



ENERGY STAR® Ceiling Fan Product Specification Review

February 2016

Drivers for Product Review

ENERGY STAR specifications are reviewed and revised frequently to ensure continued relevance in the marketplace. The ENERGY STAR ceiling fan specification was launched on April 1, 2002. Two years later, EPA released a Version 2.0 specification that removed the initial 5% tolerance for complying with ceiling fan efficiency requirements. The existing Version 3.0 specification brought changes to the ceiling fan light kit criteria and a shift to the ENERGY STAR Luminaires specification only. As such, EPA conducted a review of the ceiling fan market to determine whether a specification revision is warranted at this time. This report summarizes this review and relays the Agency's rationale for its decision regarding next steps for this ENERGY STAR product category.

Market and Product Analysis

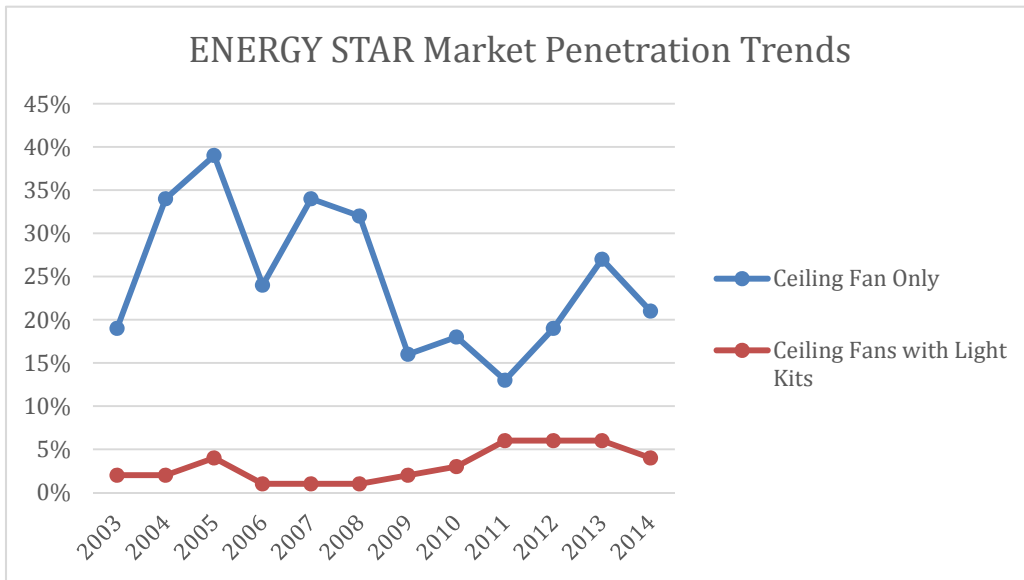
EPA reviewed product performance data, ENERGY STAR market penetration data, DOE standard rulemaking documents, and manufacturer websites to inform next steps for the ENERGY STAR Ceiling fan specification. A summary of this research is provided below.

Model Availability

One of the factors that EPA takes into account in revising specifications is whether consumers have a choice of ENERGY STAR products with a variety of features. On the other hand, if most products consumers see are labeled, then the label provides no useful differentiation. To determine the current availability of ENERGY STAR certified models in the marketplace, EPA analyzed the DOE Compliance Certification Database for ceiling fans and the current ENERGY STAR Qualified Product List (QPL). Based on EPA's analysis, ENERGY STAR certified models represent approximately 14% of the models of ceiling fans (with and without lighting) available in the U.S.

