

LED LAMPS ORIGINAL EQUIPMENT MANUFACTURER PERFORMANCE ASSESSMENT

2019 Report



September 25, 2019

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NONCOMPLIANT PRODUCTS

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, 20% 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)¹ 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, and the CBs initiate testing.

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), depending upon whether the OEM labels and sells its own branded version of the bulb, or only sells the product

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

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.

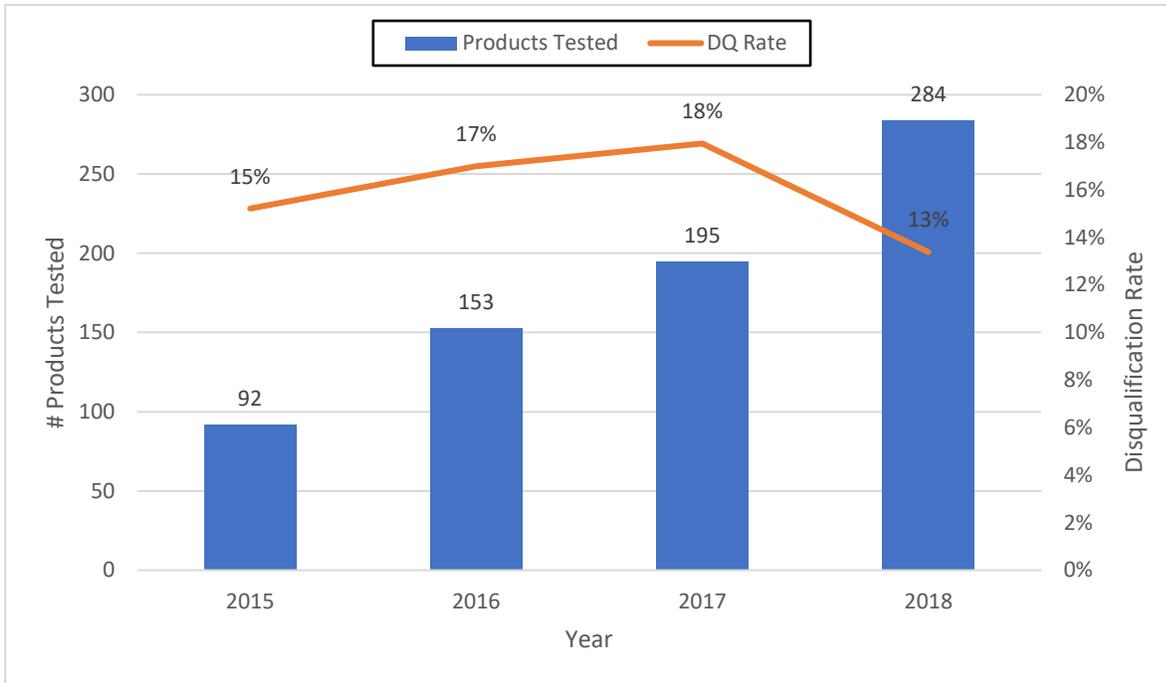
The first LED lamps became eligible for the ENERGY STAR label in 2013 and the first verification tests were completed in 2015. **As of December 31, 2018, 724 LED lamps have been evaluated and completed lifetime testing through ENERGY STAR verification testing programs.** During that period, 126 LED lamps failed to meet program requirements and were subsequently disqualified from the ENERGY STAR program, representing 17% of all tested LED lamps. (See Table 2 for 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 – 2018

Year Testing Completed	# Products Tested	# Products Disqualified	Disqualification Rate
2018	284	38	13%
2017	195	35	18%
2016	153	26	17%
2015	92	14	15%
All Years (Cumulative)	724	126	17%

Figure 1 illustrates the annual increases in number of products tested and the corresponding annual disqualification rates. A decrease in disqualification rate during an influx of products tested provides greater confidence in the significance of the disqualifications reduction.

Figure 1: Products Tested and Disqualification Rates by Year



EARLY INTERIM CERTIFICATION FAILURES

Life testing for LED lamps seeking ENERGY STAR certification requires a duration of 6,000 hours (approximately nine months). Recognizing this partner commitment, 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 but are not “disqualified products”. EPA requires the same actions to control the sale, distribution, and marketing of LED lamps for early certification failures as for disqualified products.

Erratic receipt of full-life testing failures data 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.) After a preliminary review of early certification failures, in 2017, EPA established improved data quality checks for CBs. Data from 2017 and 2018 suggest that improved data quality monitoring resulted in greater failure detection and associated product controls for affected products.

