148	$5.97	$62.79	$23.03	4%
MR	49	$13.26	$49.51	$29.51	3%
BR	19	$24.97	$92.94	$49.08	11%
Candle	16	$8.97	$20.39	$13.35	6%
G	5	$14.26	$34.75	$29.30	14%

As Figure 6 shows, there are many factors that contribute to the price of A-Lamp LEDs, but the September 2013 DOE SSL Research and Development Roadmap shows a significant decrease in all costs leading up to 2020, and already a significant price drop from 2012 to 2013.

28 DOE. April 2013. Solid-State Lighting Research and Development Multi-Year Program Plan. http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_mypp2013_web.pdf

29 http://www.energy.ca.gov/appliances/2013rulemaking/documents/responses/Lighting_12-AAER-2B/California_IOUs_Response_to_the_Invitation_to_Participate_for_LED_Lamps.pdf

Figure 6: Cost Breakdown Projections for a Typical A19 Replacement Lamp[30]



LED Lamp Dimming

Dimming remains an important consideration for residential lighting both from the perspective of the additional energy savings it offers and the installed base it represents. According to the 2010 U.S. Lighting Market Characterization[31], 12 percent of existing residential sockets are controlled by dimmers. The DOE's 2013 US Lighting Market Characterization study found that about 12 percent of residential sockets are controlled by dimmers.[32] As with CFLs, the lack of compatibility between the existing installed base of dimmers and new LED lamps is a significant challenge. Many existing dimmers were designed for very simple incandescent lamps and may not work with the more complex, smaller, non-linear loads of CFLs and LEDs. Further compounding this problem is that historically there has been wide variation between dimmer manufacturers in the electrical or electronic dimming methodology used by their dimmers.

To address this compatibility challenge, many manufacturers of LED lamps now provide a list of compatible dimmers on their websites. The forthcoming ENERGY STAR Lamps Specification V1.0 requires manufacturers to provide this list if a lamp is marketed as "dimmable." There is also a new standard called NEMA SSL-7A that will define compatibility requirements between LED lamps and dimmers that use "phase-cut" dimming, the most prominent type of dimming in residential applications. However, each of these methods to address the dim-

30 DOE SSL R&D Manufacturing Roadmap, September 2013, http://www1.eere.energy.gov/buildings/ssl/techroadmaps.html

31 http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2010-lmc-final-jan-2012.pdf

32 DOE 2010 US Lighting Market Characterization, January 2012 http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2010-lmc-final-jan-2012.pdf

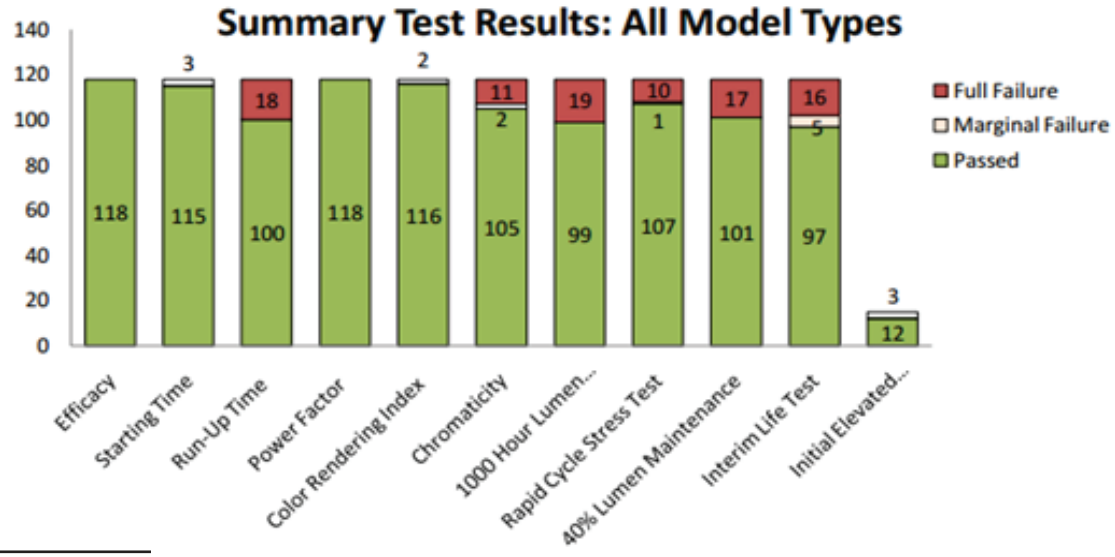
mer compatibility issue – dimmer compatibility lists and new compatibility standards – may require the purchase and installation of a new dimmer for a consumer to be able to correctly dim a new LED lamp. This is an area that energy efficiency programs may be able to address and was discussed at length in the 2013 Northeast Residential Lighting Workshop.[33]

ENERGY STAR Quality Assurance Testing

To ensure consumer confidence in the ENERGY STAR label and to protect the investment of ENERGY STAR manufacturing partners, EPA requires all ENERGY STAR products to undergo 3rd Party Testing and Verification. This requirement includes product testing in an EPA-recognized laboratory that meets international standards for quality and competency, review of the product by an EPA-recognized certification body to determine ENERGY STAR eligibility, and ongoing testing to ensure that products continue delivering superior energy efficiency and performance.

CFL Testing: The most recent testing results indicate that the quality and performance of CFL products continues to offer opportunities for improvement. In February, 2013 EPA published new CFL product testing results[34] based on 118 products tested between August 1st, 2011 and July 31st, 2012. While every product passed the Efficacy and Power Factor Tests, overall, 50 percent of models failed at least one other test, as required for ENERGY STAR qualification. When combined with previous results, overall passing rate upon verification has been 55 percent. EPA cautioned that these results should not be generalized. The sample of models tested is not representative of ENERGY STAR shipments, nor is it perfectly representative of the current list of ENERGY STAR qualified models. Figure 7 summarizes the most recent test results.

