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Commercial and Industrial Fans Naturally Occurring Baseline Review

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Executive Summary

This report presents findings from Apex Analytics' review of the Northwest Energy Efficiency Alliance's (NEEA) proposed approach to estimating a natural market baseline efficiency level for commercial and industrial fans. Based on historical trends observed in NEEA's sales data and reported in the U.S. Department of Energy's (DOE) 2023 Technical Support Document for fans and blowers, NEEA assumes that fan efficiency levels will remain constant without program intervention from NEEA or its partners. In this baseline case, NEEA also assumes shifts in average efficiency levels resulting from regulatory changes, first as the market adapts to comply with California's Title 20 regulations for fans and blowers in 2026 and a modeled scenario in which DOE adopts a federal efficiency standard, which NEEA assumes will take effect in 2035.

This review addressed two key objectives related to NEEA's baseline forecast:

- Determine whether NEEA's proposed baseline approach is reasonable, given the available data.
- Assess whether the available data are appropriate as a basis for NEEA's approach and identify any alternative data sources that NEEA should consider.

Apex reviewed NEEA's program sales data and a variety of secondary data sources to address these objectives. Sources included DOE's Technical Support Document and other documents related to the federal standard development process, prior research that NEEA had conducted into the fan market in the Northwest, and data and documents related to California's Title 20 regulations.

Findings

Program data analysis confirmed that there were no clear historical trends in fan efficiency that would justify changing NEEA's baseline assumptions. Apex reviewed historical trends by fan type, fan size, and manufacturer. While historical efficiency trends varied across these characteristics, there were no patterns that were sufficiently consistent to justify NEEA altering its assumption that baseline fan efficiency will remain constant outside of adapting to regulations. Apex further found NEEA's assumption about regulations impacting the market to be reasonable. Average fan efficiencies for most fan types already exceed the Fan Energy Index (FEI) rating of 1.0 that California's Title 20 requires, and the remaining fan types sold in the Northwest Region (Idaho, Montana, Oregon, and Washington) likely will become compliant by 2026 given the potential overlap between the Northwest and California supply chains. NEEA's assumption that a federal standard equivalent to the withdrawn 2023 standard will take effect in 2035 is more speculative but remains reasonable given the time typically required for renewed federal interest, rulemaking, and implementation of new efficiency standards. While industry actors may advocate for a less stringent future standard, DOE's technical analysis found the proposed efficiency levels to be appropriate, and it would be difficult to predict what alternative efficiency level DOE might set.

NEEA's program sales data represents a relatively small share of the fan market and may not be representative of the broader market. Based on market size estimates from two data sources, NEEA's sales data are likely to represent approximately 6% of the market for fans in the Northwest. Comparing the composition of NEEA's sales data to other market estimates suggests that there may be important differences in the distribution of fan types and sizes represented in NEEA's data relative to the market as a whole, which could impact estimates of market-wide average efficiency. Given the differences in product mix between the two manufacturers currently included in NEEA's sales data, it is possible that the inclusion of additional manufacturers will impact the historical trends in average FEI by fan type.

NEEA's program sales data represent the most regionally focused and most granular data source available. While it may not be fully representative of the market, NEEA's program sales data was the only data source Apex reviewed that provided granularity at the model level. NEEA's sales data was also the most up-to-date source available, with other data sources collected for individual research efforts at a specific point in time and not updated in an ongoing way. Finally, NEEA's sales data are targeted to the Northwest, in contrast to the data used in the analysis for California's Title 20 regulations, which were national data scaled down to California based on the state's share of total U.S. Gross Domestic Product.

Conclusions and Recommendations

Apex draws the following conclusions and recommendations from this review. We provide additional details on these conclusions and recommendations in the body of the report.

NEEA's approach to estimating a natural market baseline is reasonable. Available data do not provide a strong enough indication of any historical trends in fan efficiency that would justify a shift away from NEEA's assumption of a baseline remaining constant other than impacts of regulatory shifts from California and federal standards. NEEA's assumptions that the market will adapt to California's Title 20 standard and that a new federal standard equivalent to the 2024 draft rule will take effect in 2035 are also reasonable. Alternative assumptions would be more difficult to justify, and it is generally preferable to err on the side of caution in baseline estimates so that future adjustments to those estimates are likely to result in more savings rather than less.

NEEA's sales data is the best available source for fan market data but may not be fully representative of the larger Northwest market. NEEA's sales data provide a more regionally focused and more granular view of fan sales in the Northwest than any of the other data sources Apex reviewed. However, NEEA's sales data represent a relatively small share of regional fan sales, and it is possible that the inclusion of additional manufacturers will impact the observed historical trends in average FEI by fan type.