Table 3: Early Certification Failures (2012-2018)

Year	Number of Incidents
2012	13
2013	2
2014	2
2016	8
2017	11
2018	15
All Years (Cumulative)	51

OEM PERFORMANCE

In the United States, LED lamps are sold under a variety of brand names. These branded products, or private labels, are manufactured by OEMs who sell their products to the private label brand owners. 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 into 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 importance and broad impact of an OEM product's quality as it moves through the market.

Each year, EPA seeks to increase the number of ENERGY STAR certified LED bulb OEMs (OEMs) whose products are subject to verification testing for the first time. 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 between sources and across the industry.

TRACKING PERFORMANCE

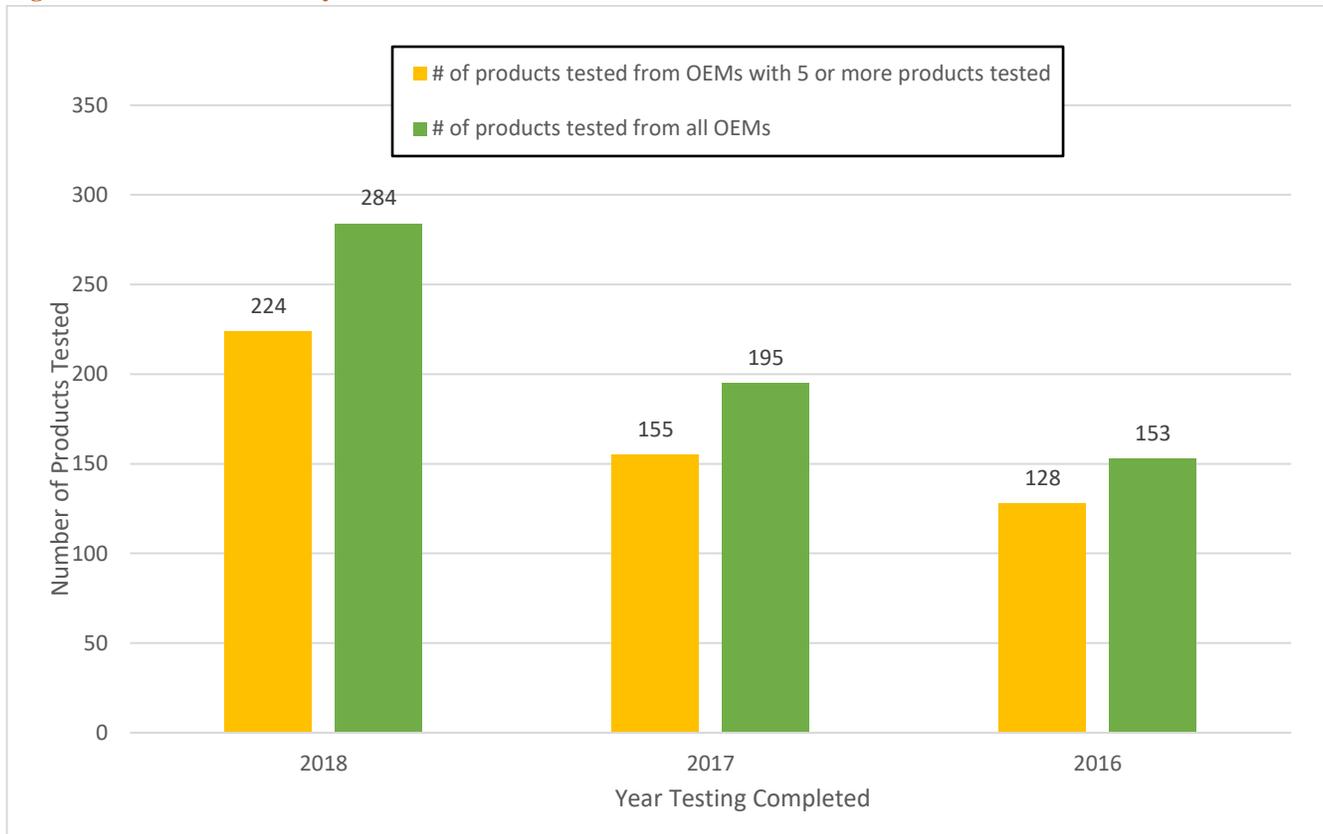
In 2013, to better understand manufacturing and market vulnerabilities, EPA began to track, and more openly communicate, annual disqualification rates associated with each OEM for CFLs. Based on its demonstrated value in assessing and affecting the CFL market (disqualification rates fell by a third), EPA has begun applying that approach to individual LED bulb OEMs.