Figure 7: Summary of ENERGY STAR CFL Batch 3 Verification Testing



33 http://neep.org/neep-events/annual-residential-lighting-workshop/2013-res-lighting-workshop

34 D&R International. February, 2013. ENERGY STAR® CFL Third Party Testing and Verification: Off-the-Shelf CFL Performance, Trends, and Implications. http://www.energystar.gov/ia/partners/downloads/ENERGY_STAR_CFLs_Batch_3_Report_Public_Feb_2013.pdf?efad-5977

As a complement to the latest report on testing results, EPA conducted a performance assessment of the original equipment manufacturers ("OEMs") that have participated in the Third Party Testing and Verification Program from May 1, 2009 through March 31st, 2013.[35] Key findings of the assessment include:

- The 334 tested products included in this assessment were manufactured by 30 different OEMs; 17 of these OEMs had five or more products tested. OEMs with five or more products tested account for 93 percent of total tested products. Among these OEMs, passing rates ranged from 15 percent to 90 percent.
- OEM pass rates as high as 90 percent indicate that effective quality control for CFLs is achievable.
- EPA is taking targeted actions to help drive improved quality control in the production of ENERGY STAR CFLs. They include individual notices to OEMs providing a recap of their testing performance in the CFL Testing Program, greater oversight of products associated with OEMs with high failure rates and heightened quality assurance requirements for labelers using products from those sources, and increased verification testing of products from OEMs with low compliance rates or that have been significantly under-tested to date.

LED Testing: Third-party testing of LED products is currently in the product nomination phase and actual testing of products has not yet begun. EPA expects the first cycle of verification for LED products to be complete sometime in 2014.

TopTen USA

TopTen USA, an organization that works to stimulate the market for super-efficient products, works to identify the top 10 efficient products in a category. Their categories range from cars to televisions, and Northeast states such as Connecticut and Massachusetts work with TopTen to get localized lists and ensure maximum savings. TopTen recently released its ranking[36] of the ten highest ranked LED PAR30 and PAR38 replacement lamps. These lamps have been ranked based on efficiency, price, and performance. All lamps on the list are ENERGY STAR qualified.

DOE Solid-State Lighting Initiative Update

The United States Department of Energy (DOE) continues to offer useful tools, reports, and events to the Energy Efficiency Program industry to support solid state lighting adoption.

One key project the DOE leads in SSL is the L-Prize, which is currently offering a competition for the L-Prize PAR38[37] that meets at least a 123 lm/watt requirement, amongst other stringent metrics. After revising some requirements, DOE re-opened the L-Prize competition to

35 The ENERGY STAR® CFL Third Party Testing and Verification Program: Original Equipment Manufacturer Performance Assessment. May, 2013. http://www.energystar.gov/ia/partners/downloads/ENERGY_STAR_CFLs_OEM_Performance_Assessment_May_2013.pdf?fd39-6faa

36 http://www.toptenusa.org/TopTen-LED-Lighting

37 http://www.lightingprize.org/PAR38.stm

PAR38 lamps. The requirements set a high bar, and thus far there are no products in the Lighting Facts database that come close to meeting the proposed efficacy criteria. The first L-Prize, for A-Lamps,[38] was won by Philips in 2011 with a lamp that reached an efficacy level of 94 lm/watt. DOE announced that the Philips L-Prize Entry A-lamp had completed 25,000 hours of testing in an elevated temperature environment. The average lumen maintenance of the lamps remains over 100 percent. This astounding result indicates that well-designed LED lamps may have lifetimes that far exceed 25,000 hours, the ENERGY STAR minimum.

The DOE also recently completed the 3rd and final phase of the Life-Cycle Impacts of LED Lighting Products Study[39] which assesses the life-cycle impacts of LED lighting. From cradle-to-grave, the study compares the energy use and environmental impact of LED, CFL, Halogen, and Incandescent Lamps. The third phase of the study looked at whether potentially toxic elements are present in concentrations that exceed regulatory thresholds for hazardous waste. The study found all lamp types – Incandescent, Halogen, CFL, and LED – exceed at least one California restriction, typically for copper, zinc, antimony, or nickel. The concentrations of elements in LED lamps were found to be comparable to concentrations in cell phones and other types of electronic devices, furthering the impetus to recycle them. All lamp types, including incandescent, halogen, CFL, and LED, should be recycled to ensure compliance with environmental regulations.

Other recent and influential tools coming out of DOE include a new fact sheet on the Optical Safety of LEDs.[40] In response to recent questions of whether LEDs are safe for eyes, DOE created a new fact sheet that program staff can use to respond to questions that generally concludes LEDs are not more hazardous for human eyes that other lighting technologies with the same CCT. DOE also released their updated 2013 Multi-Year Program Plan (MYPP)[41]. The MYPP provides a roadmap for Solid-State Lighting and includes valuable information for energy efficiency programs including predictions of efficacy and cost over time. As noted, the cost and efficacy of LED continues to track, and in some cases beat, DOE's forecasts. Finally, the DOE leads a CALIPER product testing program which continues to prove a vital resource for energy efficiency programs. Most recently CALIPER has focused primarily on C&I lighting products such as LED troffers.

38 http://www.lightingprize.org/news_25000testing.stm
39 http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/lca_factsheet_apr2013.pdf
40 http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/opticalsafety_fact-sheet.pdf
41 http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_mypp2013_web.pdf

