

# LED LAMPS ORIGINAL EQUIPMENT MANUFACTURER PERFORMANCE ASSESSMENT

2020 Report



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## ASSESSING PRODUCTS IN THE MARKET

### VERIFICATION TESTING

The ENERGY STAR Third Party Certification Program (3PC) is designed to provide a consistent structure for ENERGY STAR product certification and subsequent off-the-shelf (“verification”) testing. Under 3PC, all ENERGY STAR products are third-party certified and after introduced to the market may be subject to verification testing, administered by each of the EPA-recognized certification bodies. Each year, 10% of all ENERGY STAR certified LED lamps are verified. Up to half of the tested products are selected through an Agency-led nomination process, and the other half of tested products are selected from the ENERGY STAR Qualified Products List (QPL)<sup>1</sup> by the certification body (CB). EPA’s selection list is comprised of products nominated by ENERGY STAR stakeholders, such as utilities and industry, and by EPA. Some factors that may increase the likelihood of product nominations include: prior product failures by the same manufacturer; products that are broadly rebated; manufacturers with limited verification testing data; and products from sources with repeated program compliance issues. Once a final product list for testing is compiled, responsible brand owner partners are informed by the CBs, products are procured, and testing begins.

LED lamps subject to verification testing under 3PC undergo some variation of the same tests required for purposes of ENERGY STAR product certification (see Table 1), except that products are tested at 0 hours, 3,000 hours and 6,000 hours.

**Table 1: Tests Required for ENERGY STAR Certification and Verification**

Photometric Performance	Lumen Maintenance and Rated Life	Operational and Electrical Performance
Luminous Efficacy	3000-Hour Lumen Maintenance	Power Factor
Light Output	6000-Hour Lumen Maintenance	Start Time
Elevated Light Output Ratio	Rated Life	Run-Up Time
Center Beam Intensity	Rapid Cycle Stress Test	Transient Protection
Correlated Color Temperature (CCT)		
Color Rendering Index (CRI)		

### PRODUCT DISQUALIFICATION

During verification testing, LED lamp performance is assessed at three stages of testing: 0 hours, 3,000 hours and 6,000 hours. A product failure can occur at any of these stages. EPA addresses failed products and their association with the ENERGY STAR mark pursuant to the ENERGY STAR [disqualification procedures](#). If a product fails, then EPA sends notification that it intends to disqualify the product from ENERGY STAR to the brand owner of the tested product and all other labelers who sold that base product under another brand (“affected private labelers”). Those parties may or may not include the original equipment manufacturer (OEM),

<sup>1</sup> <http://www.energystar.gov/products>

depending upon whether the OEM labels and sells its own branded version of the bulb, or only sells the product to other labelers for market distribution. All parties notified are provided the opportunity to dispute the pending disqualification. If applicable, EPA conducts a technical review of all information the partner(s) submits in order to make a final determination on the product’s status.

For any product that warrants disqualification from the ENERGY STAR Program, EPA requires a corporate certification detailing product control measures undertaken to manage the sale, distribution, and marketing of the disqualified model, such that the ENERGY STAR name and label is no longer associated with the product. LED lamps that are disqualified appear on the [Lighting Products Disqualified from the ENERGY STAR Program](#) list on the [ENERGY STAR Program Integrity](#) webpage.

LED lamps first became eligible for the ENERGY STAR label in 2013 and the first verification tests were completed in 2015. **As of December 31, 2019, 1,017 LED lamps have been evaluated and completed lifetime testing through ENERGY STAR verification testing.** During that period, 179 LED lamps failed to meet program requirements and were subsequently disqualified from the ENERGY STAR program, representing 18% of all tested LED lamps. Table 2 provides a breakdown of number of products tested and corresponding disqualification rates, by year.