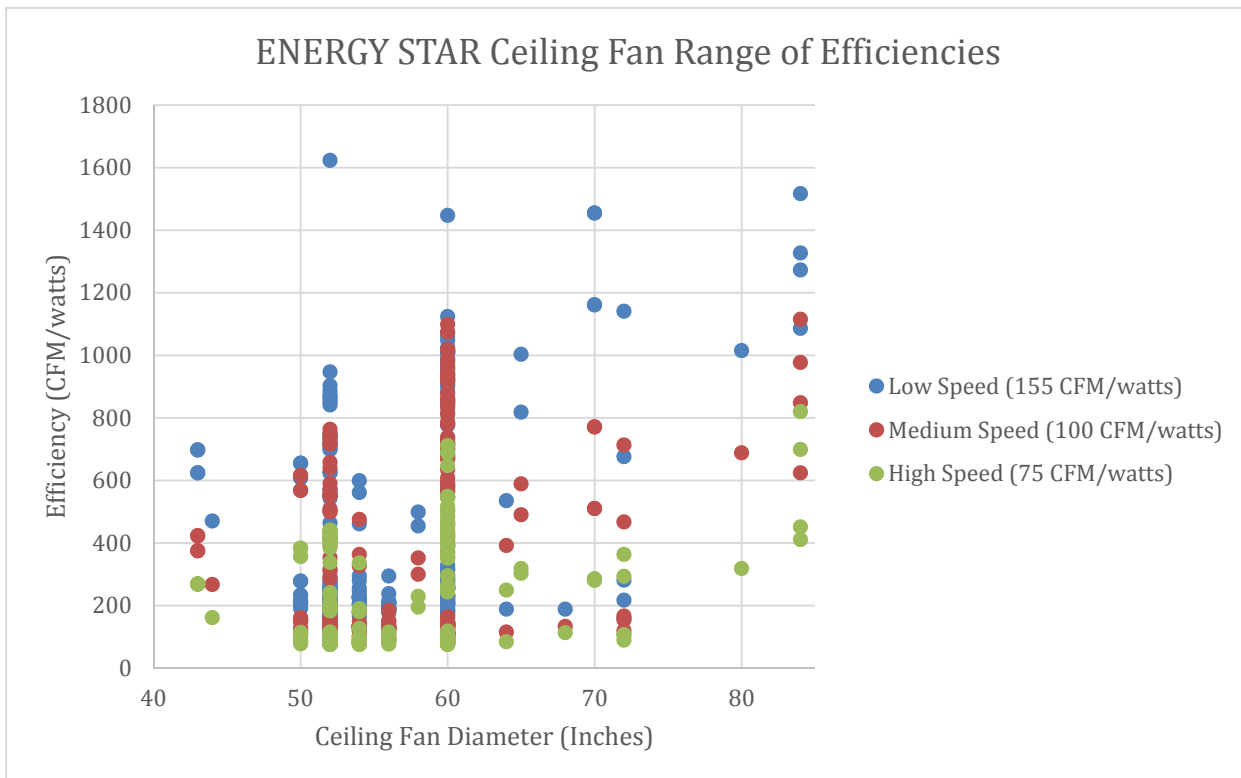
ENERGY STAR Market Penetration

EPA also looks at how many of the individual fans shipped in the US market were ENERGY STAR products. For instance, a single model can dominate sales, meaning that the market penetration and the model availability will be different. According to the 2014 ENERGY STAR Unit Shipment Data Summary Report, ENERGY STAR certified ceiling fans accounted for 21% of total shipments in the U.S. As shown in the graph below, ENERGY STAR ceiling fan (only) shipments reached a peak of 39% in 2005 but this category has experienced a decrease over the last several years. ENERGY STAR certified ceiling fans with lighting continue to experience low market penetration at <10% since program inception.



Technological Developments

The biggest drivers of ceiling fan efficiency are the motor and blade design. Standard ceiling fan designs typically offer flat blades with a single-phase induction motor. Pitch, shape, and number of blades impact airflow and thus, efficiency. In the past, ceiling fans were largely designed with 5 blades; however, today manufacturers are offering more efficient designs with 2, 3, and 5+ fan blades. Highly efficient brushless DC motors have greatly reduced fan energy consumption by two-thirds compared to standard models. These highly efficient motors have become more prevalent in the U.S. market, with models now being offered across all major brands. In 2013, EPA established ENERGY STAR Most Efficient criteria aimed at recognizing ceiling fans that incorporate DC motors. Since 2013, the list of



ENERGY STAR Most Efficient ceiling fans has increased from 12 models to over 100 models¹. The graph above shows the range of efficiencies for ENERGY STAR certified ceiling fans.

Regulatory Considerations

In 2007, DOE set federal design (e.g., reverse airflow capabilities) and test standards for ceiling fans. DOE references the “ENERGY STAR Testing Facility Guidance Manual: Building a Testing Facility and Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans,” Version 1.1. Manufacturers use the Energy Guide label on ceiling fan packaging to display the efficiency rating at high speed.