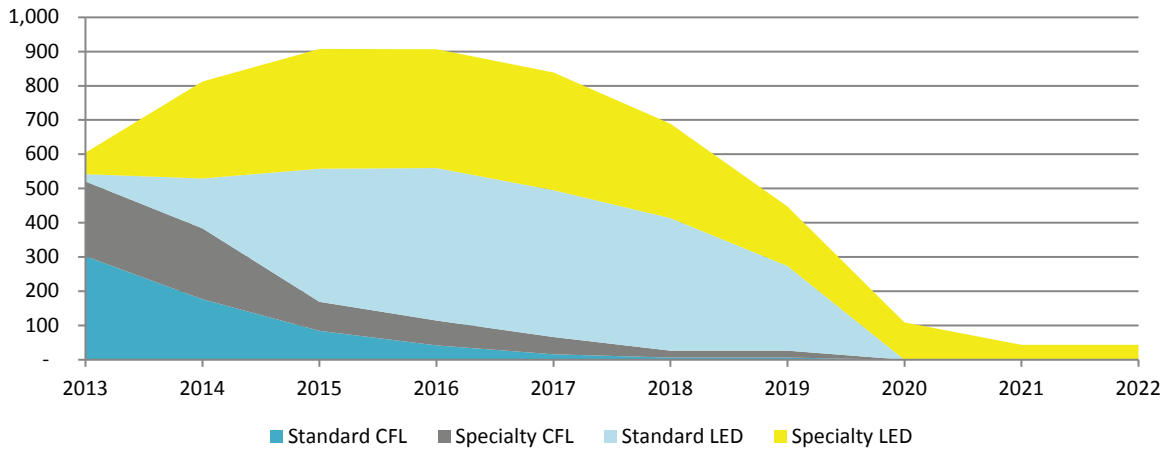
UPDATED EFFICIENCY PROGRAM PROJECTIONS

The most important conclusion presented in the initial RLS and the 2012-2013 Update was that substantial opportunities remain for PAs to continue pursuing residential lighting savings through their retail products programs and through other residential efficiency programs that promote efficient lighting. These opportunities include continued promotion of both standard and specialty compact fluorescent lamps (CFLs) as well as a ramp-up of support for light emitting diodes (LEDs), both standard (A-lamp form factor) and specialty (reflector, decorative, 3-way, etc.) LEDs.[42] While this key conclusion and recommendation remains unchanged, we have adjusted some of our assumptions and emphasis in this update. The bottom line is that lighting will and should continue to be a major component of all residential efficiency portfolios.

A high-level modeling analysis brings together all the latest information on CFL and LED pricing and efficacy trends, net-to-gross evaluation findings, and expectations about the number of bulbs that could move through efficiency programs. The intent of the exercise is to understand the potential savings regional program administrators could realistically achieve in the residential lighting sector, as well as the costs needed to acquire those savings, assuming moderately aggressive program activity.

The initial RLS forecasted regional savings potential peaking in 2012 and declining thereafter largely due to a reduced per-unit savings resulting from the EISA standards. The 2012 RLS update estimated greater levels of overall savings potential, but again forecasted a peak in 2012 followed by a steady decline thereafter. This latest savings forecast, shown in Figure 8, marks a departure from that pattern of decline, instead showing steadily rising savings followed by a long plateau at a consistently high level of annual savings potential.

Figure 8: Projected 1st Year Savings (GWh)

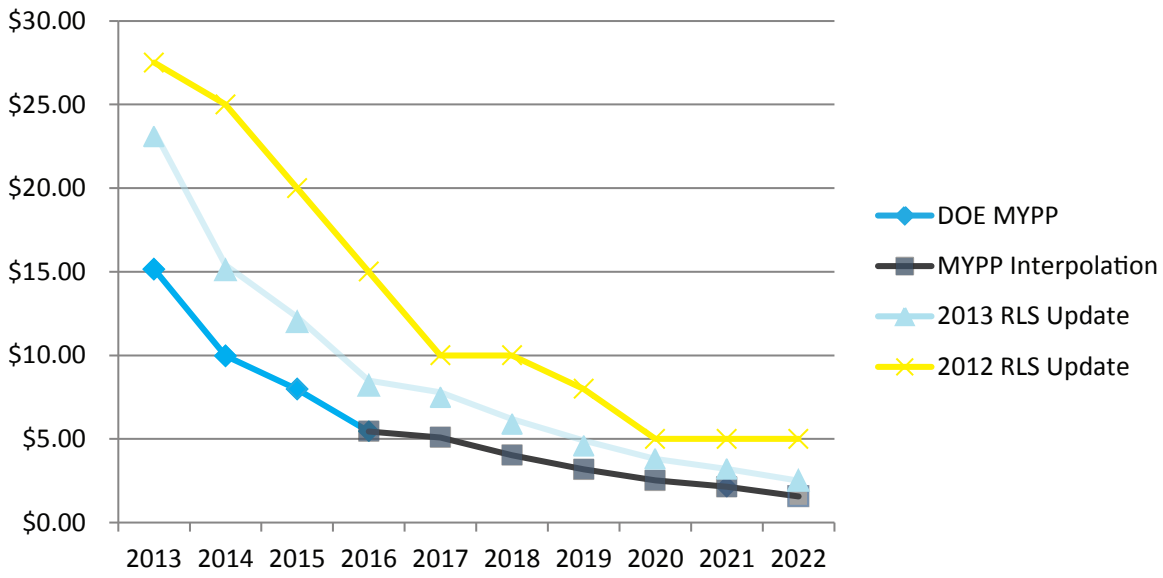


42 Note that while dimmable CFLs are classified as a specialty lamp, dimmability is generally considered an inherent trait of LEDs. Hence, dimmable A-Lamp LEDs are a standard, not a specialty, LED.

The cumulative potential over the 2013-2022 time frame is almost 25 percent higher than the previous RLS update, which was itself an increase above the original. This latest increase is driven by several changes to key assumptions, including the following.

Lower price forecast for LEDs – Based on the Department of Energy's Multi-Year Program Plan (MYPP), the forecast tracks DOE's price projections for 60W LED replacement lamps. A discount factor is applied to account for the difference between premium products (as measured in the MYPP) and those that are widely available on the market and encountered by program administrators. This forecast is depicted in Figure 9.

Figure 9: Projected Cost of 60W Equivalent LED A Lamp



Increased number of bulbs per household – This input changed in three significant ways:

- Greater number of overall efficient bulbs per household, especially 2017-2019
- Fewer CFLs in later years, including a near-complete transition away from CFLs in 2018
- Greater number of LEDs

These changes reflect a faster than previously anticipated transition to LEDs, which has been enabled by the rapid decline in prices. The new assumptions about number of bulbs per household are shown in Table 6.

Table 6: Rate of In-Program bulbs (# per household, per year)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Standard CFL	1.80	1.55	0.95	0.55	0.25	0.10	0.10	0.00	0.00	0.00	5.30
Specialty CFL	0.60	0.65	0.35	0.30	0.25	0.10	0.10	0.00	0.00	0.00	2.35
Standard LED	0.05	0.30	1.00	1.35	1.60	1.90	1.80	0.00	0.00	0.00	8.00
Specialty LED	0.10	0.35	0.55	0.65	0.80	0.85	0.80	0.50	0.20	0.20	5.00
Total	2.55	2.85	2.85	2.85	2.90	2.95	2.80	0.50	0.20	0.20	20.65

Higher in-service rate for CFLs - The increase from 0.77 to 0.9 reflects recent evidence that bulbs in storage do in fact get installed.

Higher NTG factors for LEDs in the near term - Given the rapid change in the lighting industry due to the emergence of LEDs, and the role that efficiency programs are likely to play in accelerating their adoption, substantial spillover is likely to occur in the near term.

