

Appliance Standards Awareness Project
American Council for an Energy Efficient Economy
Natural Resources Defense Fund
National Consumer Law Center (on behalf of its low-income clients)

November 4, 2019

Ms. Lucy deButts
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Office EE-5B
1000 Independence Avenue SW
Washington, DC 20585-0121

Email: GSL2018STD0010@ee.doe.gov

Docket Number: EERE-2019–BT–STD–0022

RIN: 1904-AE76

Dear Ms. deButts:

These comments comprise the response of the Appliance Standards Awareness Project, the American Council for an Energy Efficient Economy, and the National Consumer Law Center (on behalf of its low-income clients) to the Department of Energy (DOE) September 5, 2019 notice of proposed determination and request for comment (84 FR 46830).

DOE’s proposed determination that energy conservation standards for general service incandescent lamps (GSIL) do not need to be amended is based on an analysis that is incomplete, poorly structured, and factually flawed. DOE’s proposed determination is an attempt to slow the transition to energy efficient light emitting diode light bulbs. This determination would waste energy and dollars and damage the environment. We strongly urge DOE to withdraw the GSIL notice of proposed determination (NOPD) and redo the associated analysis.

The LED Revolution

Light emitting diode (LED) light bulbs are a true success story thanks to lighting industry innovation, DOE’s long-time support for research and development into solid-state lighting and, until recently, consistent federal light bulb regulations. LED light bulbs are more than five times as efficient as halogen light bulbs and last ten times as long. LEDs are broadly available and now compete with halogen bulbs on price but cost far less to own and use.

Over a ten year period the average US household with 33 light bulb sockets would need to purchase 274 halogen bulbs. The cost for the halogen bulbs¹ and the electricity to run them would be \$2,635.² Over the same period, the same household would only need 33 LED bulbs and the cost for the LED bulbs and electricity would be only \$417, a savings of \$2,218.³ These savings have made LEDs very popular and most lighting industry observers believe that the global economy will eventually transition from legacy lighting technologies like incandescent, halogen and fluorescent to LED. DOE's GSIL NOPD would delay the LED transition in the US, at a high cost to consumers. DOE's flawed analysis for this NOPD estimates that modestly more stringent GSIL standards would accelerate the transition to LEDs and generate cumulative national energy savings of 0.540 quadrillion BTU⁴ with a net present value savings of \$4.173 billion.⁵ This estimate understates the actual savings, as discussed below, but still demonstrates the magnitude of the benefits that DOE's GSIL NOPD proposes to waste.

DOE should evaluate standards based on realistic decisions consumers make in the market place

The GSIL NOPD includes a realistic scenario that assumes that consumers choose LED as substitutes for halogen GSILs, but DOE chose to base its proposed determination on a second, flawed, artificially restricted "unavailability scenario." In the unavailability scenario DOE assumes consumers buy GSILs even when they cost several times more than LEDs, an assumption that DOE acknowledges is unrealistic. We reject DOE's claim that statute requires the agency to apply the unavailability scenario in the analysis for this NOPD as lacking either common sense or legal basis, as discussed below.

We agree with DOE that more stringent GSIL standards would be unlikely to make GSILs competitive with LEDs on a lifecycle basis. We also agree that if more stringent GSIL standards make GSILs more expensive, it will accelerate the transition to LEDs. However, the current GSIL standard does not prevent, and a more stringent GSIL would not prevent, consumers from buying any kind of light bulb on the market. DOE should improve the realistic consumer choice scenario so that it better reflects actual costs and benefits of available GSIL technology options, should discard the unavailability scenario, and should redo its analysis using only the realistic consumer choice scenario.

¹ ASAP estimate of average number of light bulbs per US home based on EIA RECS 2015.

² Assuming halogen bulbs rated at 53 Watts with an average rate life of 1,100 hours, operating 2.5 hours per day of use per bulb, and the US average residential electricity rate of 13.3 cents per kilowatt hour (EIA July 2019) in 2019 US dollars assuming no real increases in electricity prices over time. Purchase price for halogen bulb is \$1.74/ea based on internet listings for "EcoSmart" halogen bulbs offered by the Home Depot obtained November 4, 2019 at www.homedepot.com/b/Lighting-Light-Bulbs/N-5yc1vZbmbu?storeSelection=3204,3209,3206,3203,3201

³ Assuming an LED bulb rated at 9 Watts with an average rated life of 11,000 hours. Otherwise, same assumptions as for halogen bulbs. Purchase price for LED bulb is \$1.74/ea based on internet listings for "EcoSmart" LED bulbs offered by the Home Depot obtained November 4, 2019 at www.homedepot.com/b/Lighting-Light-Bulbs/N-5yc1vZbmbu?storeSelection=3204,3209,3206,3203,3201

⁴ GSIL NOPD table V.4, cumulative net national full fuel cycle energy savings over 30 years.