- Recommendation: NEEA should reassess market trends as additional manufacturers begin providing data and consider whether any adjustments to its baseline approach are justified.

1. Introduction

This report presents findings from a review of the Northwest Energy Efficiency Alliance's (NEEA) approach to estimating natural market baseline efficiency levels for commercial and industrial fans. NEEA contracted with Apex Analytics to conduct this review.

1.1 NEEA's Proposed Baseline Approach

NEEA estimates natural market baselines (NMB) that predict uptake of efficient products absent any intervention by NEEA and its partners (including but not necessarily limited to NEEA's funding stakeholders and other energy-focused organizations and agencies active in the Northwest). NEEA then measures program savings against this baseline efficiency level.

NEEA's Efficient Fans initiative targets fans sold as standalone units or incorporated into packaged equipment but not captured in the equipment-level efficiency metrics applicable to that equipment, such as Annual Fuel Utilization Efficiency (AFUE), Heating Seasonal Performance Factor (HSPF), or Seasonal Energy Efficiency Ratio (SEER). The initiative covers fans from 0.70 kW Fan Electric Power (FEP) up to 150 horsepower across the nine fan classes defined by the United States Department of Energy (DOE): Axial Inline, Axial Panel, Axial Power Roof Ventilator, Centrifugal Housed, Centrifugal Unhoused, Centrifugal Inline, Radial Housed, Centrifugal Power Roof Ventilator – Exhaust, and Centrifugal Power Roof Ventilator – Supply.

NEEA assesses fan efficiency using the Fan Energy Index (FEI).[1] An FEI of 1.00 represents a reference-level fan. FEI values above 1.00 indicate above-average efficiency, while values below 1.00 indicate below-average efficiency. Using historical sales data provided by manufacturer partners, NEEA calculated a weighted average FEI for each DOE fan class, with weighting applied by both units sold and horsepower. As shown in Table 1, the resulting baseline FEI values vary across fan classes (Table 1).

[1] NEEA has supported the development of the FEI metric and its use at both federal and state levels as the standard measure of fan efficiency.

Table 1: Weighted Average FEI Values by Fan Class

DOE Class	Quantity of Sales**	Weighted Average FEI
Axial Inline	516	0.92
Axial Panel	453	1.10
Axial Power Roof Ventilator	142	1.02
Centrifugal Housed	327	1.23
Centrifugal Unhoused	3,512	1.30
Centrifugal Inline	305	1.10
Radial Housed	0	N/A
Centrifugal Power Roof Ventilator – Exhaust	706	1.04
Centrifugal Power Roof Ventilator – Supply	46	0.99

*Source: NEEA Internal Baseline Approach Memo. ** historical sales data provided by manufacturer partners*

NEEA describes data limitations for three fan classes: no Radial Housed fans were captured in the data, and sample sizes were small for Axial Power Roof Ventilator and Centrifugal Power Roof Ventilator – Supply fans. NEEA indicated it would update baselines for these types if additional data become available.

NEEA's review of historical fan efficiency data from 2020–2024 found no meaningful trend in fan efficiency over time. This finding is consistent with the Technical Support Document (TSD) DOE produced as part of its proposed federal standard update in 2023.[2] Comparing current data to an historical dataset, the TSD found that the market had not changed significantly since 2012. As a result, NEEA assumes no naturally occurring efficiency improvement in the absence of intervention.

NEEA's proposed baseline forecast assumes two regulatory developments will impact baseline fan efficiency. Title 20 efficiency regulations in California, which took effect in 2024, require all fans to meet a minimum FEI of 1.0. NEEA assumes that, in a baseline case, all fans sold in the Northwest would comply with this standard by 2026. This would impact the two fan classes with a weighted average FEI less than 1.0: Axial Inline (weighted average FEI of 0.92) and Centrifugal Power Roof Ventilator – Supply (0.99).

NEEA also assumes a federal efficiency standard will take effect in 2035, and that this standard will be consistent with the proposed energy conservation standard for fans and blowers, developed through the Notice of Proposed Rulemaking (NOPR)

[2] "Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Fans and Blowers."

process in 2023 and subsequently withdrawn.[3] The 2035 date presumes that 2029 is the earliest a new federal administration supportive of fan standards may lead DOE, after which it may take one year to finalize a standard and five additional years before compliance is required.

1.2 Review Objectives

This review addresses two objectives related to NEEA's proposed NMB approach. It seeks to determine:

- Is NEEA's approach reasonable given the available data?
- Are the available data appropriate as a basis for NEEA's approach, and what, if any, alternative data sources should NEEA consider?