**Table 2: Summary Performance Results of All LED Lamps Products Tested 2015 – 2019**

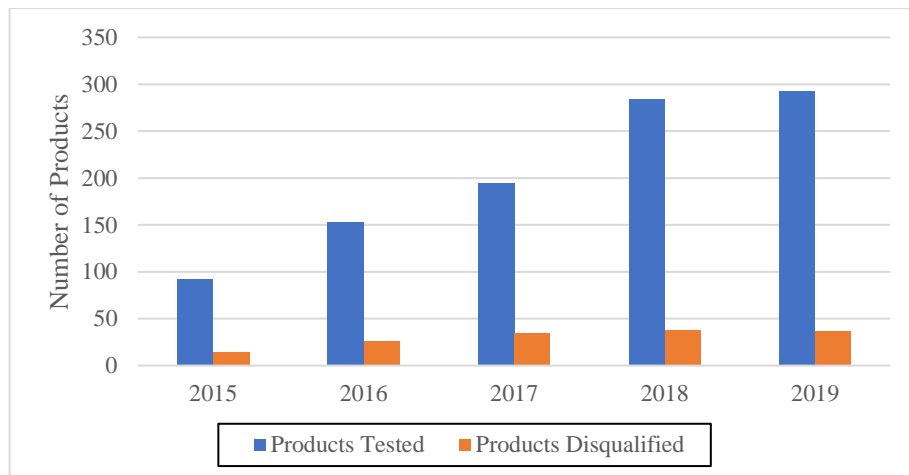
Year Testing Completed	# Products Tested	# Products Disqualified	Disqualification Rate
2015	92	14	15%
2016	153	26	17%
2017	195	35	18%
2018	284	38	13%
2019	293	37	13%
<b>All Years (Cumulative)</b>	<b>1017</b>	<b>179<sup>2</sup></b>	<b>18%</b>

Figure 1 illustrates the number of products tested annually and the corresponding number of products disqualified. A decrease in disqualification rate during an influx of products tested may suggest greater confidence in the disqualification rate reduction.

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<sup>2</sup> The total number of disqualified products through 2019 is greater than the sum of the associated years because it includes some 2019 disqualifications from early failure aspects but that will complete lifetime testing in 2020.

**Figure 1: Products Tested and Disqualified by Year**



### EARLY INTERIM CERTIFICATION FAILURES

Lifetime testing for LED lamps seeking ENERGY STAR certification requires a duration of 6,000 hours (approximately nine months). Recognizing the length of time required to bring this product to market, EPA offers Early Interim (provisional) Certification for products that meet minimum light output requirements after life testing has reached the 3,000-hour mark and all other relevant performance requirements. Full Certification depends on successful completion of the full 6,000-hour lumen maintenance life test.

Early certified products represent a small fraction of the over 20,000 LED lamps that have been certified. Because early certified LED lamps are certified consistent with specification allowances, products that fail long-term performance are removed from the QPL (and not listed as “disqualified”). EPA requires the same actions to control the sale, distribution, and marketing of LED lamps for early certification failures as for disqualified products.

Significant fluctuations in the number of full-life testing failures from 2012-2016 caused EPA to consider whether early certifications were being properly submitted by CBs to EPA (See Table 3 for annual early certification failures data by year). In 2017, EPA established improved data quality checks for CBs to improve the accurate listing of early certified products that have completed full life testing. No early interim failures have occurred since 2016, suggesting that EPA oversight of early interim failures may have positively influenced risk management regarding product introduction.

**Table 3: Early Interim Certification Failures (2012-2019)**

Year	Number of Incidents
2012	13
2013	2
2014	2
2015	8
2016	11
2017	0
2018	0
2019	0
<b>All Years (Cumulative)</b>	<b>36</b>

## THE ROLE OF OEMS

In the United States, LED lamps are sold under a variety of brand names. These branded products, or private labels, are manufactured by an Original Equipment Manufacturer (OEM) who sells its products to the private label brand owner. In some cases, an OEM will sell the product under its own brand name, as well as selling it to other private labelers. Other times, a brand owner and an OEM will enter an exclusive relationship whereby the OEM sells a product to one labeler only. Most commonly, an OEM sells the same model to multiple private labelers and each private labeler sells the model under its own brand name. This underscores the broad impact of an OEM product's quality as it moves through the market.