⁵ GSIL NOPD table V.7, net present value of savings over 30 years calculated with a 3% discount rate in 2018 dollars.

DOE's GSIL NOPD suffers from multiple legal defects

The legal defects in DOE's GSIL NOPD are discussed in detail in separate comments prepared by Earthjustice which we join in, summarized as follows:

DOE's GSIL NOPD is predicated on the agency's incorrect legal interpretation that the backstop standard contained in statute has not been triggered. The Energy Policy and Conservation Act (EPCA) imposes a backstop standard that applies if DOE fails to complete a rulemaking for general service lamps that meets all statutory requirements. Because DOE has failed to complete the required rulemaking, the EPCA backstop standard applies to all general service lamps. The backstop standard must apply as of January 1, 2020, making DOE's GSIL NOPD superfluous.

Even if DOE persists with the current GSIL standards review process and develops a final determination regarding the amendment of GSIL standards, DOE cannot use the possibility that light bulb manufacturers may choose to no longer offer GSILs to justify the application of an unavailability scenario, or as an excuse to avoid a full rulemaking analysis. LED light bulbs and GSILs provide an identical service. EPCA cannot reasonably be read to ensure that the availability of a particular technology should be protected in perpetuity.

DOE considered only a single efficiency level although there is ample evidence to support consideration of both lower and higher efficiency levels for GSILs

In its analysis, DOE considered a single energy efficiency level (EL1) extrapolated from a single General Electric (GE) halogen infrared reflector (HIR) light bulb. However, DOE acknowledges in the NOPD that at least one additional manufacturer offered an HIR A-type light bulb on the market in the US in the past, and that a third manufacturer strongly considered offering one. Our research has found that a fourth manufacturer also offered an HIR A-type bulb on the European market and we also found that more recently scientists have developed infrared reflector materials that could enable incandescent light bulbs to approach the energy efficiency of LED. By ignoring these other more efficient technology options for GSIL efficiency levels DOE produced a biased, inaccurate analysis. DOE should redo the analysis in the GSIL NOPD based on a range of efficiency levels fully representing available technology options.

The GE HIR light bulb mentioned above was initially discussed in comments submitted by General Electric in response to the original request for information issued in this rulemaking. However, the specific product was not identified by either by GE or subsequently by DOE but was said to be an A-type bulb rated at 45 Watts and 870 lumens with an average rated life of 3000 hours⁶ that retailed for around \$7.00. GE says that this bulb was introduced to the market around 2010 but was unsuccessful and discontinued after several years. We agree with GE's statement that "Due to the high price of the halogen-IR lamp, a shorter life rating would not be economically acceptable to consumers"⁷ given the availability of cheaper conventional halogen bulbs, CFLs and LED bulbs. Rather than using this GE product's specifications as inputs to the analysis, DOE hypothesized an HIR, A-type bulb that was slightly more efficient but with only one-third the average rated life, at 1,000 hours. By doing so, DOE took an

⁶ Comments of General Electric to EERE-2017-BT-NOA-0052, pg 14, Appendix A

⁷ Ibid.

“economically unacceptable” product and hypothesized an even less economically acceptable version to base its analysis on even though there was copious available information that would have allowed DOE to develop both higher and lower efficiency levels for this analysis.

In its October 2017 response to the request for information, GE complained that the expensive of producing its HIR A-type lamp led to its high price. As DOE notes in the NOPD,⁸ Venture Lighting also introduced an HIR A-type bulb. The “Vybrant 2X”⁹ offered higher efficiency and longer life than either GE’s actual or DOE’s extrapolated HIR bulb at about half the price. The Vybrant 2X bulb was sold in two-packs priced at \$6.98 (\$3.50 per bulb).¹⁰ Venture Lighting worked with Deposition Sciences to implement a less expensive technique for applying the infrared reflective coating to a halogen capsule, making the Vybrant 2X a good example of innovation to lower the cost of technology introduction and market entrance. Attachment 1 includes a figure from an article by Deposition Sciences¹¹ showing the coated halogen capsule and how it was incorporated into a more efficient light bulb. The first production run of these bulbs sold out quickly and we are unaware of any consumer issues with their performance or longevity.