When determining 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 are not distorted comparisons (for example, disqualification of one of two products yields a 50% disqualification rate for a minor examination of the party's product).² 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.

Between 2015 and 2018, a total of 132 LED bulb OEMs had products that completed verification testing. Of those 132 OEMs, 38 have had five or more LED lamps tested, representing 80% of all LED lamps tested to date. Figure 2 illustrates that between 2016 and 2018, the majority of products tested were manufactured by OEMs with a higher number of completed lifetime tests. The number of products tested by other OEMs reflects EPA's parallel goals to increase the number OEMs tested for the first time and products that bump OEMs to the significantly tested category for data comparison.

² 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



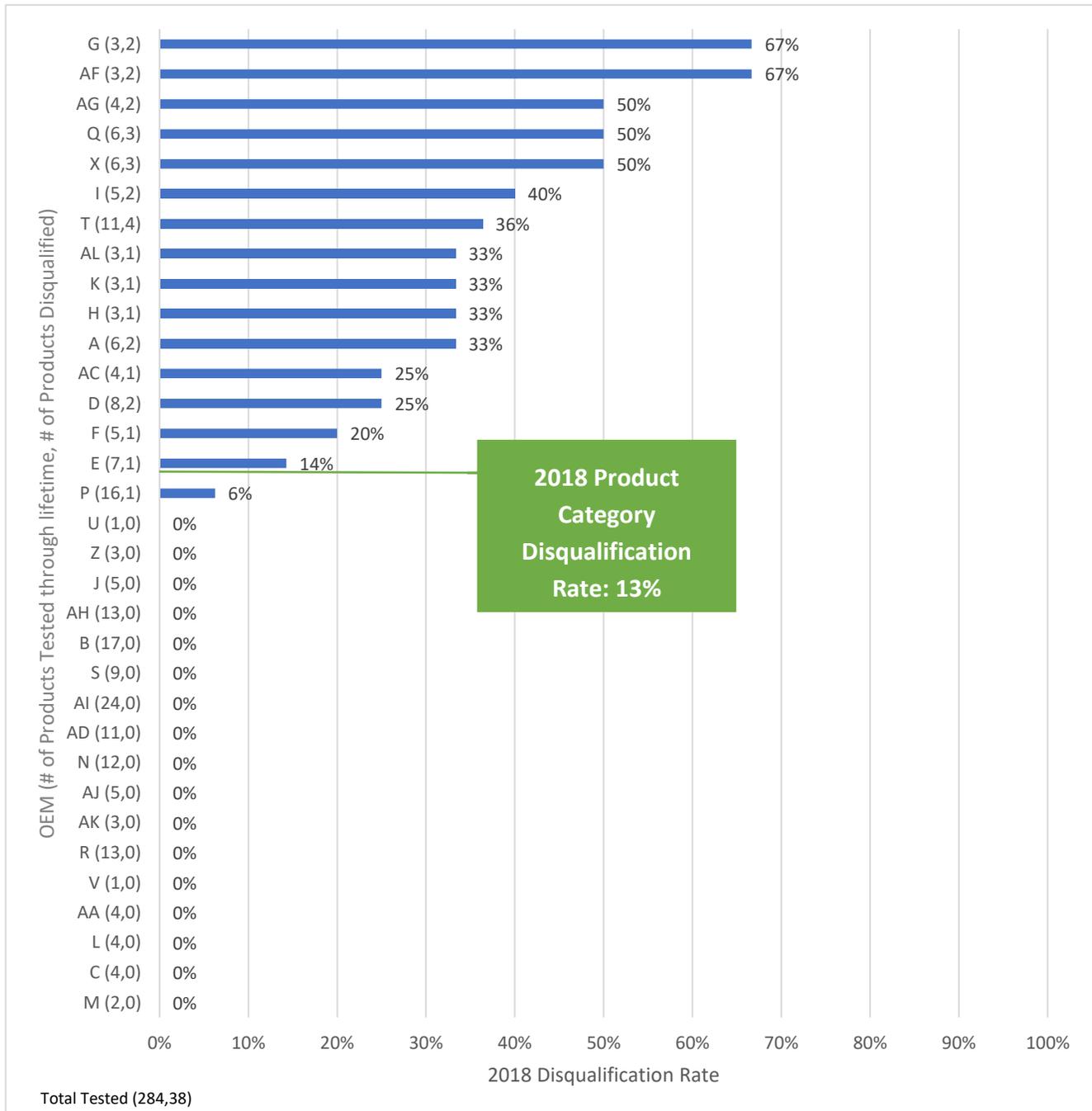
ANNUAL DISQUALIFICATION RATES

In 2018, annual disqualification rates varied widely among significantly tested OEMs, ranging from 0% to 67% (see Figure 3). Out of the 33 significantly tested OEMs tested in 2018, half (17) had zero disqualifications, and 18 had disqualification rates lower than the 2018 overall product disqualification rate of 13%. These results are generally proportionate to the number of OEM zero disqualification rates of 2017 (12), although the proportionate number of OEMs with rates below the product average was greater in 2017. This is in part due to the two poorest performing OEMs in 2017 meaningfully improving their performance in 2018.

In a cumulative assessment (2015 to 2018), the overall LED lamp disqualification rate is 17%. Individual OEM disqualification rates during that period range from 0% to 67% (see Figure 4). Of the 38 significantly tested OEMs in 2015-2018, eight had zero disqualifications. The eight OEMs with perfect testing records had between 4 and 23 products tested through lifetime. Of those OEMs most heavily tested, disqualifications ranged from 0% to 35%. The poorest performing OEMs have disqualification rates 17% higher than the next poorest performers (see Figure 4, OEMs “K” and “AF”). As more data becomes available regarding significantly tested OEMs, it will provide more insight into the full range of source quality and OEM performance.

Figure 5 displays a breakdown of individual 2017 OEM product performance. The overall product disqualification rate for 2017 was 18%, marking a 5% improvement in the disqualification rate in 2018 (13%). Note that 2018 testing included a significant increase in the number of LED lamps tested (284), compared to 2017 (195), reflecting an increase in certified models and possibly suggesting performance improvements while considering a broader universe of products.

Figure 3: 2018 Disqualification Rates, by OEM (5 or more products tested)³



³ This data includes parties where testing was begun for 5 or more products, but in some cases not all products completed lifetime testing. That is reflected in the numerical data on the Y-axis for each partner.

Figure 4: Cumulative (2015-2018) Disqualification Rates, by OEM (5 or more products tested)