1.3 Review Approach

Apex drew on secondary data sources to complete this review. These data sources included:

- **Fans Program Sales Data:** NEEA's fans program sales data incorporates two manufacturers. The first provided historical sales data beginning in January of 2020, while the second provided sales data as of August 2023. The data extract used for this review included sales through September 2025.
- **Prior NEEA Research:** Apex reviewed prior studies that NEEA had conducted into the fans market, including the Fan Systems Market Characterization (2024),[4] Fan Manufacturer Regional Market Share Research (2023),[5] and Commercial & Industrial Stand-Alone Fans Market Research (2021).[6]
- **DOE Rulemaking Documents:** Apex reviewed DOE's Technical Support Document,[7] as well as comments that market actors and other stakeholders submitted as part of the rulemaking process.
- **California Regulatory Documents:** Apex reviewed documents related to California's Title 20 fan efficiency regulations, including the California Energy Commission's analysis of the effects of the standard and California's database of efficiency by fan model.[8]

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[3] Energy Efficiency and Renewable Energy Office, "2024-01-19 Energy Conservation Program: Energy Conservation Standards for Fans and Blowers; Notice of Proposed Rulemaking and Announcement of Public Meeting."

[4] Dyson et al., *Fan Systems Market Characterization*.

[5] Dyson and McClaren, *Fan Manufacturer Regional Market Share Research*.

[6] Michelson et al., *Commercial & Industrial Stand-Alone Fans Market Research*.

[7] "Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Fans and Blowers."

[8] Galdamez, "Analysis of Efficiency Standards and Test Procedures for Commercial and Industrial Fans and Blowers."

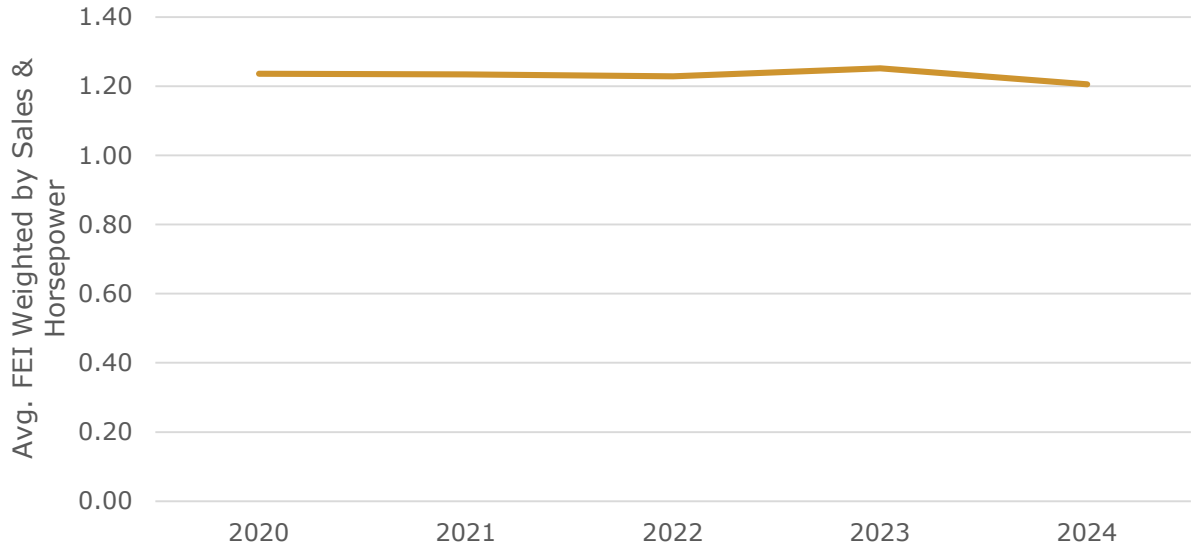
2. Findings

This section summarizes Apex Analytics' findings related to each of this review's objectives.

2.1 Approach Review

Based on historical data and the DOE Technical Support Document's finding that the market has not changed significantly since 2012, NEEA forecasts no change in average fan efficiency in a natural market baseline case. Figure 1 illustrates historical average fan efficiency – expressed as average Fan Energy Index (FEI) weighted by sales volume and fan horsepower – based on sales data that NEEA's manufacturer partners have provided. As NEEA's forecast notes, there is no consistent trend in average fan efficiency over time.

Figure 1: Market Average Fan Efficiency 2020-2024



This lack of change in fan efficiency is consistent with the analysis presented in DOE's Technical Support Document for Fans and Blowers.[9] The analysis compared 2012 sales data to recent manufacturer catalogs and found that, despite inclusion of fan efficiency in ASHRAE Standard 90.1, the fans currently available had not changed significantly relative to the 2012 sales mix.