As with the original RLS and the 2012 update, these lamp numbers are meant to reflect a moderately aggressive level of program activity and may not reflect current or planned program activity at the individual PA or state level. The net effects of the changes to our assumptions are greater savings, both annual and lifetime, but also greater incentive spending, especially in the near term. The lower LED price forecast is not enough to offset the much greater volume of LED bulbs relative to CFLs forecasted to move through programs. This effect is depicted in Figure 10, which shows total incentive spending in 2015 more than double that of 2013 and in Figure 11, which shows the volume and proportion of bulbs moving through programs.

Figure 10: Incentive Costs (Million $)

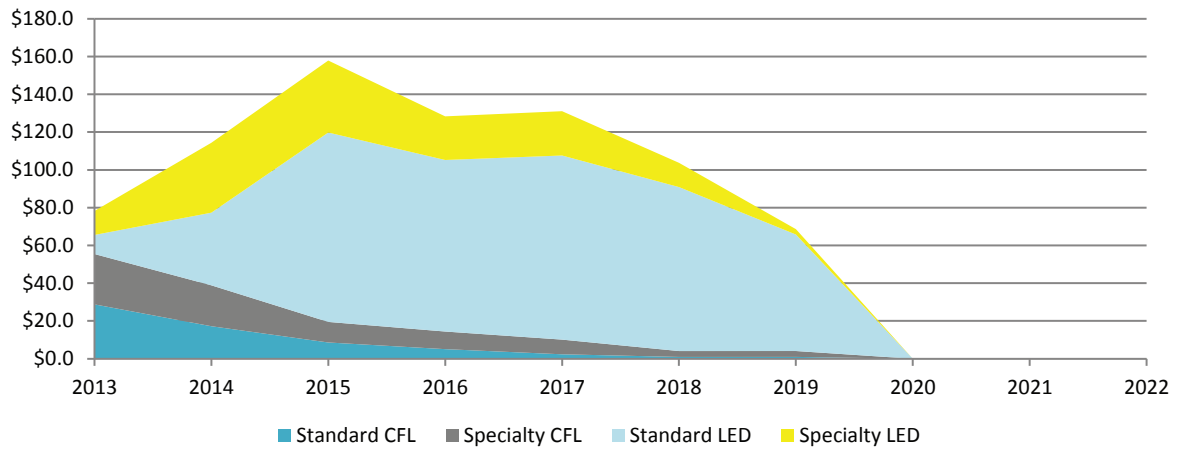
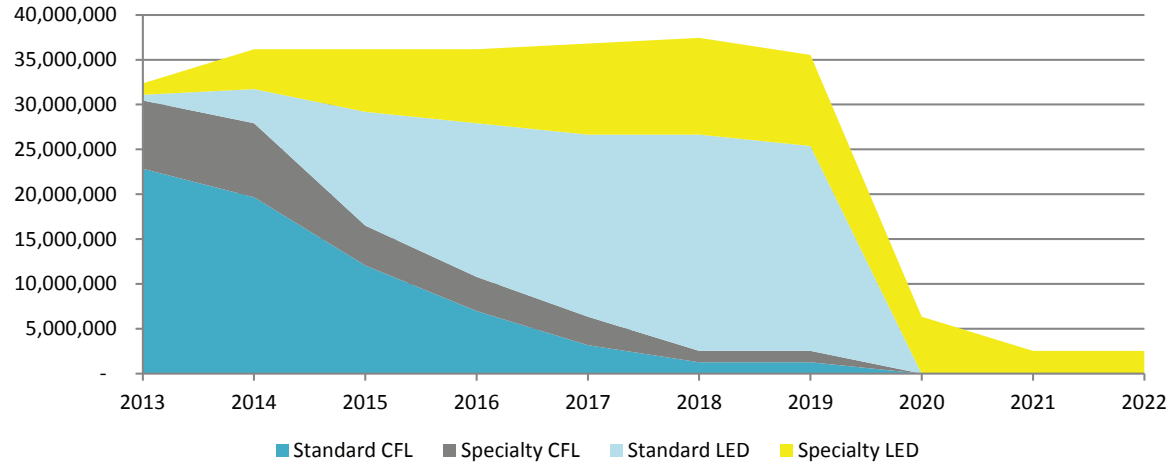


Figure 11: Number of Bulbs per Year



In contrast to the initial RLS and the 2012 update, this latest forecast finds costs to attain residential lighting savings will decrease over time as measured on a per net kWh basis ($/net kWh). This reflects a change in the assumption about the maximum incentive per bulb. Previously the incentive was capped at $10. That cap has been removed to reflect the fact that in reality many PAs offer incentives greater than $10 per bulb. The steady decline in PA cost per net kWh is driven by the lower price forecast for LEDs. Figure 12 shows the forecast of incentive costs per annual kWh, while Figure 13 shows the forecast of incentive costs per lifetime kWh.

The lower, and steadily declining, costs per kWh reinforce the fact that efficient lighting will continue to be an important and cost efficient resource in PAs' residential portfolios.