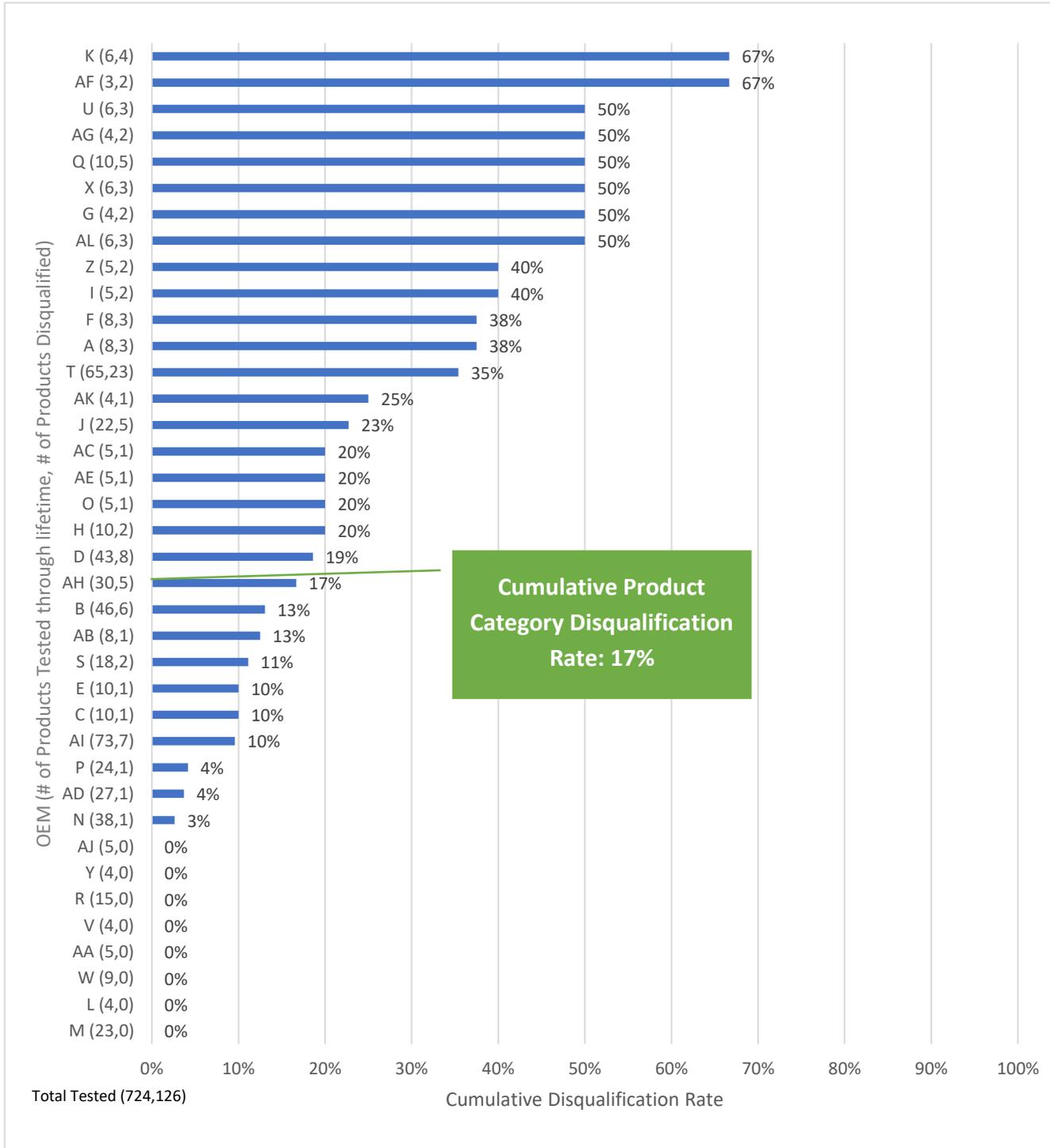