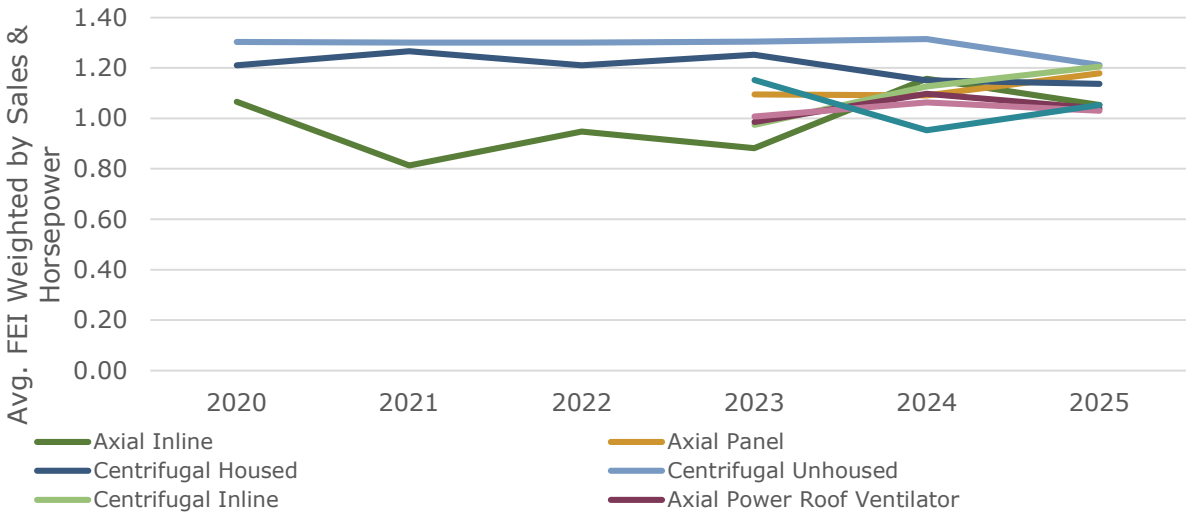
While the overall market average does not show a consistent trend over time, it may be worthwhile to incorporate any consistent trends present within subsets of the market into a baseline forecast. Apex analyzed the sales data NEEA provided to

9 "Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Fans and Blowers."

identify any trends in average efficiency across fan types and between manufacturers.

Average efficiency varied across the eight DOE fan classes represented in NEEA's dataset, and average efficiency levels fluctuated from year-to-year within each class (Figure 2).

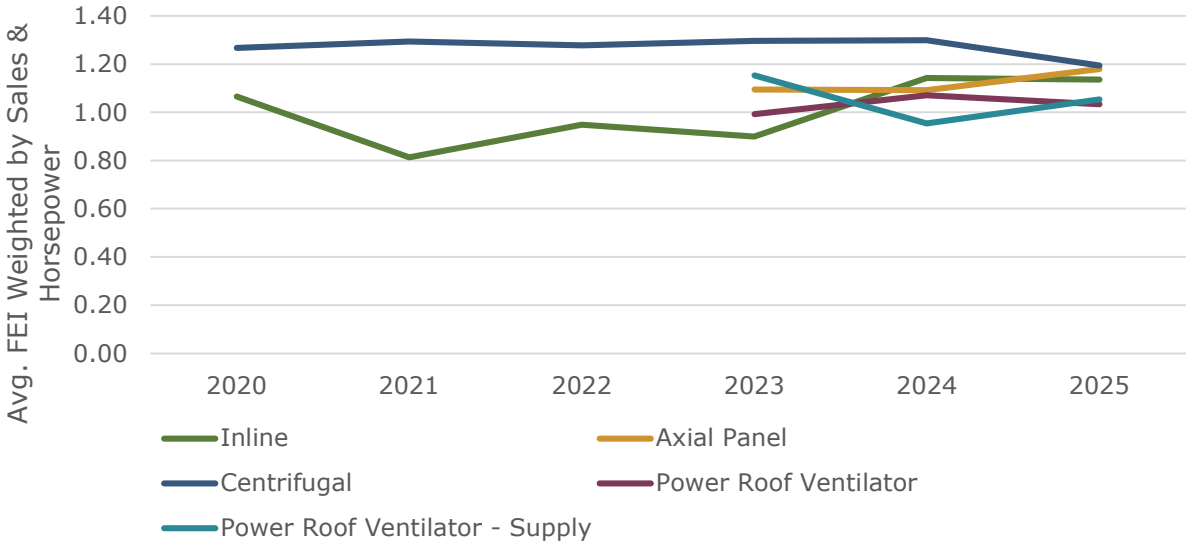
Figure 2: Average Fan Efficiency by DOE Class 2020-2024



Apex combined product classes to assess whether a more simplified classification would produce any clearer trends in efficiency over time.[10] The most notable trend was a general trajectory of increasing FEI among inline fans from 2021 through 2025 (Figure 3). However, this followed a notable drop in FEI between 2020 and 2021, potentially reflecting pandemic-related supply disruptions and subsequent recovery.