Figure 12: Incentive Amount per 1st Year kWh Savings

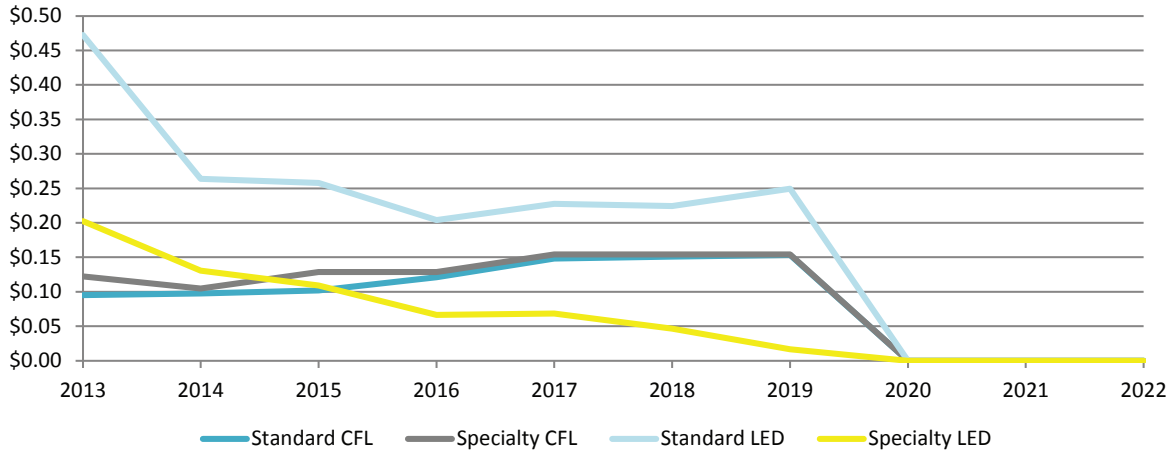
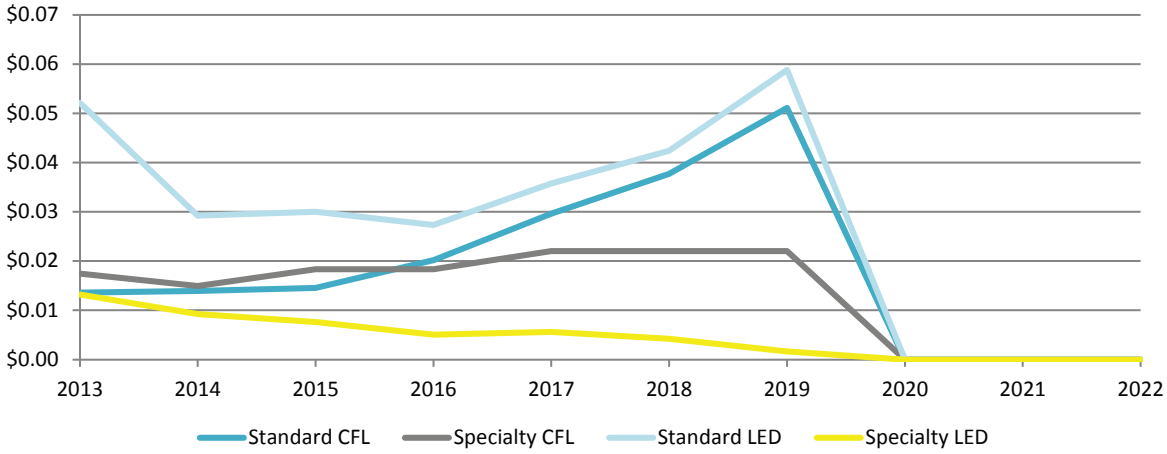


Figure 13: Incentive Amount per Lifetime kWh Savings



RECOMMENDATIONS: KEY STRATEGIES FOR SUCCESS OF THE RLS

Based on the research and analysis presented in this report, some of the original recommendations from the RLS and 2012 RLS Update have been changed. We present three new recommendations as well as continued support for 6 remaining recommendations.

New Recommendation #1

Recommendation: Accelerate use of ratepayer funds to support LED technology in near-term due to rapidly dropping price and superior performance over CFL. PAs develop long-term strategies to shift away from CFLs.

Replaces: Aggressively support CFLs through retail products, income eligible, existing homes, and new construction programs to maintain residential lighting savings levels AND Ramp up promotion of ENERGY STAR LEDs as products improve, become more available, and prices reduce.

Rationale: Because LEDs are rapidly offering a cost competitive superior product in many applications, we recommend a dramatic shift towards their promotion. Table 7 shows the number of LED bulbs per household used in our analysis.

Details:

- NEEP and PAs closely monitor market to track ENERGY STAR qualified LED pricing and availability and PAs set and adjust (as needed) appropriate LED incentive level
- Manufacturers seek ENERGY STAR certification for all eligible LED products
- Retailers provide preferential display of ENERGY STAR qualified products and as CFL products fail, retailers expand CFL recycling efforts
- Manufacturers and PAs communicate and work with builders, electricians and electrical supply houses on how best to use CFLs and LEDs to meet building energy code lighting efficiency requirements
- PAs identify and implement cost-effective LED direct install opportunities, e.g., high hours of use applications in income eligible, existing single family and multi-family homes, and new construction programs; possibly supported by bulk purchase efforts
- NEEP and PAs coordinate with DesignLights Consortium™, PA C&I programs, retailers, and others on the promotion of residential and commercial LED Products

Table 7: Rate of In-Program LEDs (# per household, per year)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Standard LED	0.05	0.30	1.00	1.35	1.60	1.90	1.80	0.00	0.00	0.00	8.00
Specialty LED	0.10	0.35	0.55	0.65	0.80	0.85	0.80	0.50	0.20	0.20	5.00
LED Total	.15	.65	1.55	2.00	2.40	1.75	2.60	0.50	0.20	0.20	13.00

New Recommendation #2

Recommendation: Partner with manufacturers, retailers, and ENERGY STAR to improve marketing, messaging, and education on key issues, including dimmer compatibility, using the right lamp for the application, and the most efficient lamp choices.

Replaces: Deliver a clear and consistent message to consumers on efficient lighting choices
Rationale: As discussed in the report introduction, consumer education is a significant barrier to success. Deeper, more collaborative, and more strategic marketing and messaging is necessary to overcome this barrier.
Details:

- All parties work with national (LUMEN) and regional groups (NEEP) to develop consistent consumer messages informed by ongoing market research to understand how to build consumer acceptance of and satisfaction with high efficiency lighting products
- PA messaging may need to be more targeted on driving consumers to efficient product choices and/or value of ENERGY STAR label
- All parties leverage EISA standards and new FTC lamp labeling as an opportunity to move consumers to efficient lighting choices
- PAs structure NCP submissions to include industry marketing/educational component
- PAs leverage on-going, planned and proposed industry market research and PA EM&V efforts to inform "local content" of this messaging

New Recommendation #3

Recommendation: Leverage markdown and buy-down agreements to specifically promote higher quality, lower cost LED lamps to reduce program incentive costs, product costs, and increase consumer adoption.

Rationale: As the cost of some LEDs becomes competitive with CFLs with only a small incentive, the need to spend large incentives on expensive products diminishes. If there are lower cost products that still meet the required quality measures, then shifting incentive dollars towards those products and promoting a higher volume of lower cost products will help ensure LED adoption. Additionally, this may help shift down the market prices, as demand for lower cost LEDs will grow and supply should follow.
Details:

- If PAs are concerned about promoting low-cost LED products, especially given negative experiences of early promotion of inferior CFL products, we recommend PAs only support products that are ENERGY STAR certified. The existing and new lamp specifications from ENERGY STAR both have substantially increased requirements for 3rd party testing and lamp qualities in general. As such, the risk of a low quality product is less currently with an ENERGY STAR LED than it was historically with an ENERGY STAR CFL.