Technical Consumer Products (TCP), a major manufacturer of compact fluorescent lamps, also worked with Deposition Sciences to develop its own HIR A-type light bulb (see Attachment 1) with higher efficiency than the Vybrant 2X and at a similar price point. The product was announced at the ENERGY STAR Products Partner meeting 2011 but never commercially introduced in the US. The available information on the Venture Lighting and TCP HIR bulbs provides at least as good a basis for the development of an efficiency level as the unidentified GE HIR bulb that DOE used to develop EL1. We suggest that DOE develop a higher efficiency, lower cost EL2 using the product information described here.

The hypothetical HIR A-type bulb DOE developed for EL1 incorporates an infrared reflective coating which increases filament operating temperature and pressure within the halogen capsule. DOE identified other, valid energy efficiency technologies such as thinner filaments and less conductive inert fill gas but did not develop an energy efficiency level that included these options. Philips Lighting offered an HIR A-type bulb rated for 230 volt operation in Europe, as discussed in a 2008 report by Ecos Consulting for the European Commission.¹² The Philips’ EcoClassic HIR bulb included an internal power supply to drive the halogen capsule at 12 volts allowing Philips to use a sturdy, compact filament well-suited for use in a HIR capsule.¹³ DOE also did not consider this technology option. Finally, in 2016, researchers at the Massachusetts Institute of Technology published research¹⁴ showing the application of engineered photonic crystals as the infrared reflectors in a proof-of-concept, high-efficiency light

⁸ GSIL NOPD section IV.A.(3) Technology Options

⁹ See Attachment 1 and <http://business.time.com/2013/05/09/long-live-the-lightbulb/>

¹⁰ Archive of online discussion of Vybrant 2X pricing: [www.candlepowerforums.com/vb/showthread.php?363165-REVIEW-vybrant-50w-1600-lumen-\(100w-equivalent\)-A-19-incandescent-bulb](http://www.candlepowerforums.com/vb/showthread.php?363165-REVIEW-vybrant-50w-1600-lumen-(100w-equivalent)-A-19-incandescent-bulb)

¹¹ www.techbriefs.com/component/content/article/lighting-technology/lighting-technology/15641

¹² See Attachment 2, Philips EcoClassic

¹³ Ecos Consulting. “B Class Halogens and Beyond: Design Approaches to Complying with Proposed EU Eco-design Domestic Lighting Requirements”, for the European Commission, 12 December 2008

¹⁴ Ognjen, Ilic et. al. “Tailoring high-temperature radiation and the resurrection of the incandescent source” *Nature Nanotechnology* 11, 320-324 (2016)

bulb, which DOE also did not consider. DOE could have included these technologies either individually or in combination to develop efficiency levels to provide a more complete analysis.

In addition to the EL2 proposed above, we encourage DOE to evaluate an efficiency level below EL1 (which we will call ELO.5) that achieves a more modest improvement than the 26% efficiency gain over ELO represented by EL1 or the 53% efficiency gain of EL2. For ELO.5 we extrapolated an HIR A-type bulb that is slightly less efficient than GE’s unidentified HIR A-type bulb and priced between the Vybrant 2X and the ELO incandescent. Table 1 below compares the various attributes of GSILs that meet ELO, ELO.5, EL1 and EL2 efficiency levels.

Table 1: Suggested Efficiency Levels

	Technology	Power (Watts)	Light Output (Lumens)	Avg Rated Life (hours)	Efficacy (lumens per watt)	Price per Bulb (\$)
ELO	Halogen	43	750	1000	17.4	1.81
ELO.5	ASAP Extrapolation	43	800	3000	18.6	2.50
EL1	DOE Extrapolation	34.3	750	1000	21.9	7.00
EL2	Vybrant 2X	30	800	1500-2000	26.7	3.50

The GSIL NOPD gives passing mention to the Vybrant and TCP HIR A-type bulbs, ignores the Philips product and the MIT research, and fails to incorporate any of this relevant technical information in its analysis. DOE’s GSIL NOPD analysis is incomplete and does not support the proposed determination. We strongly recommend that DOE withdraw the NOPD and redo the analysis.

