Appliance Standards Awareness Project
American Council for an Energy-Efficient Economy
Natural Resources Defense Council
New York State Energy Research and Development Authority

March 19, 2024

Mr. Jeremy Dommu
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Office, EE-2B
1000 Independence Avenue SW
Washington, DC 20585

RE: Docket Number EERE-2022-BT-STD-0002: Energy Conservation Standards for Fans and Blowers

Dear Mr. Dommu:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), American Council for an Energy-Efficient Economy (ACEEE), Natural Resources Defense Council (NRDC), and the New York State Energy Research and Development Authority (NYSERDA) on the notice of proposed rulemaking (NOPR) for energy conservation standards for fans and blowers. 89 Fed. Reg. 3714 (January 19, 2024). We appreciate the opportunity to provide input to the Department.

We generally support DOE's proposed rule, which would set the first federal efficiency standards for general fans and blowers (GFBs) as well as air circulating fans (ACFs). If finalized, the proposed rule would provide very large national energy savings, over 18 quads, and consumer savings of up to nearly $50 billion.[1] However, while we acknowledge the rationale in allowing manufacturers to show non-compliant operating points for GFBs, we are concerned that this could undermine the proposed standards; we therefore encourage DOE to continue exploring options to drive improved fan selection. We also encourage DOE to establish labeling requirements for GFBs. Additionally, while we support combining all axial ACFs into a single equipment class, we encourage the Department to consider an equation-based approach for the standard for axial ACFs that maintains utility and avoids large jumps in the efficiency levels. These topics and others are outlined in more detail below.

DOE's proposed standards for fans and blowers are highly cost-effective for purchasers. In the NOPR, DOE has proposed to adopt Trial Standard Level (TSL) 4, which generally reflects improved impellers and aerodynamic design for GFBs and more efficient direct-drive motors and improved aerodynamic design for ACFs. For axial panel, centrifugal housed, and centrifugal unhoused fans, which together make up about 85% of the GFBs market, average life-cycle cost (LCC) savings range from $1,170 to $2,423, and simple payback periods are 0.6 to 1.7 years.[2] For axial ACFs, average LCC savings range from $327 to $668, and payback periods are 6 months or less. For small axial ACFs (i.e., 12" ≤ diameter <36"), the average LCC savings ($327) exceed the installed cost of the fan ($313).[3] We also note that while DOE

[1] 89 Fed. Reg. 3718.
[2] *Ibid*.
[3] 89 Fed. Reg. 3812.

ultimately decided not to propose higher levels,[4] TSL 5 and TSL 6 are cost-effective for many equipment classes, including for each of those discussed above.

We encourage DOE to continue exploring options to drive improved fan selection for GFBs. The general idea regarding efficiency standards for GFBs, dating back to the Fans and Blowers Working Group, has been to drive energy savings through improved fan selection. The original framework for improving fan selection was to limit the range of operating points, as shown in manufacturer literature and selection software, to those meeting a specified fan energy index (FEI) level. In the NOPR, DOE proposes to allow manufacturers to make representations at non-compliant operating points provided that the representations include a disclaimer;[5] the Department further states that the manufacturer would be responsible for ensuring that a fan is not sold and selected at non-compliant operating points. While we acknowledge the rationale in allowing manufacturers to show non-compliant operating points, we are concerned that this could undermine the proposed standards for GFBs. Thus, we encourage the Department to continue exploring options to drive better fan selection. For example, DOE could clarify that fan selections returned in manufacturer selection software must be compliant at the user-specified operating point. In other words, while a user could see the full operating range for each of the fans that are compliant at the user-specified operating point, the user would be unable to see noncompliant fans.

DOE's approach to the engineering analysis for GFBs helps ensure that fan utility is maintained at all evaluated efficiency levels (ELs). In DOE's engineering analysis, all GFB ELs evaluated by the Department, including the maximum technologically feasible or "max-tech" EL, represent fan efficiencies available on the market today.[6] DOE's analysis also constrained fan diameter to that of the baseline fan for all GFB equipment classes except for power roof ventilators (PRVs);[7] this assumption helps preserve the performance and utility of fans that may be embedded into other equipment or used in space-constrained applications (e.g., ductwork). Finally, while DOE determined that a separate equipment class for centrifugal housed fans with forward-curved impellers was not warranted,[8] DOE analyzed a parallel design path for forward-curved centrifugal housed fans to estimate the costs associated with forward-curved designs at higher ELs; this approach helps ensure that forward-curved fans would remain available at each evaluated EL. Taken together, DOE's modeling assumptions help ensure that fan utility is maintained at higher ELs, including at the proposed standard levels.