Test Standard. DOE is in the process of revising the ceiling fan test procedure and released a *Federal Register* notice of proposed rulemaking (79 FR 62521) on October 17, 2014. Proposed changes to the test procedure will impact how ceiling fans are tested and rated for efficiency. For purposes of testing, ceiling fans will be classified as either low-volume or high-volume defined by airflow direction, blade span, blade edge thickness, and maximum tip speed and airflow volume. DOE proposes to apply a single metric based on airflow efficiency to all ceiling fans. For low-volume products, DOE is proposing to use a weighted average of the airflow and power consumption at high and low speeds and for high-volume products, airflow and power consumption at high fan speed will be used to determine efficiency. Furthermore, DOE is proposing to incorporate standby power consumption into the new performance metric. Efficiency calculations shared by DOE include values for operating hours, standby, and active modes. There are also several changes being proposed with regards to test conditions and chamber set-up compared to the ENERGY STAR test procedure, including the removal of the test cylinder. Multi-headed and hugger ceiling fans are also specifically addressed in DOE’s proposal.

On June 3, 2015, DOE published a *Federal Register* supplemental notice of proposed rulemaking (NOPR) which puts forth some clarifications and additional revisions to the ceiling fan test procedure (80 FR 31487) released the prior October. Since there are no current DOE performance standards in effect, DOE requires that manufacturer efficiency claims will need to refer to the new test procedure 180 days after publication of the final rule in the Federal Register.

Minimum Standards. In March 2013, DOE released a rulemaking framework document for ceiling fan standards. The following year, on September 29, 2014, a preliminary technical support document (TSD) was released followed by an extension of the stakeholder comment period to December 9, 2014.

On January 13, 2015, DOE released a NOPR proposing airflow efficiency (CFM/Watt) levels for 5 product classes:

- Very Small Diameter – not highly decorative, one or more fan heads, each of which has a blade span of 18 inches or less.
- Hugger – not a VSD or a highly-decorative ceiling fan, lowest point on fan blades is ≤ 10 inches from the ceiling, blade thickness ≥ 3.2 mm at the edge, and maximum tip speed \leq the applicable limit in the UL 507 Table.
- Standard – not a VSD or highly-decorative ceiling fan, lowest point on fan blades is > 10 inches from the ceiling, blade thickness of ≥ 3.2 mm at the edge, and maximum tip speed \leq the applicable limit in the UL 507 Table.
- High Speed Small Diameter – not a VSD or highly-decorative ceiling fan, blade thickness of < 3.2 mm at the edge, and maximum tip speed $>$ the applicable limit in the UL 507 Table.
- Large Diameter – ceiling fan with diameter > 7 feet.

¹ ENERGY STAR Most Efficient 2016 List as of February 25, 2016.

DOE is required to consider establishing separate exempted product classes for highly decorative fans for which air movement performance is a secondary feature. A public meeting was held on February 3, 2016 and comments are due by March 14, 2016. A final rule is expected to be released in Q2 2016, with new standards taking effect in Q2 2019.

The establishment of a new test procedure and new minimum standards for ceiling fans will require EPA to re-evaluate specification definitions, scope, test requirements, and performance metrics and levels.

Conclusion Based on Review

Based on the review of product availability and market penetration data, ENERGY STAR continues to serve as a differentiator in the current marketplace. However, growth in the availability of ENERGY STAR Most Efficient ceiling fans and the differentiation presented in the current ENERGY STAR QPL suggest that there may be an opportunity to revise Version 3.0 efficiency levels. Yet, changes proposed to the DOE test standard and the development of new ceiling fan performance standards will have a significant impact on how ceiling fan efficiency is tested, rated, and compared. Therefore, EPA will maintain the current levels for the time being and begin revising the ceiling fan requirements once the DOE test method nears finalization, at which point the new DOE efficiency standards should also be nearing finalization. When we revise, we will work closely with manufacturers to better understand the potential efficiency gains for this product category. EPA anticipates re-evaluating ENERGY STAR categorization, performance levels, and scope (e.g., expanding to cover high-volume, large diameter models) in light of DOE action.