Ms. Brenda Edwards
U.S. Department of Energy Building Technologies Office
1000 Independence Avenue SW
Washington, DC 20585-0121

May 16, 2016

RE: Docket Number EERE–2013–BT–STD–0051 (RIN # 1904-AD09): Notice of Proposed Rulemaking for General Service Lamps

Dear Ms. Edwards:

Northeast Energy Efficiency Partnerships (NEEP) appreciates the opportunity to provide comment to the US Department of Energy (DOE) on the Notice of Proposed Rulemaking (NOPR) for General Service Lamps (GSL). We represent a broad and diverse group of stakeholders from across the Northeast and Mid-Atlantic region that are very interested in the ultimate result of this rulemaking process, for the Final Rule will have direct and significant impacts to our states, communities and territories. NEEP works collaboratively with a network of stakeholders that span state energy officials, efficiency program administrators, local efficiency advocates and many others to maximize the benefits associated with federal appliance standards rulemakings. Doing so provides economic benefits while protecting public health and the environment. After reviewing the NOPR and participation in the April 20th public meeting, NEEP along with the United Illuminating Company; the National Consumer Law Center, on behalf of its low-income clients; the Vermont Public Service Department; Efficiency Vermont; Eversource Connecticut; and the Rhode Island Office of Energy Resources (henceforth referred to as "NEEP"), submit the following comments for DOE's consideration.

Overall, NEEP is very supportive of proposed components of the NOPR. NEEP strongly supports the proposed efficacy levels of TSL3, and very strongly cautions DOE against considering lower trial standard levels which stakeholders may suggest. NEEP is confident that by the time the rule is in effect, there will be a wide variety of high quality, low priced, highly efficacious LEDs to meet the target levels. NEEP encourages DOE to issue a final rule in a timely manner and keep schedule for an effective date of 2020. There are some specific elements of the NOPR that NEEP requests DOE address before it is finalized, detailed below:

Concerns on Proposed Regulation of Standby Power, Propose Setting Explicit Standby Power Limit:

NEEP is concerned with the treatment of standby power for connected lamps. As connectivity is a new and growing feature for GSLs, we understand DOE's approach to set efficacy thresholds that are less stringent for connected lamps. Relying only on proposed efficacy curve, however, and not concurrently setting an explicit standby power limit, creates the opportunity for standby power to become a very significant energy adder.

When calculating the impact of standby power, one must take into account the number of hours spent in on and standby mode; since residential lighting hours of use are usually only in the 2-3 hours/day, the time spent in standby mode could realistically reach a staggering 7,500 hours/year or more. This time can have a very significant impact on the annual kWh energy use of the lamp. While the efficacy levels set for standby mode

lamps appear to be a minor allowance (starting wattage moving from 101.6 to 96 in low-lumen, and from 73.4 to 70.5 in high-lumen), the actual impacts are much larger as demonstrated below.

- Let's start with an 800 lumen LED lamp.
- With no standby mode, it must be at least: 94.1 lm/w, which means a wattage max of 8.5W
- With standby mode, it must be at least 88.5 lm/w, which means a wattage max of 9W

The apparent impact of moving from an 8.5W to 9W product appears on the surface to be a 6% energy loss, which NEEP agrees seems reasonable. Using this mathematical analysis, it may seem that the curve essentially has a .5W limit. However, as demonstrated in the chart below showing the annual kWh of various standby powers, because of all of the time spent in standby mode a standby power limit even as low as a .5W standby power still adding 47% more energy consumption to the total lamp over a lamp with no standby power draw.

Starting Lamp wattage	Standby power (in both on and off modes)	Annual kWh (at 3 hours of use/day + 21 hours/day in just standby mode)	% increase from no standby mode
8.5	0W (not connected)	9.3	
8.5	.2W	9.53 + 1.53 = 11.06	19%
8.5	.5W	9.86 + 3.83 = 13.69	47%
8.5	1W	10.40 + 7.66 = 18.06	94%
8.5	2W	11.50 + 15.32 = 26.82	188%

Furthermore, consider this scenario:

- Another 800 lumen connected lamp uses only 8W in lumen production (100lm/w), but uses 1W of energy for connectivity features.
- As such, in total, it would look to be a 9W lamp at 88.5lm/w, but because of the time spent in standby mode, it would draw nearly 90% more energy than the non-connected alternative.
- Since both the .5W standby lamp and the 1W standby lamp draw 9W in on mode, they would be indistinguishable for the standard, however the energy impacts are significantly different.