We encourage DOE to re-visit the axial PRV cost analysis. In the NOPR, DOE proposes an FEI of 0.85 for axial PRVs. Higher levels (e.g., EL 5, FEI = 1.0) were not found to be cost-effective for purchasers.[9] For axial PRVs, the estimated incremental cost increase at the first aerodynamic re-design level (from EL 4 to EL 5) was about $1,700 compared to only about $20 for axial panel fans and $600 for axial inline fans.[10] The increased installed cost at EL 5 arises from a conversion cost markup associated with aerodynamic

[4] 89 Fed. Reg. 3843, 3849.
[5] DOE proposes that representations at non-compliant duty points would be identified with the following disclaimer: ''Sale at these duty points violates Department of Energy Regulations under EPCA". 89 Fed. Reg. 3860.
[6] Max-tech represents the 95th percentile FEI available for most GFB equipment classes. 89 Fed. Reg. 3769.
[7] 89 Fed. Reg. 3765.
[8] DOE observed that centrifugal housed fans using backward-inclined and airfoil impellers are available with similar noise levels as forward-curved fans and that more efficient models were generally quieter. Thus, DOE determined that higher ELs would not increase centrifugal housed fan noise levels. 89 Fed. Reg. 3754.
[9] Tables V-13, V-14. 89 Fed. Reg. 3809.
[10] EL 2 and EL 3 represent the levels associated with the first aerodynamic re-design for axial panel and axial inline fans, respectively. Tables V-3, V-5. 89 Fed. Reg. 3805, 3806.

re-design. However, ASHRAE 90.1, a widely used building efficiency standard, includes an FEI of 1.0 for axial PRVs, and DOE estimates that about half the market is at or above an FEI of 1.0 (EL 5).[11] Thus, it seems plausible that DOE is overestimating the costs for purchasers at an FEI of 1.0 for axial PRVs.

We support DOE's proposal regarding embedded fans. GFBs may be sold as standalone products or they may be embedded into a piece of OEM equipment. In the NOPR, DOE excludes some but not all types of embedded fans from the scope of the analysis;[12] most of the proposed exclusions are for regulated equipment where the efficiency metric includes fan energy use. We support this approach to help ensure that inefficient fans are not embedded into products whose energy use is not captured by a DOE efficiency metric. Further, since fans used in OEM equipment may be purchased directly from a fan manufacturer, exempting all embedded fans would create enforcement challenges (i.e., it would be difficult to determine a given fan's end use).

DOE's approach to the GFBs analysis likely overestimates the number of fans that would need to be re-designed at higher ELs. As part of the NOPR analysis, DOE determined that about one-quarter of GFBs meet the proposed standards at the representative pressure and airflow operating points used in the engineering analysis. Based on this information, DOE assumes that about three-quarters of GFBs would need to be re-designed.[13] However, this approach would appear to overestimate the number of fans that would need to be re-designed in response to the proposed standards. GFBs are used across a wide range of operating points, and a fan that does not meet the proposed standards at the representative operating points in DOE's engineering analysis would not necessarily need to be re-designed. In some cases, this fan will still be compliant and could be sold for use at other compliant operating points. In other words, rather than eliminating a given fan from the market, the proposed standards in many cases may simply limit the fan's advertised operating range.

Further, DOE did not consider increased fan diameter for any non-PRV GFB equipment classes since these fans may be embedded into other equipment or used in space-constrained applications. While this is a rational assumption that helps ensure that compliant fans would be available under the proposed standards for all applications, it likely overestimates the number of fans that need to be re-designed. Using an existing larger diameter fan at a lower speed to deliver the same airflow as a smaller fan is a common way to improve FEI at a given operating point and may be a likely path to meeting the proposed standards for some fan installations. For example, DOE assumes that a little less than half of axial panel fans end up in OEM products.[14] For axial panel fans not embedded in OEM products that are used in new installations, such an increase in fan diameter may not be problematic.

We encourage DOE to establish labeling requirements for GFBs. As part of the California Energy Commission's (CEC) regulations for commercial and industrial fans and blowers,[15] GFBs must include labels that specify the maximum airflow, maximum fan speed, and maximum pressure at which the FEI is ≥ 1.00. DOE should consider requiring similar markings for GFBs at the finalized FEI levels in order to help communicate the compliant operating range of the fan.