- Additionally, PAs could set their own requirements beyond ENERGY STAR including factors such as warranty (which for most LEDs at present is only 3 years under ENERGY STAR). Many products offer longer warranties, and this is an additional safeguard that could help ensure a better experience with the product.
- Another potential tactic could be to direct promotions to manufacturers with a better track record of quality. If allowed by procurement processes, PAs can limit promotions to a subset of manufacturers with whom they have had good past experiences or better historical testing results.

Existing Recommendations to Remain:

Consider adoption of creative or alternative program and promotional approaches to maximize impact while minimizing potential free-ridership.

Details:

- PAs to work together and with other interested stakeholders to develop and adopt consistent approaches to evaluate program impacts, such as through Regional EM&V Forum protocol development.
- PAs seek up-front regulatory engagement/ approval as needed
- PAs target hard-to reach retailers and customer segments that are otherwise unlikely to adopt efficient lighting products
- Examples of approaches include Market Lift and the Revenue Neutral Model to assess free-ridership (see Appendix C for more information).

Support strong lighting efficiency requirements in building energy codes to help increase efficient lighting in new construction.

Details:

- In anticipation of IECC 2012 75 percent efficient lighting requirement, NEEP and PAs work with builders, lighting designers, code development officials and others to educate them on best lighting choices in RNC. Supporting the adoption and implementation of IECC 2012 will help the region move towards a goal of higher socket saturation of efficient lighting.

PAs focus on promoting quality lighting products using ENERGY STAR as a key indicator of quality.

Details:

- PAs only support ENERGY STAR qualified LEDs and CFLs with incentives and marketing
- DOE CALiPER and ENERGY STAR third-party testing efforts continue with active NEEP and PA participation, where failed products are delisted
- PAs withdraw funding from delisted products quickly

Develop and implement regional systems to track key product and market data to inform program design, implementation, and evaluation.

Details:

- PAs and industry work through NEEP and others to promote methods to track and share sales data
- Reduce the cost of evaluation and market analysis through regional approaches (e.g., EM&V Forum) to collect commonly needed data (e.g., product availability and price, socket saturation rates, customer knowledge and satisfaction with high efficiency lighting products)
- Investigate third-party efforts to track market activity; e.g. Consortium for Retail Energy Efficiency Data or CREED initiative (see Appendix D), which NEEP and several Northeast programs have joined.
- Collaborative retailer efforts such as the Retail Action Council convened by the EPA/ENERGY STAR may help coordinate data sharing efforts.

Continue to engage regulatory bodies early to reinforce need for continued and aggressive PA engagement in the residential lighting market and to limit regulatory uncertainty.

Details:

- All parties reinforce message that Phase 1 EISA standards will not diminish the need for continued residential lighting market intervention: CFLs will not be the baseline
- Incorporate elements of this RLS Update into PAs' 2014 Plan submissions and public input processes to encouraging adoption of long-term market transformation goals and general strategy
- Manufacturers and retailers convey their support of the RLS to regulators in letters of support and public input hearings
- NEEP and PAs highlight large remaining savings potential in not only retail products program, but other PA residential programs
- NEEP and PAs clearly convey message that costs for lighting program savings will increase and that this may affect overall program, sector and portfolio cost rates
- PAs and regulators limit regulatory uncertainty by emphasizing the need for program flexibility and reaching agreements early on planning assumptions: net-to-gross ratios, measure lifetimes, baseline wattages.
- Regulators consider and pursue as appropriate alternative cost-effectiveness approaches such as utility cost test (or energy and water test) and claiming gross vs. net savings

Continue regional lighting engagement on an on-going basis.

Details:

- NEEP develops, with regional stakeholder input, RLS updates to provide to regulators and other key stakeholders

CONCLUSION

The 2013-2014 Update to the Northeast Residential Lighting Strategy has analyzed and projected a complex but savings-rich scenario for residential lighting. While great savings have been realized, the lighting market has not been transformed and the region still has a long way to go to reach the goal of 90 percent efficient lighting socket saturation. Efficiency programs are key drivers to increase the adoption of efficient residential lighting products; increased spending and focus on LED promotions are necessary to ensure efficiency goals are met.

Note about EISA

In reading the RLS Update closely, one might notice the partial omission of an original recommendations regarding working towards a strong 2020 EISA standard. This was not an error, but rather a slight shift in how we are thinking about the lighting efficiency regulations affecting general service lamps that were written into the Energy Independence and Security Act of 2007 (EISA).[43] EISA includes three main phases; Phase I is currently being implemented between 2012 and 2014 with efficiency levels described in Table 8. Phase II involves a DOE rulemaking process to establish new efficiency requirements to be effective no sooner than 2020. That rulemaking is set to take place between 2014 and 2016 and contains a backstop provision which is discussed later. A third phase of EISA lighting regulations involves another DOE determination and rulemaking process to again revise the efficiency levels. If DOE determines amended standards are appropriate, a rulemaking is to be completed by 2022 with an effective date no sooner than 2025.

Table 8: Impact of EISA 2007 Standard[44]

Traditional Wattage	Lumen Ranges	After the Standard	Minimum Efficacy (Lm/Watt)	Standard Effective Date
100 watt	1490-2600	≤ 72 watts	20.7	January 1, 2012
75 watt	1050-1489	≤ 53 watts	19.8	January 1, 2013
60 watt	750-1049	≤ 43 watts	17.4	January 1, 2014
40 watt	310-749	≤ 29 watts	10.7	January 1, 2014

While Phase 1 of EISA is impacting the product mix available to consumers (and is discussed in the program planning section), there will also be a Phase II of EISA which will go into effect no sooner than 2020. In this process, DOE will assess the baseline lighting efficacy in the US through a rulemaking process and will determine the appropriate baseline level to set. Written into the Act is a 45 lm/watt efficacy backstop, which would become effective only if DOE was not able to develop new standard levels that achieved at least as much energy as the 45 lm/watt across the board standard. There is clearly an opportunity to have

43 http://www.gpo.gov/fdsys/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf, starting page 82
44 Energy Independence and Securities Act, 2007

a higher baseline than what is specified in the backstop. When Phase II of EISA goes into effect in 2020, however, it won't influence the success of the RLS in reaching 90 percent efficiency socket saturation as that goal expires in 2020.