DOE’s price estimate for the EL1 GSIL is too high

In the GSIL NOPD¹⁵ DOE says that it reviewed the incremental pricing from the 2015 incandescent reflector lamp (IRL) final rule for the baseline halogen lamp and the more efficacious HIR substitute and “...added the incremental change in end-user price from the 2015 IRL final rule to the baseline GSIL analyzed in this evaluation.” The retail price for the baseline GSIL in the NOPD is \$1.81 and the retail price for DOE’s extrapolated EL1 bulb is \$7.00 (in 2019\$) which suggests that the incremental cost obtained from the 2015 IRL final rule is equal to the difference, which is \$5.19. DOE provides no explanation of how this incremental value was derived from the 2015 IRL final rule. By basing an extrapolated EL1 cost on the price history of relatively more expensive IRL bulbs, DOE assumed high production costs that were apparently not experienced by Venture Lighting for the Vybrant 2X. Had DOE extrapolated EL1 pricing from the Vybrant 2X, (\$3.93 in 2019\$) the incremental cost estimate would have been only \$2.21.

However, even this lower, more realistic value would not take price learning effects into account. In the 2015 IRL rule DOE applied price learning to project future price estimates for HIR IRLs. In the 2014 Technical Support Document¹⁶ for EERE-2011-BT-STD-0006 DOE states:

¹⁵ GSIL NOPD section IV.C Product Price Determination

¹⁶ Section 11.3.5 Price Learning

Accordingly, the initial lamp prices determined in the pricing analysis (chapter 7 of this TSD) are adjusted for the observed learning rate at later times in the analysis period.

During DOE's October 15, 2019 public meeting on the GSIL NOPD DOE's contractors responded to questioning by ASAP that they had included price learning effects for CFLs and LEDs but no price learning effects for HIR bulbs when considering out-of-scope alternatives to GSILs. On slide 52 of DOE's presentation, the consultant claimed that EL1 compliant GSILs represented a mature technology, despite the fact that such light bulbs are not currently commercially available and have never been sold in large numbers. DOE should expect that EL1 compliant GSILs to exhibit significant price decreases through price learning during the 30-year analysis period. We strongly recommend that DOE withdraw this NOPD and redo the lifecycle cost and payback period analyses using a more appropriate cost estimate based on an identified HIR A-type bulb, adjusted for price learning.

DOE based its out-of-scope incandescent bulb on a shatter-proof incandescent lamp, although shatter proof lamps are subject to standards under EISA in a way that makes DOE's analysis invalid

Shatter proof lamps largely use incandescent technology and are exempt from the definition of GSILs. However, shatter-proof lamps are one of five lamp types covered by federal standards that require DOE to track shipments. If shipments of shatter-proof lamps exceed 100% of modeled unit projected growth in a given year, DOE must set standards for shatter-proof lamps within one year. If DOE does not conclude an accelerated rulemaking on time, shatter-proof lamps are subject to a backstop standard of

*“(I) a maximum wattage limitation of 40 watts on shatter resistant lamps; and
“(II) a requirement that those lamps be sold at retail only in a package containing 1 lamp.”¹⁷*

DOE imposed similar standards for vibration service and rough service lamps after shipments of those lamp types exceed modeled unit values. DOE's scenarios in the GSIL NOPD are unrealistic because they do not account for the fact that if shipments of incandescent shatter proof bulbs were to increase, that they would cause DOE to set standards or trigger the backstop. The backstop requirement would limit shipments since a conventional 40 Watt shatter-resistant incandescent lamp would be incapable of providing adequate levels of light for common uses. DOE should redo the analysis for the GSIL NOPD using a different product for the out-of-scope incandescent lamp.

DOE should complete all analyses based on a realistic scenario that includes substitution by non-GSIL light bulbs

In the NOPD, DOE assumes that no manufacturer would invest in the production capacity for GSILs that comply with EL1, and that few consumers would buy such GSILs if they were produced. DOE then uses the assumed lack of shipments of EL1 compliant GSILs as a rationale for not providing a cumulative regulatory burden analysis, a consumer subgroup lifecycle cost analysis, a utility impact analysis, or an emissions analysis in the NOPD. DOE also gave potential unavailability as a rationale for not transmitting the proposed determination to the Attorney General's office to obtain an assessment of the impact of any lessening of competition likely to result from the determination as required by statute.

¹⁷ 121 Stat. 1584 Public Law 110-140 Dec. 19, 2007

DOE has not demonstrated that industry will fail to provide a more efficient incandescent product in response to any improved GSIL standard level. As we have shown above, DOE has failed to model a range of available technology improvements for GSILs and, for the one efficiency level evaluated, has overestimated costs. DOE should develop additional ELs based on realistic assumptions and publish a revised NOPD that includes all of the customary analyses.