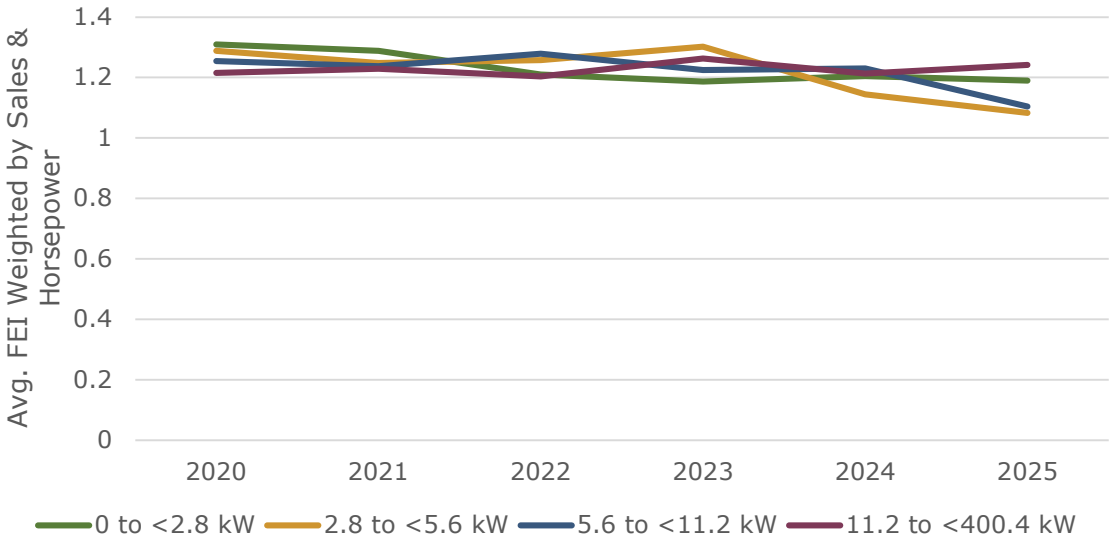
[10] This simplified classification grouped Axial Inline and Centrifugal Inline classes under a single "Inline" category. It further grouped Centrifugal Housed and Centrifugal Unhoused fans into a combined "Centrifugal" category. Finally, it grouped the Axial Power Roof Ventilator and Centrifugal Power Roof Ventilator – Exhaust classes into a combined "Power Roof Ventilator" category.

Figure 3: Average Fan Efficiency by Combined Class 2020-2024



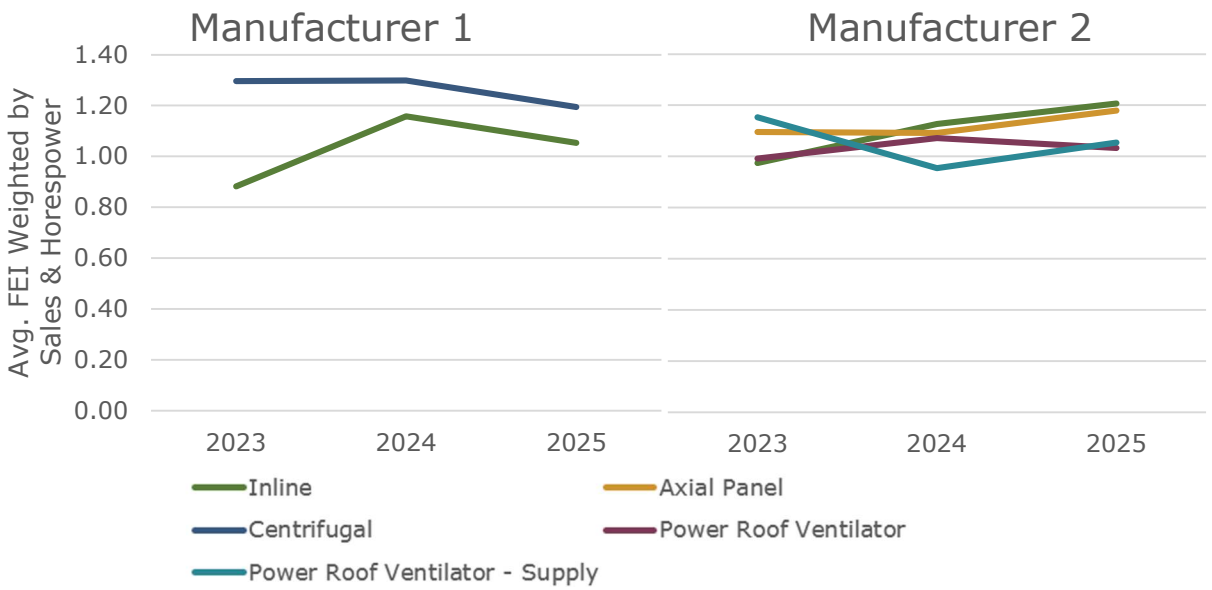
Efficiency trends also varied somewhat between fan sizes (Figure 4). Average efficiency levels were most consistent among the largest fans (11.2 kW and greater). Average efficiency levels generally declined from 2020 to 2025 for smaller fans. The most notable decline took place within the 2.8 to less than 5.6 kW group, which saw a slight gain in efficiency from 2020 to 2023 but then fell from a weighted average FEI of 1.3 in 2023 to less than 1.1 in 2025. However, this decline coincides with the inclusion of sales data from the second manufacturer. As a result, it may be more reflective of a shift in the product mix represented in the data than a change in the market more broadly.