Even so, aggressive support of efficient products in the next 1-3 years will influence the Phase II rulemaking and could help raise the baseline for next generation general service lighting. If we are able to secure a high efficacy baseline effective in 2020, that will represent a significant win for efficiency standards, energy savings and carbon emissions reductions. NEEP's Appliance Standards Project will be actively engaging the Phase II rulemaking and offers regional stakeholders an opportunity to participate in this important rulemaking.

Next Steps

NEEP will continue to help organize the Northeast Mid-Atlantic region to push the high efficiency residential lighting market forward. NEEP intends to continue convening a Leadership Advisory Committee and hosting regional conversations on the issues facing residential lighting. We welcome additions to this effort and shared thoughts in this space. Additionally, NEEP has developed an online Residential Lighting Resource Center which is a clearinghouse of relevant information and helpful tools.

Some of the continued topics of interest for 2014-2015 include consumer education, better data for better planning and evaluation, residential controls, and achieving aggressive savings goals given the challenging landscape ahead. Through continued partnerships with regional efficiency programs, national experts, manufacturers, retailers, regulators, policymakers, and a strong partnership with ENERGY STAR, this region can continue to lead the nation in efficiency success for residential lighting.

APPENDIX A

2013 Northeast Residential Lighting Efficiency Program Elements

	CT		DC	MA					NH	NY		RI	VT
	Connecticut Light and Power	United Illuminating Company	DC Sustainable Energy Utility	Cape Light Compact	National Grid (MA)	NSTAR Electric & Gas Corporation	Unitil	Western Massachusetts Electric	New Hampshire[6]	Long Island Power Authority	NYSERDA	National Grid (RI)	Efficiency Vermont
Hard to Reach	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓
School Fundraiser	✓	✓		✓	✓	✓		✓	✓			✓	✓
Food Bank			✓									✓	✓
Market Lift				✓[1]	✓[1]	✓[1]		✓[1]					✓[1]
TopTen USA	✓[2]	✓[2]		✓[2]	✓[2]	✓[2]	✓[2]	✓[2]				✓[2]	✓[3]
LED Direct Install	✓[4]	✓[4]	✓	✓	✓	✓	✓	✓		✓		✓	
CFL Direct Install	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lightbulb Finder App				✓	✓	✓	✓	✓		✓		✓	
Retail Sales Events (e.g., Techniart)	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
Behavior Programs (e.g., OPower, C3, etc.)	✓	✓		✓	✓	✓		✓				✓	
EISA/FTC Label Education	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓
Television	✓	✓				✓				✓			
Radio	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Print/Outdoor Media	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓[5]	✓	✓
Social Media (e.g., Facebook, Twitter)	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Online Catalog	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	

1. Market Lift implementation in mid-2013
2. For appliances and/or consumer electronics
3. Paid TopTen sponsor, not yet integrated into program offerings
4. Co-pay required, but no limit on number of LEDs unlike with other PA direct install efforts that limit number of free LEDs
5. NYSERDA Partners are required to provide educational material, such as print and outdoor media, in conjunction with NYSERDA buy-downs
6. New Hampshire includes: Public Service of New Hampshire; Unitil; NH Electric Co-Op; Liberty Utilities (formerly National Grid NH)

APPENDIX B

The Light Bulb Finder App

Light Bulb Finder

The free mobile app for energy-efficient lighting

On-demand decision making tool for consumers at home and in stores

A BRIGHT IDEA

Switch easily from incandescent to energy efficient lighting with the Light Bulb Finder mobile app, available as a free download on iOS and Android smartphones and tablets.

- ✓ Enter information about your current bulb and fixture types.
- ✓ Get instant recommendations for energy-efficient bulbs with equivalent light quality, fit and style.
- ✓ See your savings potential and environmental impact.
- ✓ Create shopping lists for easy reference in stores.
- ✓ Link to local efficiency promotions.

NATIONAL AWARDS & ACCOLADES

EPA Winner
"Best Overall App"

Sprint
Green ID Pack

AT&T Winner
Power Your Future

Featured By:
ABC, NBC, Fox News, USA Today, New York Times, Consumer Reports, This Old House, and others!

REGIONAL UTILITY PROGRAMS

Light Bulb Finder leverages the speed and agility of mobile technology to provide utility customers with updated, on-demand information at home and in stores. In-app messaging reinforces utility marketing campaigns to drive participation in local efficiency programs.

Offer the app to residents via mobile devices, computers, and retailer tablet-kiosks. Customize with local bulb databases and discounts. Gather critical data on consumer buying habits and product preferences.

Spanish language is also available.

BENEFITS

- Provide utility customers with 24/7 accessibility to updated information.
- Cost-effectively drive proactive bulb purchases and installs.
- Track and report users' aggregate financial, energy and environmental impact.

MARKETING AND OUTREACH

Light Bulb Finder programs include turn-key marketing collateral, public relations support and educational tools for easy integration into utility marketing and outreach strategies.

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APPENDIX C

The Revenue Neutral Sales Model:
A New Approach to Estimating Lighting Program Free-Ridership

Tami Buhr, Opinion Dynamics, Waltham, MA

Stan Mertz, Applied Proactive Technologies, Springfield, MA

ABSTRACT

Lighting programs are a key component of many utilities' residential portfolios generating a large portion of overall program savings. Despite the importance of these programs, lighting program net-to-gross (NTG) estimates are plagued by uncertainty and can be highly contentious as a result. Most lighting programs are implemented in an upstream method where products are marked down at the point of purchase.

These programs are more challenging to evaluate because they lack participant data. Existing evaluation methods are expensive, questionable in terms of their validity, and produce results that are unpredictable. In 2008, NTG ratios across several lighting programs ranged from 0.19 to 9.17. It is widely acknowledged that such sizable differences are not due to program design but rather the methods used to estimate NTG. In this paper, we present a new and innovative method that uses existing data to estimate free ridership associated with upstream lighting programs. The Revenue Neutral Sales Model is based on an understanding of retailer behavior that underlies their participation in utility lighting programs.

In this paper, we outline the challenges associated with the evaluation of upstream lighting programs and weaknesses of current evaluation methods. We then discuss the theoretical underpinnings of the Revenue Neutral Sales Model. With the theory explained, we provide an example of the model in use in the evaluation of an actual lighting program. We finish with a discussion of the additional information provided by the model that is lacking from traditional lighting NTG methods including estimation of maximum free ridership by bulb type, retailer type, and during special promotional periods.