When determining individual OEM disqualification rates, EPA considers only those OEMs who have had five or more products tested to date ("significantly tested OEMs") to ensure that average rates do not result in distorted comparisons (for example, disqualification of one of two products yields a 50% disqualification rate for a minor examination of the party's product).<sup>3</sup> Each year as verification testing nominations are prepared, EPA strives to increase the number of OEMs that have had five or more products tested so that comparisons of individual OEMs are more comprehensive (see Figure 2). In addition, EPA seeks to increase the number of tested products that are manufactured by ENERGY STAR certified LED bulb OEMs who have not yet been subject to verification testing. The significance of the increase in OEMs tested is that it provides a better understanding of quality among a broader universe of sources, as well as comparisons across the industry.

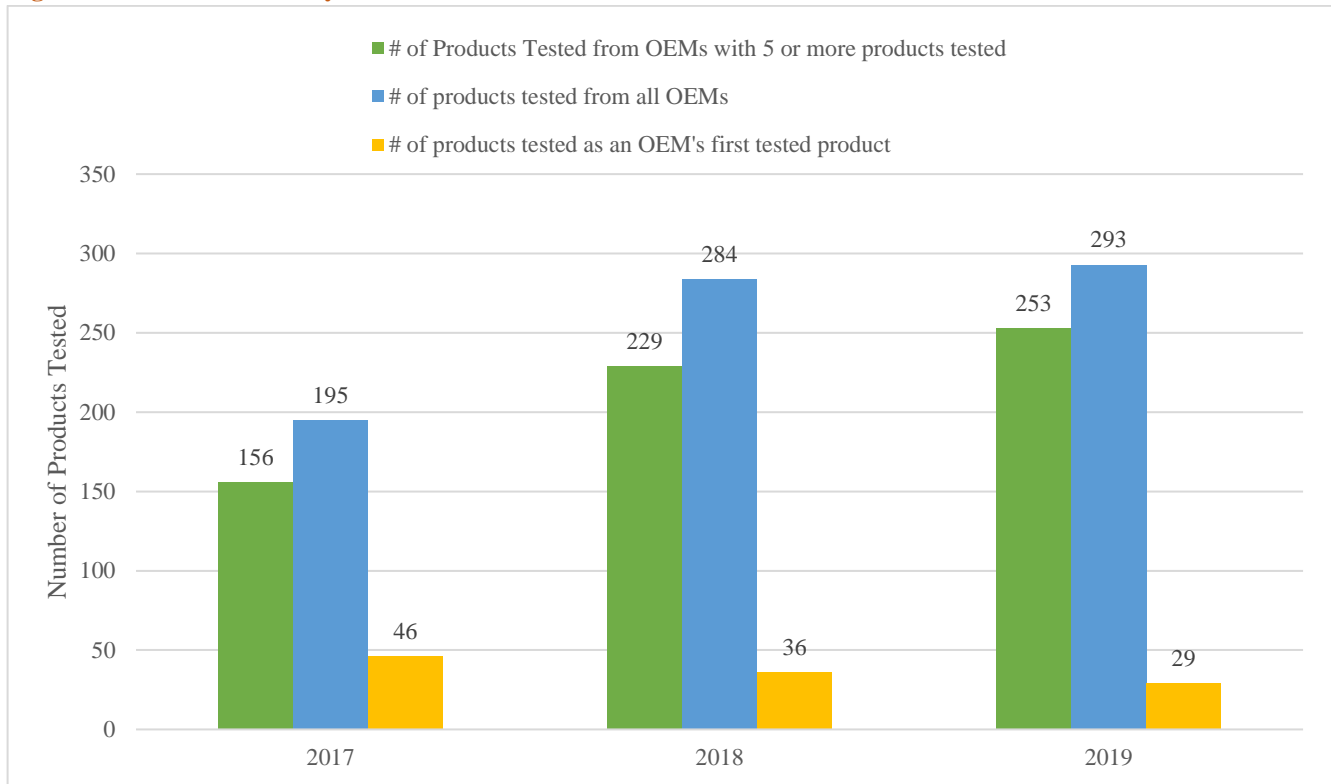
Between 2015 and 2019, a total of 151 LED bulb OEMs had products that completed verification testing. Of those 151 OEMs, 44 have had five or more LED lamps tested, representing 83% of all LED lamps tested to date. Figure 2 illustrates that between 2017 and 2019, most products tested were manufactured by OEMs with a higher number of completed lifetime tests. The distribution of OEMs and products tested reflects EPA's parallel goals to increase the number OEMs tested for the first time and the number of OEMs with five products tested.