Figure 4: Average Fan Efficiency by Fan Size (kW) 2020-2025



There was some variation in average efficiency trends between manufacturers, with one manufacturer showing a more steadily increasing efficiency level for inline fans than the other over the period from 2023 to 2025 (Figure 5). However, three years is a relatively limited period from which to identify trends and other fan types did not show as clear of a pattern.

Figure 5: Average Fan Efficiency by Combined Class and Manufacturer 2023-2025



While NEEA's proposed baseline approach does not anticipate change in fan efficiency based on historical trends, NEEA does incorporate some shifts in the market based on anticipated regulatory changes. NEEA assumes that California's Title 20 regulations, which took effect in 2024, will cause average efficiencies to increase to at least meet the standard's efficiency requirement of an FEI of 1.0. Based on NEEA's baseline calculations, this would only impact axial inline fans (historical weighted average FEI of 0.92) and centrifugal power roof ventilator – supply fans (historical weighted average FEI of 0.99). This is a reasonable assumption. California is a large market, and manufacturers will likely update their product designs to comply with California regulations. Even if manufacturers continue producing fans that are not Title 20 compliant for use outside of California, there is likely enough overlap in distribution networks between California and the Northwest that NEEA's region is likely to primarily receive compliant fans.

NEEA assumes that, in a baseline case, federal efficiency standards equivalent to those proposed in the 2024 draft rule will take effect in 2035. This is based on the assumption that fan efficiency standards are unlikely to be adopted under the current administration. If a federal administration that is more interested in advancing fan efficiency standards enters in 2029, it will likely take at least a year to finalize standards, and the DOE would likely allow a five-year grace period for any new standards to take effect. It is not certain that any new standards would be equivalent to the withdrawn 2024 draft rule, and industry may advocate for less

stringent standards. However, we find this to be a reasonable assumption for two reasons:

- The proposed efficiency standards provide specific efficiency levels that DOE found to be appropriate in its technical analysis. As a result, they provide a justifiable point of reference. It would be difficult to establish a similarly justifiable alternative efficiency level on which to base baseline estimates.
- While it is important for baseline estimates to be as accurate as possible, it is generally preferable to err on the side of caution. Once a new federal standard is finalized, NEEA can reassess its assumptions and adjust the baseline if necessary. An adjustment that lowers the baseline and thus increases savings is preferable to the alternative.

Washington State's energy code also sets energy efficiency standards for fans, with the 2021 energy code requiring an FEI of 1.00 or higher for constant speed systems and an FEI of 0.95 for variable air volume systems. NEEA does not factor this code into its baseline estimates. As noted above, a natural market baseline estimates the efficiency in the market absent any intervention from NEEA. By not including the Washington code in its baseline estimate, NEEA assumes that the code change would not have occurred without intervention from NEEA and its partners. NEEA has been active in the code adoption process in Washington, and it is reasonable to assume that these codes would not have been adopted in a baseline case with no involvement from NEEA or its partners. NEEA's Codes program conducts evaluations to assess the program's influence on code adoption, which can provide further insight into NEEA's role in the Washington code update.