Full report is available at: http://www.opiniondynamics.com/wp-content/uploads/2013/08/The-Revenue-Neutral-Sales-Model-A-New-Approach-to-Estimating-Lighting-Program-Free-Ridership1.pdf

For questions or more information, contact:

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APPENDIX D

The Consortium for Retail Energy Efficiency Data (CREED)

Consortium for Retail Energy Efficiency Data (CREED)

APEX ANALYTICS, LLC

CREED/LightTracker Initiative (LTI)

CREED is a consortium of program administrators, retailers, and manufacturers working together to collect the necessary data to better understand lighting decision making and purchase patterns.

The Need for CREED/LTI

In 2012, 138 energy efficiency program sponsors spent more than $450 million promoting energy efficient lighting.[1] Lighting programs represent the largest share of energy efficiency savings, yet face tremendous uncertainty due to the phase-in of the 2007 Energy Independence and Security Act (EISA), as well as emerging technologies such as EISA-compliant halogens and light emitting diodes (LEDs). A more comprehensive understanding of lighting decision making and purchase patterns will allow:

- **Program administrators** to design effective, forward-looking programs;
- **Program evaluators** to assess baseline efficiencies and behaviors;
- **Retailers and manufacturers** to assess how their sales patterns compare to the market as a whole.

A Comprehensive Picture of the Long-Range Goals

By teaming with a number of third-party market research firms, LTI anticipates being able to collect and aggregate the most comprehensive data ever available for the lighting market. The data are collected at the Point-of-Sale (POS), so as to represent actual sales. The POS data are collected from the entire United States and represent regions that have been aggressively promoting energy efficient lighting for over a decade to regions that have no utility sponsored programs. In addition, all of the major distribution channels are represented, including:

- Do-it-yourself "big box" stores
- Major Discounters
- Grocery and Drug Stores
- Club Stores
- Hardware Stores

LTI Includes Sales Data for Nearly All Residential Light Bulbs, Including:

Spiral CFLs

Specialty CFLs

LEDs

Incandescents

Halogens

[1] ENERGY STAR Summary of Lighting Programs, St. Paul Conference, Oct. 2012.

APEX ANALYTICS, LLC

LightTracker

Membership Benefits (February 1, 2013)

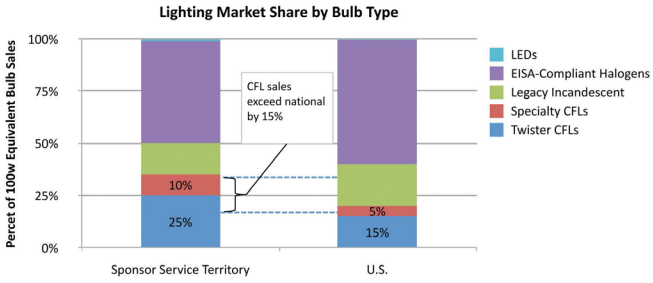
CREED/LTI will conduct monthly conference calls to discuss member issues and suggestions plus report on progress and new initiatives. This is done with the intent to stimulate new and creative solutions, alliances and effective actions. A summary email will be sent to all members after the monthly conference calls. The CREED/LTI effort is a work in progress and it is expected to grow over time in it's ability to impact major retailers to be more co-operative in releasing pertinent sales data to support efficiency programs. Members will be encouraged to participate in the process to the extent they wish to contribute, but it is not mandatory to receive any other benefits.

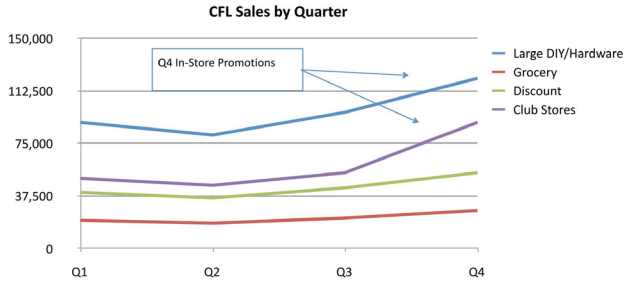
CREED/LTI Member-Subscribers receive a number of benefits, including:

Full credit dollar for dollar of annual membership fees toward purchase of CREED/LTI retail lighting sales reports which will be published as soon as the POS data is available.

Quarterly and Annual Reports. As soon as sufficient data is available from multiple sources LTI plans on producing quarterly retail lighting sales reports that show total bulb sales broken down by bulb type, region, distribution channel, and level of program activity. See example shown below. In addition, each member receives a custom report for their own region broken out separately, allowing for comparison with other markets. Annual reports will highlight trends, plus provide additional analyses into the data.

Sales Data. Members that wish to conduct their own analysis will also be able to access the aggregated POS sales data made available to CREED/LTI. There will be additional costs for this access which will be determined by the cost to obtain the data by CREED. Since this data will be shared by many members, it is expected to be cost effective and moderately priced. To protect the confidentiality of those that provide the data, all sales will be aggregated up to the distribution channel level and will satisfy agreements with retailers that prevent the release of what they consider proprietary information.





Subscription Information

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APPENDIX E

Information on the Impact of Phase I of EISA

What's happening with light bulbs?

Question:

I hear that stores are going to stop selling the old types of incandescent light bulbs that I, my parents and even my grandparents grew up with. **What's happening?**

Answer:

The Energy Independence and Security Act (EISA) of 2007, signed by President George W. Bush on December 18, 2007, is a technology-neutral performance standard. It is not banning incandescent bulbs and it is not forcing people to buy CFLs, but rather requiring the regular light bulbs use less energy. Benchmarks have been set to create realistic and smooth changes:

- Beginning on January 1, 2012, light bulbs as bright as a 100 watt traditional incandescent bulb can use no more than 72 watts of electricity,
- In January 2013, bulbs as bright as current 75-watt incandescents will not be able to use more than 53 watts,
- Starting January 1, 2014, the standard will apply to 60 watt bulbs, which will not be able to use more than 43 watts and 40 watt bulbs will not be able to use more than 29 watts, and
- Additional savings begin in 2020.

The light bulb standard has spurred innovation in lighting and given consumers more choices. There are now new options like halogen incandescent bulbs and LEDs, in addition to CFLs. Manufacturers across the country are producing light bulbs that meet the standard's requirements.

More information from the LUMEN Coalition: http://lumennow.org/