EPA continues to learn about ENERGY STAR LED bulb sourcing. In 2016 and 2017, ENERGY STAR visited OEM factories in China to learn more about common production practices and challenges, quality control within the factory, OEM and brand relationships, and other issues affecting product performance. EPA provided technical guidance regarding ENERGY STAR specifications and reviewed with OEMs their verification testing compliance rates in the context of competitor performance overall. EPA was able to educate OEMs regarding the reach of product disqualifications, and the implications for their buyers, as well as increased exposure to additional product testing. EPA noticed increasing disqualification rates were stemmed and showing signs of reversal after meetings and inspections with OEMs at their factories.

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<sup>3</sup> Overall annual product disqualification rates include all products that have completed lifetime testing, not solely those manufactured by OEMs with five or more tested products.

**Figure 2: Products Tested by Year**

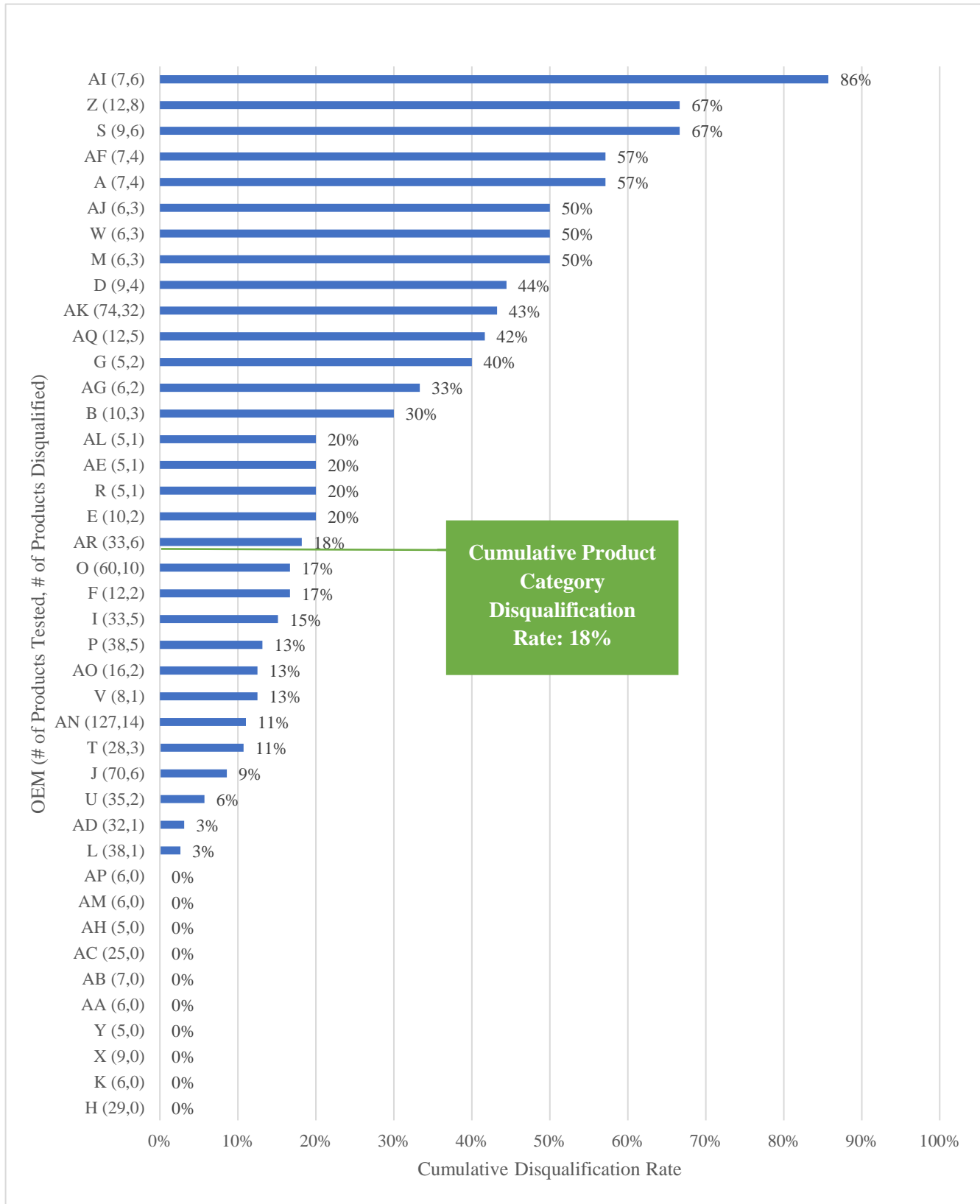


## ANNUAL DISQUALIFICATION RATES

In LED bulb testing conducted from 2015 to 2019, the overall product disqualification rate is 18%. Individual disqualification rates for significantly tested OEMs during that period range from 0% to 86% (see Figure 3). Of the 41 significantly tested OEMs in 2015-2019, 10 had zero disqualifications, and 18 performed below the overall product disqualification rate. The 10 OEMs with perfect testing records had between 5 and 29 products tested through lifetime. Of the 13 OEMs most heavily tested, disqualifications ranged from 0% to 43%. The poorest performing OEM has a disqualification rate 19% higher than the next poorest performers (see Figure 4, OEMs “AI” and “Z”).

