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Corrected fan cost estimates for embedded fans

Additional submitted attachment is included below.

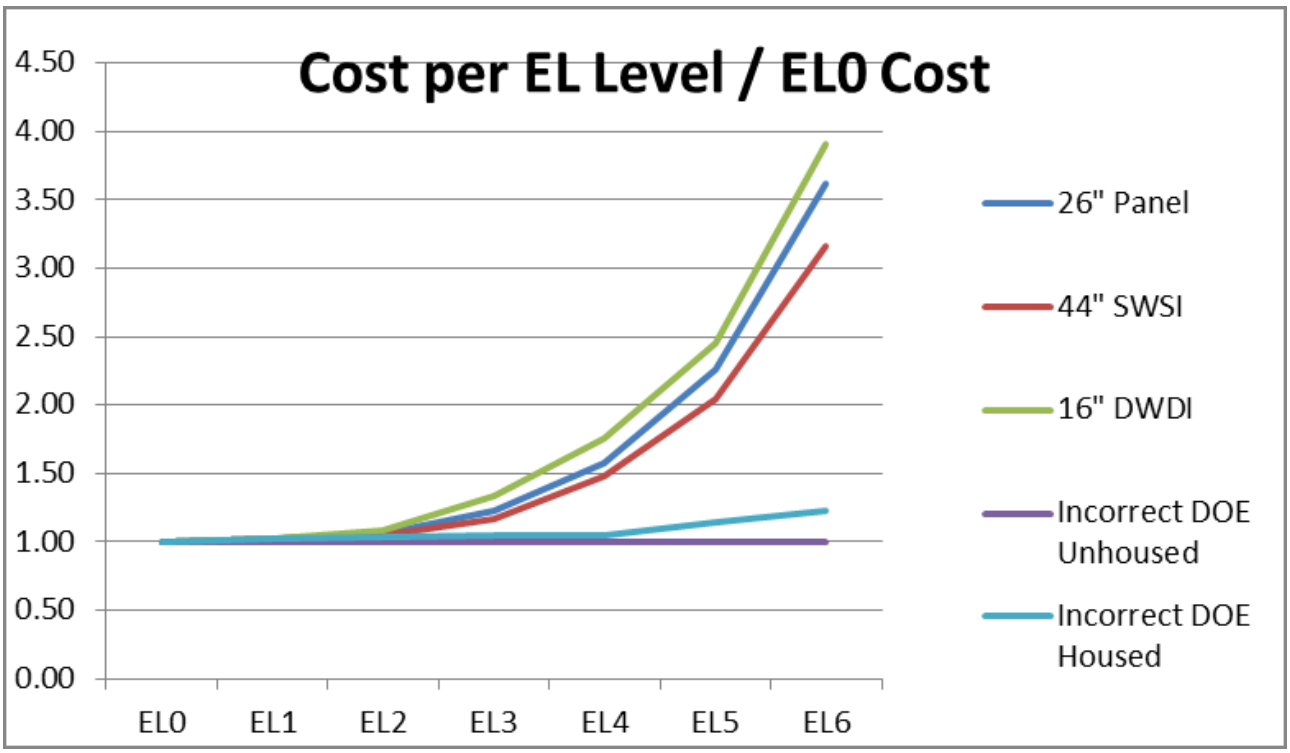
Daikin Applied Comments: Commercial and Industrial Fans and Blowers (CIFB)

Subject: Docket # 17 AAER-06

These comments are submitted by Daikin Applied in response to California's proposed appliance efficiency regulations for CIFBs. Daikin Applied is headquartered in Plymouth, Minnesota, manufactures commercial HVAC equipment, employs over 9,000 people, and is a division of Daikin Industries.

The Draft Staff Report, docketed 6-11-2018, needs significant corrections before good decisions can be made regarding proposed embedded fan regulation.