2.2 Assessment of Data Sources

As noted above, the sales data that NEEA has collected from its manufacturer partners is a key data source informing NEEA's baseline estimate. Apex compared NEEA's sales data to other market data sources in order to assess how much of the overall market NEEA's data covered and the extent to which NEEA's data was representative of the broader market. We also assessed alternative data sources for use in developing baseline estimates.

NEEA's fan sales data represent a small share of the fan market in the Northwest. Two data sources provided similar estimates of total fan sales in the Northwest. The Fan Systems Market Characterization report estimated that approximately 27,000 fans were sold in the Northwest each year.[11] An analysis drawing on national sales data, using an approach similar to that used in analysis conducted for California's Title 20 standard, resulted in an estimate of approximately 28,000 annual sales in the region.[12] NEEA's dataset tracked sales of 1,715 fans in 2024, the only year in

[11] Dyson et al., *Fan Systems Market Characterization*.

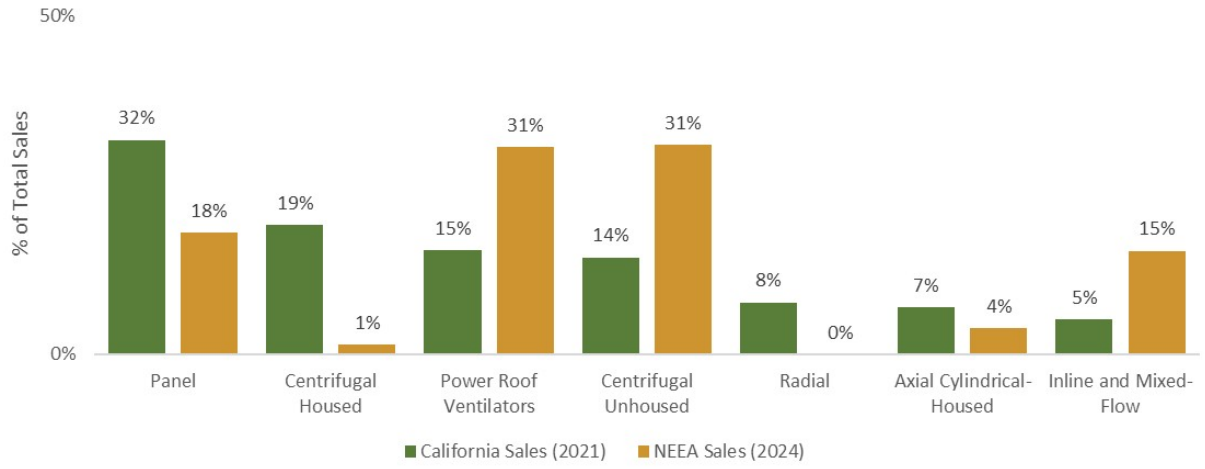
[12] Apex calculated national sales as: 86,775 (estimated California sales, reported in Title 20 analysis)/14.63% (California share of U.S. GDP in 2021) = 592,957 units. We then estimated Northwest sales as: 592,957 units (estimated national sales) x 4.73% (four-state Northwest region share of U.S. GDP in 2021) = 28,071 units sold.

the data export used for this analysis that included full-year data for both manufacturers. This represents approximately 6% of total regional sales, based on either estimate of market size.

There are important differences in the composition of NEEA's fan dataset and in the composition of other market estimates. A proportionately small sample may provide an accurate assessment of the larger market if it is representative of that market. However, our analysis found important differences in the fan classes and fan sizes represented in NEEA's dataset relative to other market data sources.

Apex compared NEEA fan sales data against national fan sales data (as reported by California regulations, represented in Figure 6 as California sales).[13] NEEA data has substantially higher sales of power roof ventilators and centrifugal unhoused fans relative to California fan sales, whereas California fan sales show much higher panel and centrifugal housed market share (Figure 6). These differences may, to some extent, reflect differences in climate or building stock between the Northwest and other regions. Nonetheless, differences in the fan types offered between the two manufacturers in NEEA's dataset (see Figure 5, above), suggest that these differences in sales by fan type may also reflect the limited nature of NEEA's data.