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[11]Table IV-19. 89 Fed. Reg. 3790.
[12]Table III-1. 89 Fed. Reg. 3741.
[13]89 Fed. Reg. 3843.
[14]Technical Support Document (TSD), p. 9-4. www.regulations.gov/document/EERE-2022-BT-STD-0002-0133
[15]Docket 22-AAER-01, Commercial and Industrial Fans and Blowers.
efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-AAER-01

We support combining axial ACF types into a single equipment class. As discussed in the NOPR, DOE determined that air circulating panel fans, box fans, cylindrical ACFs, and unhoused air circulating fan heads can all be used interchangeably; each of these axial ACF types are capable of delivering similar air velocity and thrust. Therefore, DOE is proposing to establish a single equipment class for all axial ACF types.[16] We support this proposal as each of these axial ACF types is intended to provide the same utility (directional airflow for cooling people, livestock, etc.) and they are generally interchangeable.

We encourage DOE to adopt an equation-based standard for axial ACFs that accounts for airflow. In the NOPR, DOE is proposing three equipment classes for axial ACFs based on the fan diameter,[17] and each of the three equipment classes has a single proposed efficiency level. We are concerned that the significant jump in the proposed standard between each class could cause market distortions. For example, while a 36" fan must meet a CFM/W of 17.3 under DOE's proposal, a 35" fan must meet a CFM/W of only 12.2. Additionally, reducing fan speed and resulting airflow is a straightforward way to increase an ACF's CFM/W,[18] but may reduce utility. Therefore, we encourage DOE to develop an equation-based standard for ACFs that considers airflow in order to avoid large jumps in the standards as diameter increases and to account for the fact that ACFs of the same diameter may deliver very different airflows. We believe that such an equation-based approach will help prevent potential market disruptions or a loss in utility for ACFs.

We encourage DOE to set a standard for housed centrifugal ACFs. In the NOPR, DOE is not proposing to set any standards for housed centrifugal ACFs,[19] stating that EL 1 and EL 2 were not considered since the average LCC savings were negative.[20] However, DOE's analysis shows that EL 3 is cost-effective for consumers with an average LCC savings of $18 and only 14.1% of consumers experiencing a net cost.[21] While it appears that DOE may have opted against proposing EL 3 for housed centrifugal ACFs due to manufacturer impacts,[22] at a minimum we encourage the Department to set a standard for housed centrifugal ACFs at the baseline level (EL 0). Setting a standard, even at EL 0, would ensure a minimum level of efficiency for housed centrifugal ACFs on the market and would help provide additional data to inform potential future standards.

DOE's expanded scope electric motors (ESEMs) rulemaking will have a minimal impact on projected ACF savings. Improved motor efficiency represents one route towards increasing ACF efficiency. If finalized, DOE's recent NOPR for ESEMs[23] would set the first efficiency standards for permanent split capacitor (PSC) motors commonly used in ACFs, and high-efficiency PSC motors (EL 2 in the ACF analysis) would effectively become the baseline motor for ACFs. While this increase in ACF baseline would affect the energy savings attributable to the ACF standards, DOE's analysis estimates that less than 10% of

[16] 89 Fed. Reg. 3755, 3756.
[17] Table I-3. The fan diameter (D) ranges for each class are: 12" ≤ D <36", 36" ≤ D < 48", D ≥ 48". 89 Fed. Reg. 3717.
[18] Per the affinity laws, reducing fan speed by 50% reduces airflow by 50%, but reduces input power by nearly 90%.
[19] Housed centrifugal ACFs, often referred to as "portable blowers," are used primarily to dry flooring.
[20] 89 Fed. Reg. 3805.
[21] Table V-28. 89 Fed. Reg. 3814.
[22] DOE states that TSL 4 represents the maximum energy savings for ACFs that does not result in significant negative impacts to ACF manufacturers. 89 Fed. Reg. 3850.
[23] 88 Fed. Reg. 87062.

ACFs on the market today are below EL 2,[24] and a sensitivity analysis on purchaser impacts showed a minimal impact on ACF savings were the ESEM rule to be finalized.[25]

Thank you for considering these comments.

Sincerely,

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[24]Table IV-20. 89 Fed. Reg. 3790.
[25]TSD, p. 8C-1 to 8C-3. www.regulations.gov/document/EERE-2022-BT-STD-0002-0133