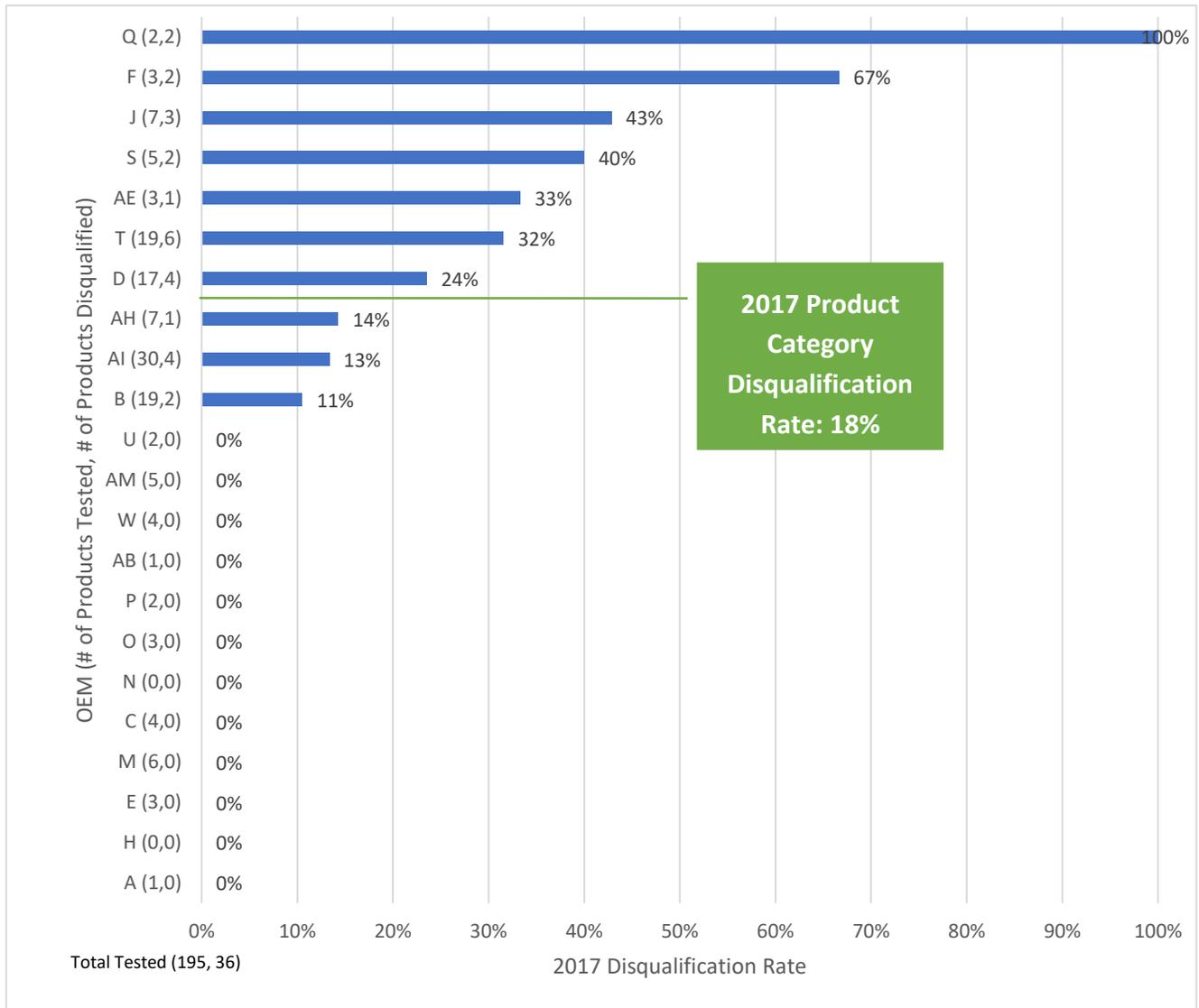