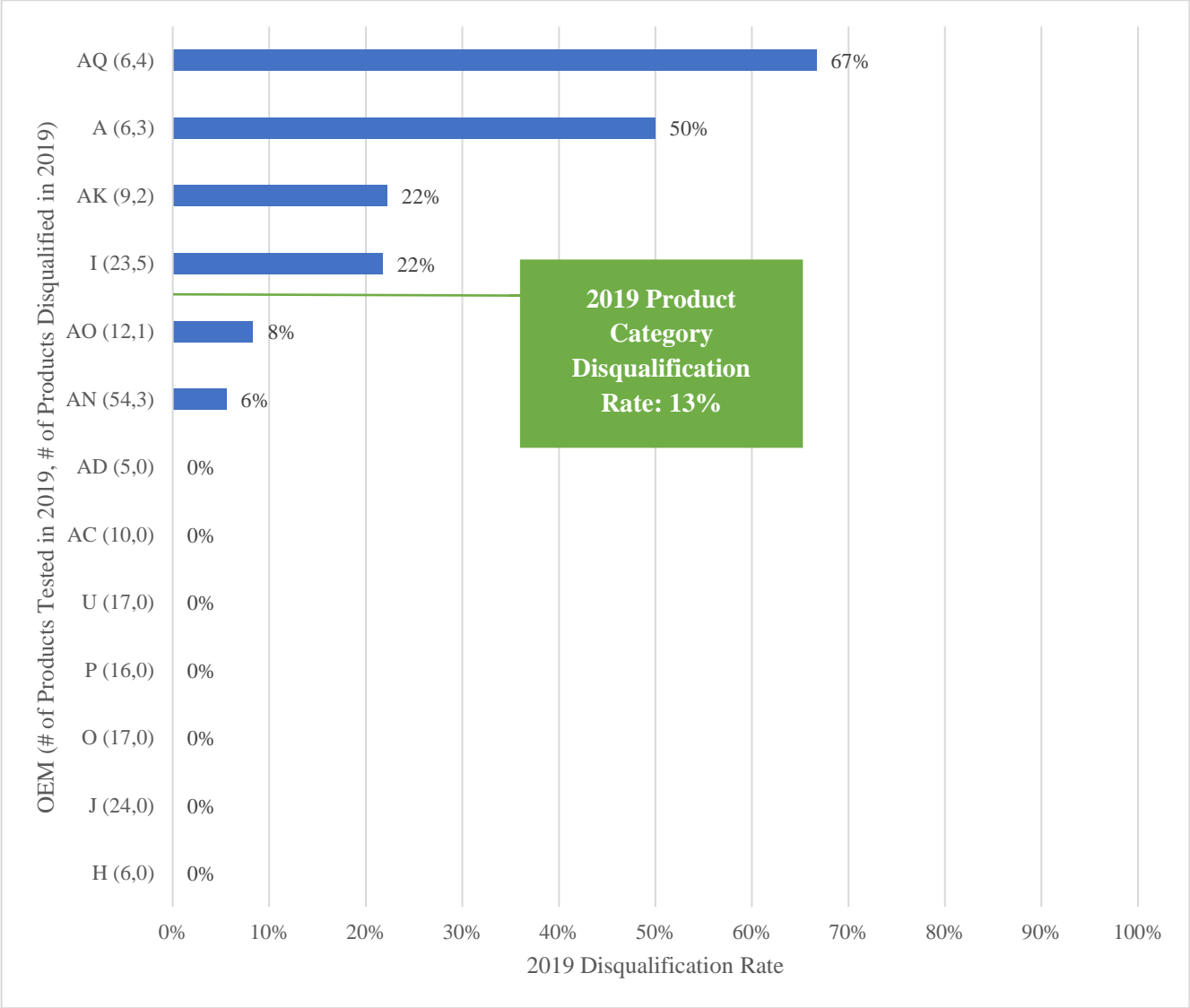
In 2019, annual disqualification rates varied widely among the significantly tested OEMs, ranging from 0% to 67%, with an overall product disqualification rate of 13% (see Figure 4). Out of the 13 significantly tested OEMs this year, 7 had zero disqualifications, and 9 had disqualification rates lower than the 2019 overall product disqualification rate of 13%. These results reflect a reduction by half to the 2018 number of significantly tested OEMs that performed below average that year (4 in 2019; 8 in 2018). (See Figure 5). That reduction is in part due to a few poor-performing OEMs in 2018 meaningfully improving their performance in 2019. Figure 4 also reflects a reduction in number of products tested by significantly tested OEMs in 2019 (the number of LED lamps actually increased to 293 from 284 in 2018). This is because 2019 included more OEMs who had not been previously tested or have been undertested, and who will be represented as significantly tested in 2020 data. Figure 5 displays a breakdown of significantly tested OEMs in 2018.