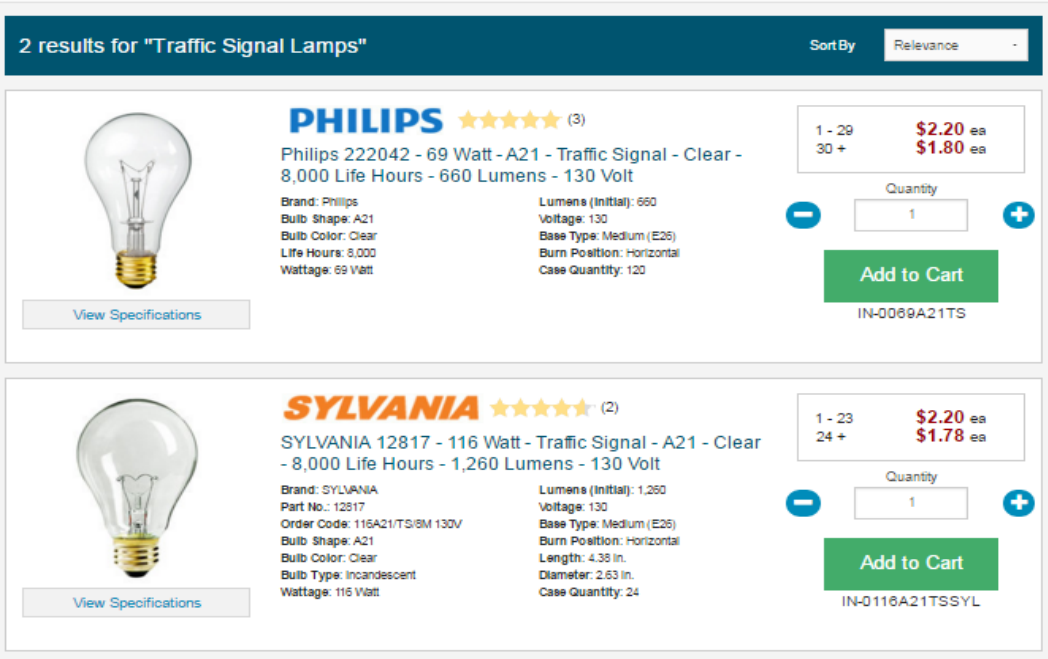
As the chart above demonstrates, standby power is a powerful energy consideration and even relatively low standby power levels make major impacts on the total energy used by a lamp, especially as the number of connected lamps grows.

It is NEEP's recommendation the DOE keep the proposed curve for standby mode products, but also **sets an explicit standby power limit of .5W or lower**. This is consistent with EPA ENERGY STAR's standby power limit in their Lamps 2.0 specification, finalized in early 2016. As LED technology evolves rapidly, and with ENERGY STAR setting realistic standby goals for current products, we feel that .5W is a very generous level for standby power. As such, we would be supportive of a lower limit if DOE felt it appropriate, as products currently available are drawing even lower standby power levels now. We feel it is critically important that DOE set an explicit standby limit in addition to the lm/w level, however, to keep the standby power from becoming a much more significant energy user that anticipated.

NEEP Encourages DOE to Avoid Potential Loophole Products:

Through analysis of currently listed exempted products, NEEP found the following products may be candidates for loophole in the rule as they offer low prices, similar form factor, and comparable general service lighting, even if intended for specialty applications:

- Appliance bulb: NEEP found 25 products available at 1000bulbs.com, ranging from 15W to 60W, with prices as low as $0.73/bulb. [1] These products appear very similar to traditional incandescent besides the slightly shorter length of the A15 form factor. While there may be a legitimate application for use of these bulbs in appliances, they are currently readily available for any application. NEEP recommends DOE revisit the definition of Appliance Lamp to ensure it is sufficiently stringent to limit applicability and avoid potential exploitation of this as a loophole.
- Traffic Signal Lamps: NEEP found the below two lamps available at untraditional yet viable lumen outputs each for $2.20.[2] While that price is higher than most products that could be loopholes, with an 8,000 hour lifetime, there could be a market for traditional incandescent technology, light, and form factor, with a long lifetime that may be exploited, especially if production of these bulbs reach economies of scale and the price decreases.



[1] https://www.1000bulbs.com/category/appliance-light-bulbs/
[2] https://www.1000bulbs.com/category/traffic-signal-light-bulbs/

NEEP Requests further Clarity on Exemptions and Definitions of Exempted Lamps:

In reading through the NOPR and in discussions with efficiency and industry stakeholders, considerable confusion exists around which products are covered by the standard, exempted from the standard, or subject to the backstop. NEEP recommend DOE include with the final rule a chart of all lamp types that had been included in discussion for this rule and detail what the rule requires for each. A sample abbreviated table is below.