Figure 5: 2017 Disqualification Rates, by OEM (5 or more products tested)



OEM LEADERSHIP

As the universe of OEMs tested in the 3PC and testing data available for significantly tested OEMs increases, individual OEM performance trends become more pronounced. The significant volume of test data for 2018 added clarity to trends and conclusions from the cumulative 2015-2017 data.

In 2018, ENERGY STAR issued a special recognition award to an OEM for outstanding verification testing results as an LED bulb supplier for years 2015-2017. In 2019, a special recognition award was issued to another OEM for its 2018 verification testing results. Both award recipients were heavily tested and represent significant market sources for ENERGY STAR LED bulbs. These achievements, combined with the increasing number of OEMs with zero disqualification rates, and measured against the robust ENERGY STAR specification for bulbs, indicate bulb quality in ENERGY STAR is achievable, and delivering on the expectation of a superior bulb for consumers.

HEIGHTENED OVERSIGHT

LED BULB FACTORIES

EPA continues to learn more about ENERGY STAR product sourcing and issues affecting product performance. In 2016 and 2017, ENERGY STAR visited OEM factories in China. This provided the opportunity for EPA to meet with OEMs that do not have an ENERGY STAR partnership (they do not own an ENERGY STAR brand and do not directly label product for distribution) but are significant sources of ENERGY STAR products. During those meetings, 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 notes increasing disqualification rates were stemmed and showing signs of reversal after meetings and inspections with OEMs at their factories.

Factory visits also allowed EPA to learn about common production practices and challenges, quality control within the factory (e.g., management of products manufactured for different brands), issues surrounding OEM and brand owner relationships, sales practices (including the assertion from one major source that lesser performing products are directed toward the European market), and in many instances how OEMs were positioning themselves for future roles in the market.

To address high disqualification rates during the CFL Testing Program, 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. These efforts highlighted individual OEM compliance rates by way of annual compliance letters to OEMs, and encouraged private labelers with failed CFLs to examine and correct the root causes of failure among their products. In addition, it subjected poor performing OEMs, and private labelers associated with them, 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 decreased starting in 2013, from 30%, to 19% in 2014 to 2016. Twenty-four private labelers were subject to additional control measures, including additional product testing, due to the poor performance of their OEM. Additionally, 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, which went into effect in 2015.

Because of the success of the heightened oversight efforts with CFL OEMs and private labelers, in 2017, EPA began to implement a similar approach for LED lamps OEMs. Similar to CFL OEMs, LED lamps OEMs with disqualification rates higher than the product average, and the labelers associated with the failed product, are subject to heightened oversight, including increased verification testing under the provisions of the ENERGY STAR Partnership Commitments.

In 2019, EPA issued letters to 62 OEMs to notify them of their annual verification testing performance, including the overall product disqualification rate. Heightened oversight efforts may have contributed to the five

percent reduction of the 2017 disqualification rate in 2018. 2019 data will provide additional insight as to the effectiveness of such efforts.