**Figure 3: Cumulative (2015-2019) Disqualification Rates, by OEM (5 or more products tested)**

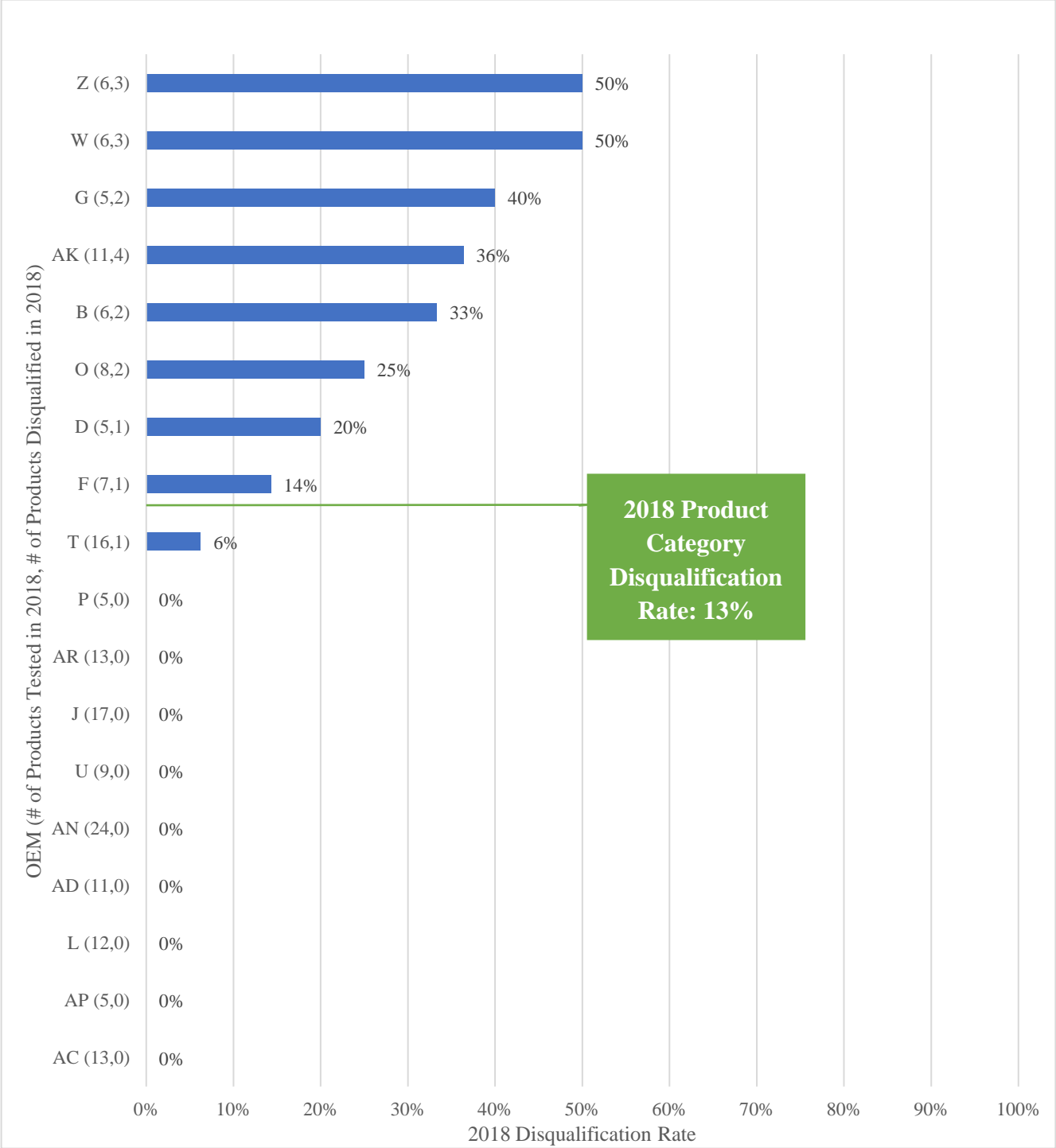




**Figure 4: 2019 Disqualification Rates, by OEM (5 or more products tested in 2019)**



**Figure 5: 2018 Disqualification Rates, by OEM (5 or more products tested in 2018)**



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## OEM LEADERSHIP

In 2018, ENERGY STAR issued a special recognition award to Feit Electric for outstanding verification testing results as an LED bulb supplier for years 2015-2017. During that time, Feit Electric had a perfect testing record (zero disqualifications), and among those OEMs with perfect records, had the greatest number of products tested. This special recognition is intended to be a one-time annual award that recognizes an OEM presenting consistently high manufacturing quality among the product examined in verification testing.

In 2019, a special recognition award was issued to Xiamen Longstar Lighting for its 2018 verification testing results. Xiamen Longstar Lighting had a perfect testing record (zero disqualifications), and among those OEMs with perfect records, had the greatest number of products tested. This year's special recognition was issued to Shanghai Dangoo Electronics Co., Ltd. for a perfect testing record established through significant testing.

As more data becomes available regarding significantly tested OEMs, it will provide more insight into the full range of source quality and OEM performance. OEMs with low disqualification rates based on a broad sample of products tested benefit from becoming a of lower priority for future Agency test nominations.