- DOE's 3rd NODA understates the MPC cost difference between EL levels for panel, housed centrifugal, and unhoused centrifugal fans. Corrected cost ratios per EL level for panel, housed and unhoused centrifugal fans are shown in the chart below. See confidential page 4 for specific examples.
- The Tear Down Sheet in the Engineering Analysis indicates only one actual, 20" diameter and two virtual, 20" diameter tear downs were performed. This is insufficient because of the many fan variations. Their conclusion of almost no cost difference between EL levels is very poor.
- DOE MPC cost estimates do not include the cost of larger cabinets that will often be required to enclose more efficient fans. Furthermore; associated curb adapter and new support structures for larger replacement units are also not accounted for in the installed cost.



- DOE's Data Base Overview & Use Tab in the Engineering Spreadsheet does not allow conversion costs if a compliant fan was found with less than 2" greater diameter and could handle 80% of the CFM and SP. This is not valid and conversion costs are required on most embedded fan changes for the following reasons.

    - 100% CFM and TSP normally is required. CFM is dictated by load and ventilation. CFM or TSP reduction compromises comfort conditions on design days and may not meet code. Excessive CFM or TSP wastes energy.
    - Most HVAC imbedded SAFs and RAFs already use centrifugal fans which have superior efficiency than any other fan class. If compliance is a problem then larger fans are required and they won't fit in existing cabinets. Perhaps FC fans can be replaced by AF fans but their shapes, RPM and inlet requirements are substantially different.
    - 2" greater diameter results in 4" greater outside fan housing dimensions.
    - Many equal diameter replacements will not fit because outside dimensions are not the only issue as shown in page 3 photos. Motor mount, outlet dimensions and support requirements vary between manufacturers and models even for a given diameter.
- DOE's OEM Equipment Conversion Cost Tab in the Engineering Spreadsheet understates conversion costs. Every embedded fan change involves selection, design, and testing for vibration and embedded performance. Cabinet changes usually are required. All of this costs more than $150,000 per fan and we support AHRI's $304,000 per fan estimate for <u>basic</u> conversion costs. However the following consequential conversion costs are not included in basic changes and are detailed in our confidential rooftop comments.
    - Any fan change requires new shake tests and seismic certification.
    - New acoustical ratings are required based on anechoic or reverberant room tests of the imbedded fans and cabinet.
    - Gas or electric heat unit require new safety testing with any SAF or related cabinet change based on UL 1995 and ANSI Z88 requirements.
    - SAF or related cabinet changes generally require new DX testing for unitary equipment.
    - For example, the proposed levels on very large packaged rooftops will require redesign costs of about $3 million for almost all existing product lines.
    - If embedded fan regulation proceeds then some embedded products need 5 years implementation time because the consequential design requirements, listed above, must be done in series.
- If embedded fan regulation proceeds then the proposed submittal and labeling burden must be reduced. Plus the vast amount of proposed data will be difficult or impossible to capture, display, filter and use for design and enforcement purposes.
    - One of our products has 2208 fan / motor HP / VFD combinations. Table 6-2 data must be submitted on all combinations. About 15 of our products are in scope. Confidential confirming details are provided on page 4.
    - The same product has 92 fans. 90 different performance values must be calculated and submitted on each per Table 6-3. If this submittal is valuable [we suggest it is not because there is too much information] then allow another option of submitting a fan curve showing compliant and non-compliant operation per Figure 8-4 in the Staff Report.
    - Proposed regulations require customer requested, design CFM, TSP, RPM and FEI be manually labeled on each unit [until replaced by automated processes that do not currently exist.] Unfortunately manufacturers only know what the customer estimates and tells them so we instead suggest enforcement must be based on the CEE web site and building design documents.

- Regarding enforcement, almost all fans are both compliant and not compliant, depending on the application. Therefore enforcement depends on job specific design and application knowledge so exceptions do not complicate enforcement.

Thank you for considering Daikin Applied comments. Please contact me if you have any questions.

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