Summary

DOE's GSIL NOPD is based on an incorrect legal interpretation of statute, is poorly structured, incomplete, and factually flawed. We strongly urge DOE to withdraw this proposed determination and redo the analysis.

Thank you for the opportunity to provide these comments.

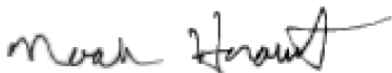
Sincerely,



Chris Granda
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Appliance Standards Awareness Project (ASAP)



Jennifer Thorne Amann
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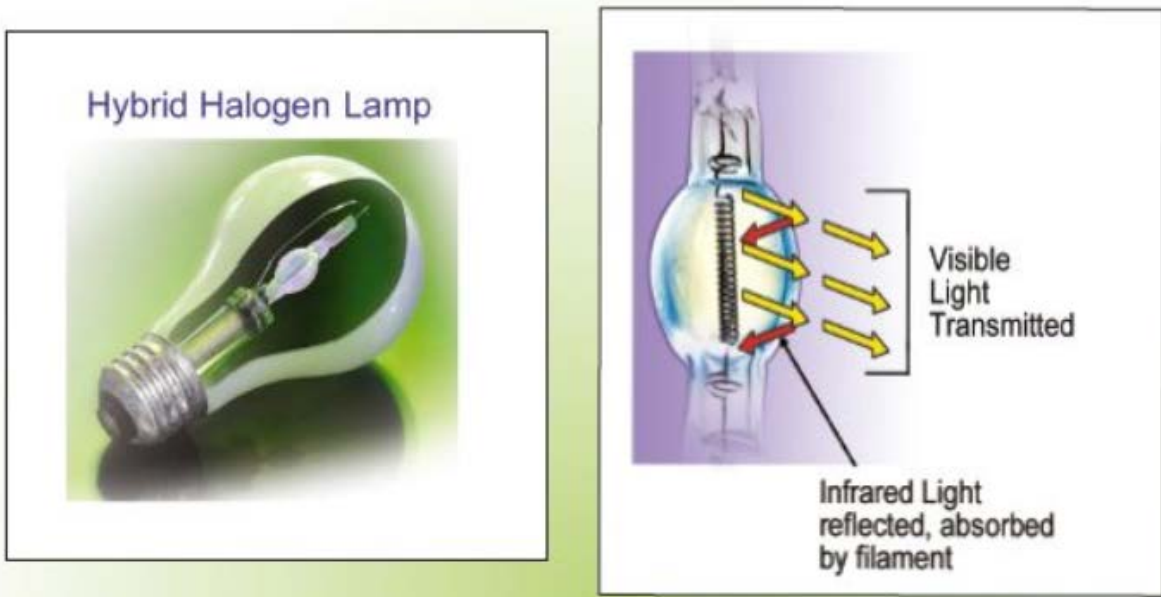


Noah Horowitz
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Attachment 1: Halogen Infrared Reflector Light Bulbs




Source: TechBriefs www.techbriefs.com/component/content/article/lighting-technology/lighting-technology/15641

The first version of these dramatically more efficient HIR lamps was Venture Lighting's "2X" light bulbs which provided double the efficiency and longer lifetime than conventional incandescent or halogen light bulbs.



Photo: Noah Horowitz Natural Resources Defense Council

Venture Lighting also offered a 30 Watt, 800 lumen version as a replacement for the conventional 60 Watt incandescent A-lamp. TCP, the lighting company that was the largest producer of CFLs sold in the US at the time was also developing a similar 2X bulb but never brought it to the market. The TCP product was expected to have an average rated life of 2,000 hours.



TCP Generation 2 Hybrid Halogen

TCP exclusive Hybrid Halogen technology

Highest efficacy ratings (50% more energy efficient) with a max efficacy rating = 32 LPW

Full range of products

- 50W = 100W @ 1600 lumens
- 40W - 75W @ 1150 lumens
- 30W = 60W @ 850 lumens

2,000 hour life rating

Source: Noah Horowitz, Natural Resource Defense Council presentation at 2011 ENERGY STAR partner meeting

The product below was sold by Philips Lighting in Europe and achieved 50% energy savings over a conventional halogen bulb with an average rated life of 3,000 hours. Due to the lower US distribution voltage, a US version of this HIR bulb should be cheaper to manufacture than the European version.



Source: Ecos Consulting