Lamp Type	Implications of Rule, must meet at least:
Integrated, non-reflector, medium base GSLs that are not GSILs, 310 to 2,000 initial lumens no standby	101.6 - (29.42*(0.9983)^ initial lumens)
Integrated, non-reflector, medium base GSLs that are not GSILs, 2,000 to 2,600 initial lumens with standby	70.5 - (29.42*(0.9983)^ initial lumens)
GSILs (both conventional and modified spectrum)	Subject to backstop
GSLs >2,600 lumens	Subject to backstop
Marine signal lamps	Exempt, no implications from this rulemaking

In addition to better clarity on the entire range of products, NEEP requests several specific points of clarify from DOE.

- Regarding appliance lamps, we implore DOE to limit the definition to high-temperature appliance lamps needed to produce light for products such as ovens and clothes dryers that reach high temperatures where there is not an available alternative. For appliance applications such as refrigeration, however, LEDs are a great replacement and have been used as such in both commercial and residential applications. Therefore, NEEP recommends that DOE go further into the definition for appliance lamps to be limited to those suitable for high temperatures to ensure that they are being manufactured and sold for the proper applications.
- Regarding lamps that are colored (including black light, bug, colored lamps, and plant light lamps), NEEP encourages DOE to explicitly state that the color-element of these products must be inherent in the construction of the lamp, and could not be satisfied by a film or cover placed over an inexpensive incandescent that could easily be removed by the consumer. If the coloration was a permanent component of the lamp, then they would not provide general service lighting and therefore their exemption from the rule would be justified. If the color could be removed, allowing them to provide general service lighting, then the risk of this becoming a loophole product exists. In an analysis of pricing from 1000bulbs.com, NEEP found products under $1.00, demonstrating the potential for a loophole. (see below): [3]

[3] https://www.1000bulbs.com/category/yellow-bug-light-bulbs/

- NEEP requests DOE to clarify the treatment of MR-16s and Candelabra-based GSLs and specify in which cases these products would be covered, at which level, and in which cases (if any) they may not.
- NEEP also requests that DOE propose a definition for "marine lamps" which currently are listed as not-exempt with Left-handed thread, but have no formal definition. Because of the remaining exemption of "marine signal lamps," we anticipate that without clarity on what a "marine lamp" is, there could be confusion in what classifies as exempt.
- Finally, NEEP encourages DOE to consider the definitions for Vibration and Rough service lamps. While the DOE is considering them two separate lamps, with vibration service lamps shipping triggering attention from the 2015 shipment data, in marketing and applications, it seems that these two terms are nearly interchangeable.

Addressing Concerns on Manufacturer Limitations to Ramp up Production

At the public meeting to discuss the NOPR on 4/20, several manufacturers expressed concerns with the shipment analysis presented on slide 88 of the presentation. Particularly, there was much concern expressed regarding the proposed ramp up curve for LEDs, moving from approximately 240 million LED shipments in 2019 to nearly 700 million shipments in 2020. While NEEP understands that this rapid jump of over 2-fold as portrayed in this analysis is concerning, market indicators suggest that the ramp-up will in fact be much less dramatic than portrayed by DOE. The following are several reasons why NEEP reaches the conclusion that DOE's analysis is not accurate and manufacturer ramp up for implementation of this standard is realistic:

- Domestic LED production is already ramping up rapidly. Recent socket saturation surveys from Connecticut[4] and Maine[5] found residential penetration of LEDs up to 10% and 9% respectively in 2015. Utility efficiency programs throughout the Northeast and much of the nation have been aggressively promoting efficient lighting, for years. Many states have aggressive efficiency goals and rely on residential lighting, especially long-life LEDs, to reach their goals. For example, in program year 2015, just 7 states in the northeast promoted over 13 million lightbulbs.[6] That number is only for efficient lighting attributed to an efficiency program and the population of these programs represent less than 5% of US households. While these efficiency programs represent some of the most successful in the

[4] http://www.energizect.com/sites/default/files/R154%20-%20CT%20LED%20Lighting%20Study_Final%20Report_1.28.16.pdf
[5] http://www.efficiencymaine.com/docs/2015-Maine-Residential-Baseline-Study-Report-NMR.pdf
[6] http://www.neep.org/northeast-and-mid-atlantic-residential-lighting-strategy-2015-2016-update

nation, even if one extrapolated this information out very conservatively, it would be reasonable to estimate that the penetration of long-lasting efficient lighting is higher than captured in the shipment analysis, and will continue to grow in the 4 years before the standard is effective.