Figure 6 National (CA-based) versus NEEA fan composition



Source: CEC Analysis and NEEA sales data

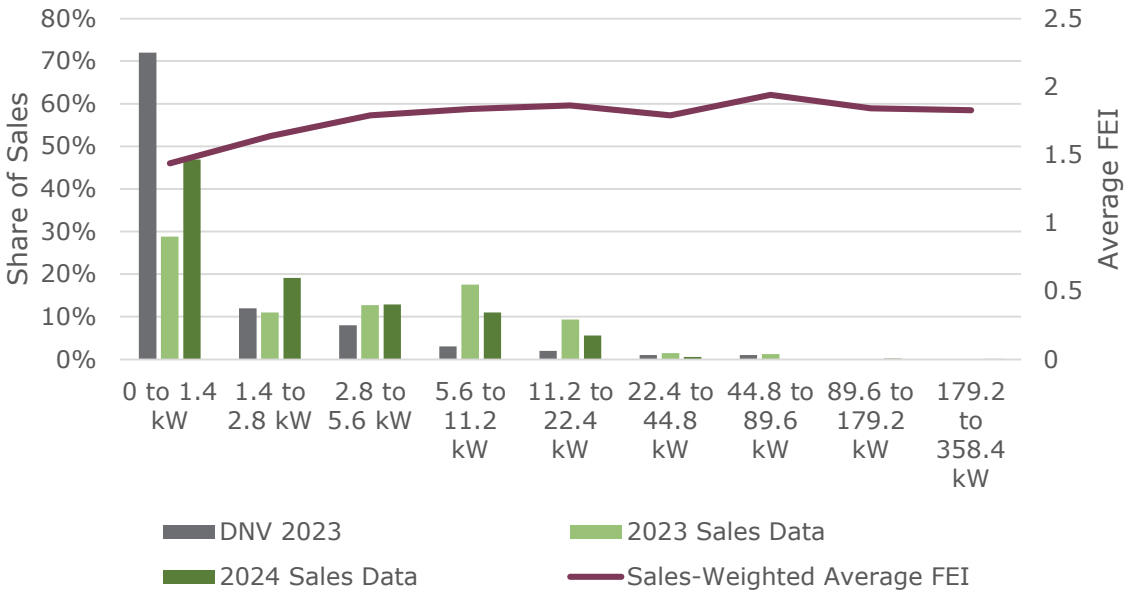
The distribution of fan sizes in NEEA's dataset also differed from the regional fan size distribution estimated in the 2024 Fan Systems Market Characterization that DNV conducted for NEEA.[14] That characterization estimates a considerably higher proportion of fan sales in the smallest size category (0-1.4 kW) than was present in NEEA's sales data. Fans in this smallest size category also had the lowest average

[13] California used national sales data apportioned to California based on the state's relative contribution to national GDP (14%). While the California fan regulations sometimes reference this as California data, they reflect national market composition.

[14] Dyson et al., *Fan Systems Market Characterization*.

FEI (Figure 7), suggesting that the overall average FEI estimate based on manufacturer data may overestimate the actual FEI of the market.

Figure 7 Fan Size, Market Share, and Sales Weighted FEI



Source: DNV Fan Systems Market Characterization Report and NEEA sales data

NEEA's sales data is unique as an ongoing source of model-level, region-specific sales estimates. The other data sources that we consulted for this assessment were not released on a regular schedule. They were the products of dedicated studies or analysis to assess proposed efficiency requirements. As a result, they would be of limited value in tracking the market in an ongoing way. These data sources also lacked the granularity of NEEA's sales data, reporting sales in aggregate by fan size or fan type. NEEA's sales data allows for much more detailed analysis.

3. Conclusions and Recommendations

NEEA's approach to estimating a natural market baseline is reasonable. Available data do not provide a strong enough indication of any historical trends in fan efficiency to justify a shift away from NEEA's assumption of a constant baseline. While there is some variation in efficiency trends by product class, size, and manufacturer, none of these trends rise above potential confounding factors like pandemic-related supply disruptions and changes to the product mix represented in the data to indicate a trend that the baseline should address. NEEA's assumptions that the market will adapt to California's Title 20 standard and that a new federal standard equivalent to the 2024 draft rule will take effect in 2035 are also reasonable.

NEEA's sales data is the best available source for fan market data but may not be fully representative of the market. NEEA's sales data provide a more targeted and more granular view of fan sales in the Northwest than any of the other data sources

Apex reviewed. However, NEEA's sales data represent a relatively small share of regional fan sales, and differences in the composition of fan sales between NEEA's sales data and other market estimates suggest that NEEA's sales data may not be fully representative of the market. Given the differences in product mix between the two manufacturers currently included in NEEA's sales data, it is possible that the inclusion of additional manufacturers will impact the historical trends in average FEI by fan type.

- **Recommendation: NEEA should reassess market trends as additional manufacturers join the program and begin providing data and consider whether any adjustments to its baseline approach are justified.** This assessment becomes more difficult as the program begins influencing the market to a greater extent. As a result, it will be important to gather as much historical data as possible from new participants and consider how consistent the trends reflected in expanded pre-intervention data are with NEEA's existing data and its projected baseline.

Appendix: Sources

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