## HEIGHTENED OVERSIGHT

In 2013, to better understand manufacturing and market vulnerabilities, EPA began to track and more openly communicate annual disqualification rates associated with each OEM for CFLs. In addition, EPA instituted heightened oversight practices, a series of program elements that provide greater oversight of those OEMs with a demonstrated history of below-average performance to prompt increased quality control. Poor performing OEMs, and private labelers associated with them, became subject to increased verification testing. Models from sources with failure rates greater than the overall CFL program average (based on five or more tested products) were considered for verification testing nominations, and private labelers were required, as part of corrective measures, to establish and submit additional quality control assurances covering all models that they carry from that source.

As a result of these heightened oversight efforts, the CFL program disqualification rate fell by a third from 2013 to 2016. Four of the five worst performing OEMs with CFLs tested during the CFL Testing Program did not certify any CFLs to the new Lamps Version 1.0 Specification. By eliminating poor performing sources from the ENERGY STAR CFL market, EPA intended to decrease the likelihood of their participation in the ENERGY STAR LED bulb market.

Based on its demonstrated value in assessing and affecting the CFL market, EPA began applying that approach to individual LED bulb OEMs. Similar to CFL OEMs, LED lamp OEMs with disqualification rates higher than the product average, and the labelers associated with the failed product, are subject to increased product testing. Heightened oversight efforts may have contributed to the stabilization of the disqualification rates between 2018 and 2019. In 2020, EPA issued letters to 127 LED bulb OEMs to notify them of their annual verification testing performance, including the overall product disqualification rate. EPA encourages brand owners to seek compliance data from OEMs, including the notifications provided by EPA. 2020 data will provide additional insight as to the effectiveness of such efforts.

## APPENDIX

### TEST DATA FOR LED LAMP OEMS 2014-2019

OEM	2018 Tested	2018 Disqualified	2019 Tested	2019 Disqualified	Cumulative Tested	Cumulative Disqualified	Cumulative Disqualification Rate
H	2	0	6	0	29	0	0%
K	4	0	2	0	6	0	0%
Q	0	0	3	0	4	0	0%
X	0	0	0	0	9	0	0%
Y	4	0	0	0	5	0	0%
AA	0	0	4	0	6	0	0%
AB	1	0	3	0	7	0	0%
AC	13	0	10	0	25	0	0%
AH	0	0	2	0	5	0	0%
AM	0	0	2	0	6	0	0%
AP	5	0	1	0	6	0	0%
L	12	0	0	0	38	1	3%
AD	11	0	5	0	32	1	3%
U	9	0	17	0	35	2	6%
J	17	0	24	0	70	6	9%
T	16	1	4	1	28	3	11%
AN	24	0	54	3	127	14	11%
V	0	0	0	0	8	1	13%
AO	3	0	12	1	16	2	13%
P	5	0	16	0	38	5	13%
I	4	0	23	5	33	5	15%
F	7	1	2	1	12	2	17%
O	8	2	17	0	60	10	17%
AR	13	0	3	0	33	6	18%
E	3	1	0	0	10	2	20%
R	0	0	0	0	5	1	20%
AE	0	0	0	0	5	1	20%
AL	4	1	0	0	5	1	20%
N	0	0	3	0	4	1	25%
B	6	2	2	1	10	3	30%
AG	4	2	2	0	6	2	33%
G	5	2	0	0	5	2	40%
AQ	3	1	6	4	12	5	42%
AK	11	4	9	2	74	32	43%
D	5	1	1	1	9	4	44%
C	0	0	1	1	2	1	50%
M	3	2	2	0	6	3	50%
W	6	3	0	0	6	3	50%
AJ	1	0	0	0	6	3	50%
A	0	0	6	3	7	4	57%
AF	3	0	2	0	7	4	57%
S	3	1	3	3	9	6	67%
Z	6	3	2	2	12	8	67%
AI	3	2	4	2	7	6	86%