- As the installed base of efficient CFLs and LEDs increases between now and 2020, the replacement rate of lighting products across the nation changes. CFLs and LEDs last longer then inefficient halogens, typically on the order of 10-20 times longer. As such, as CFL and LED penetration ramps up, the time of replacement of these products becomes staggered. Between now and 2020, LEDs and CFLs will continue to fill many burned out bulbs, and the inefficient bulbs most likely to burn out between now and 2020 are likely to be those in the highest hours of use applications. This suggests that the replacement cliff will actually take place over a longer time horizon.
- While there certainly will be many halogens that burn out in 2020, with lifetimes in the 1000-2000hour range, and in lower hours of use applications, the burn out rate of halogens will be much more gradual than reflected in current analysis. This says nothing of the potential stockpiling of halogens that may occur in anticipation of the new standard.
- Finally, as lighting is an international market with most production occurring overseas, it is not realistic to look only at the US implications of the standard to understand the impacts on manufacturers. There are other standards throughout the world that will be going into effect between now and 2020, all of which are heavily reliant on increased LED availability. As such, manufacturers may be ramping up LED production much more in the coming years to meet the needs of other parts of the world, and by 2020, it may be a beneficial confluence of events that international LED demand has settled down and manufacturers have excess production capacity to easily meet increased domestic demand.

Given these considerations, it is our position that LED sales will be significantly higher in 2019 than demonstrated by DOE, as manufacturers continue to ramp up production in the next several years of a highly popular product. We also feel that the burn out rate and existing installation of many efficient, longer-lived lamps will spread out the need for replacement to take place at a slower pace over several years. As such, it is likely that in 2020, there will be a ramp up of LED production for domestic sales, but we anticipate that to be much easier and more gradual than in the DOE shipment analysis at present.

Areas for Improvement in Analysis

While in general NEEP believes DOE's analysis of the impact of this standard is accurate, there are few areas that additional data may help improve. Regarding the **anticipated increased savings from smart lighting**, NEEP cautions DOE to be more conservative than the 30% savings estimate included in the analysis. While very little data exists on the use of smart lighting, a small research and development study from Efficiency Vermont looked at the lighting usage of smart LEDs compared to standard LEDs; this study is near publication and should be

regarded by DOE in this analysis, rather than just the 30% assumption.[7] Since smart lighting is a new product area, NEEP recommends DOE remain conservative in the energy savings it expects from this product category, especially considering that with the additional factor of standby power (as mentioned above), these products are likely to be some of the least efficient LEDs available.

Regarding the **distribution of lumen levels** across the 40W, 60W, 75W, and 100W categories, there was much discussion of potential inaccuracies in DOE's assumptions. Through research into this issue from the past several years, we found that a concrete correct answer is challenging to find, but wanted to share the following pieces of data that we have come across.

- Results of the Massachusetts On-site Lighting Incentive, 2014, Final, 3/2015

Table 42. Saturation by Lumens, Massachusetts 2014

Lumen Range	All Types	CFLs	Fluorescent	Halogen	Incandescent	LEDs
Sample Size	*261*	*261*	*261*	*261*	*261*	*261*
All Bulbs	**13,083**	**4,560**	**1,147**	**927**	**6,028**	**421**
Bulb Saturation by Lumen Range (Rows sum to 100%)						
<310	4%	3%	<1%	34%	52%	11%
310-749	23%	15%	1%	11%	69%	4%
750-1049	44%	48%	<1%	2%	48%	2%
1050-1489	13%	53%	8%	8%	29%	2%
1490-2600	9%	22%	28%	3%	46%	1%
2,600+	6%	2%	91%	4%	4%	0%
Don't Know	2%	13%	6%	19%	14%	48%
Lumen Saturation by Bulb Type (Columns sum to 100%)						
<310	4%	<1%	<1%	20%	4%	12%
310-749	23%	9%	3%	40%	33%	27%
750-1049	44%	63%	1%	10%	45%	23%
1050-1489	13%	20%	11%	17%	8%	9%
1490-2600	9%	6%	28%	4%	9%	2%
2,600+	6%	<1%	56%	4%	<1%	0%
Don't Know	2%	1%	1%	6%	1%	28%

Base: All on-site respondents

- Horner 2007 and CLTC, 2008:

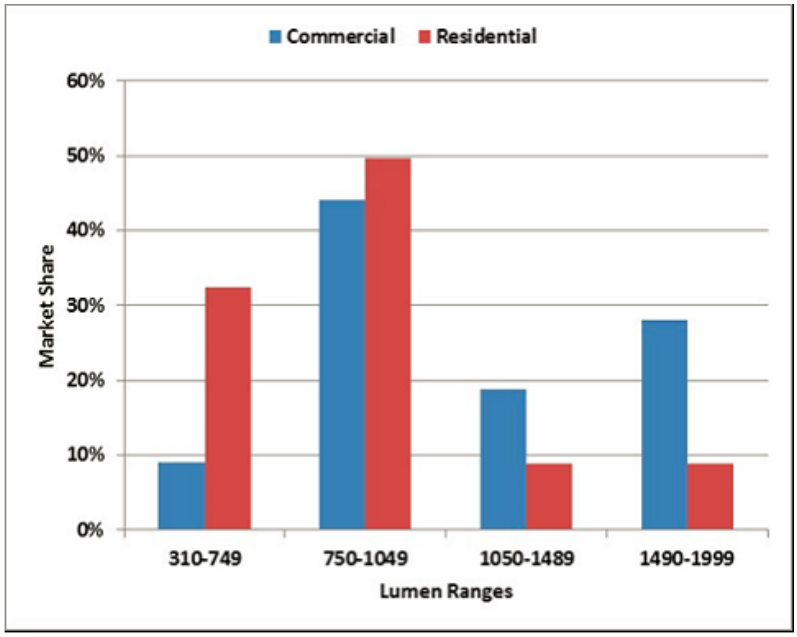
Table 3. Breakdown of Sales of Standard Incandescent Lamps Types (Horner, 2007; CLTC, 2008)

Wattage	2000 Percent*	2006 Percent
40 watt	13.5%	13 %
60 watt	43.3%	46%
75 watt	24.6%	19%
100 watt	18.0%	21%
150 watt	0.5%	1%
TOTAL	100.0%	100.0%

* Note: These data include only sales of: Soft White, Vibration Resistant, and Standard Clear lamps.

[7] Study not published at time of submission of comments, but expected to be published before final rule issued. NEEP will send completed study when available.

- Residential Lighting End-Use Consumption Survey, Cadeo Group:



Residential distribution (approx.):

310-749: 32%

750-1049: 49%

1050-1489: 8%

1490-1999: 8%

- Results of the Massachusetts Onsite Lighting Inventory, NMR Group, 2013: http://ma-eeac.org/wordpress/wp-content/uploads/Onsite-Lighting-Inventory-Results-Final-Report-6.7.13.pdf

Table 2-10: Saturation by Lumens

(Base: All onsite respondents)

Lumen Range	All Types	CFLs	Fluorescent	Halogen	Incandescent	LEDs
Sample Size	*150*	*150*	*150*	*150*	*150*	*150*
All Bulbs						
<310	2%	<1%	0%	15%	2%	20%
310-749	25%	9%	3%	66%	33%	13%
750-1049	45%	63%	2%	2%	46%	5%
1050-1489	13%	19%	11%	15%	10%	4%
1490-2600	10%	8%	32%	2%	9%	4%
2,600+	5%	1%	52%	1%	<1%	0%
Don't Know	1%	1%	0%	<1%	<1%	55%

- The Impact of EISA on Residential A-Lamps, NEEP and D&R International, 2014: http://www.neep.org/file/2176/download?token=3KIbMtr1

Table 2: 2012 Starting A-Lamp Socket Saturation by Technology and Lumen Bin, Northeast States

	Lumen Bin						
Technology	**<310**	**310-749**	**750-1049**	**1050-1489**	**1490-2600**	**2600+**	**Total**
Incandescent	0.0%	10.2%	35.2%	5.3%	7.5%	0.1%	58.3%
CFL	0.0%	2.1%	25.7%	4.8%	8.6%	0.1%	41.3%
Halogen	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.2%
LED	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%
Total	0.1%	12.3%	61%	10.2%	16.2%	0.2%	100%

Source: NMR Group, Inc. Results of the Massachusetts Onsite Lighting Inventory Final.

Again, NEEP and the United Illuminating Company; the National Consumer Law Center, on behalf of its low-income clients; the Vermont Public Service Department; Efficiency Vermont; Eversource Connecticut; and the Rhode Island Office of Energy Resources, appreciate the opportunity to weigh in on this important rulemaking. We welcome any questions on our comments and look forward to the successful implementation of a strong general service lighting standard.

Sincerely,

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