<table>
<thead>
<tr>
<th><strong>Docket Number:</strong></th>
<th>17-AAER-06</th>
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<tr>
<td><strong>Project Title:</strong></td>
<td>Commercial and Industrial Fans &amp; Blowers</td>
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<tr>
<td><strong>TN #:</strong></td>
<td>224115</td>
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<tr>
<td><strong>Document Title:</strong></td>
<td>Presentation - Commercial and Industrial Fans and Blowers</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Proposed Standard Draft Staff Report - Presentation by Alejandro Galdamez - July 10, 2018 Workshop</td>
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<tr>
<td><strong>Filer:</strong></td>
<td>Alex Galdamez</td>
</tr>
<tr>
<td><strong>Organization:</strong></td>
<td>California Energy Commission</td>
</tr>
<tr>
<td><strong>Submitter Role:</strong></td>
<td>Commission Staff</td>
</tr>
<tr>
<td><strong>Submission Date:</strong></td>
<td>7/10/2018 3:24:21 PM</td>
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<td>7/10/2018</td>
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Presentation Agenda

- Rulemaking Process
- Background
- Staff Proposal
- Technical Feasibility
- Savings Methodology
- Cost Effectiveness
- Statewide Energy Savings
- Conclusions
- Scheduled Presentations
- Public Comments
Rulemaking Process

1. Commission Issues Order Instituting Rulemaking
2. Invitation to Participate (gather information)
3. Vet Information in Public Workshop
4. Invitation to Submit Proposals
5. Vet Proposals in Public Workshop
6. Publish Draft Staff Analysis with Proposed Regulations
7. Discuss Draft Staff Analysis in Public Workshop
8. Revise Draft Staff Analysis with Feedback

Comment Period: You are here

Typically 180 days
- Publish Standardized Regulatory Impact Assessment (major regulations only)

Typically 45 day comment period
- Publish Notice of Proposed Action, Initial Statement of Reasons, Proposed Regulations, & Final Staff Report
- Discuss Proposed Regulations in Public Workshop

Typically one year from adoption to effective date
- Commission Adopts Regulations at Business Meeting
- Submit Final Rulemaking Package to Office of Administrative Law
- Effective Date of Regulations

Public Participation

No changes
Changes
Background

• The U.S. Department of Energy started the process to regulate commercial and industrial fans and blowers

• Issued the Notices of Data Availability and used data provided by industry for the analysis

• DOE assumptions were used in analyzing embedded fan shipments
Staff Proposal

- Staff proposal focuses on stand-alone fans and embedded fans in non-regulated equipment

Stand-alone axial inline fan  Axial panel embedded fans
Staff Proposal

• The draft staff report contains proposal details

• Staff seeks comments and supporting data for the proposed standard
Staff Proposal

• Stand-alone and embedded fans in non-regulated equipment:
  – Break horsepower greater or equal to 1 horsepower or 1 kilowatt
  – Air horsepower less than or equal to 150

• Covered fans: Axial inline fans, axial panel fans, centrifugal housed and unhoused fans, centrifugal inline fans, inline mixed flow fans, power roof/wall ventilators
Staff Proposal

• CEC staff is proposing the Fan Energy Index (FEI) of 1 as the metric for the fans covered under this proposal

• FEI is equal to the Reference Fan Electrical input power ($FEP_{\text{ref}}$) compared to the actual fan electrical input power ($FEP_{\text{act}}$)

\[ \text{FEI} = \frac{FEP_{\text{ref}}}{FEP_{\text{act}}} \]
Staff Proposal

• ANSI/AMCA 208-18 Calculation of the Fan Energy Index
  – AMCA 208-18 requires ANSI/AMCA Standards 210 and ANSI/AMCA 207
  – Both AMCA 210 and AMCA 207 are necessary for the calculations of AMCA 208
Technical Feasibility

Maximum speed in which FEI ≥ 1.0 at best efficiency point
Technical Feasibility

Centrifugal Roof Vents,
Total Efficiency @
selection point

Connected Load

Total Efficiency at Fan Design Point
Technical Feasibility

295 Fans with Motors ≥ 1 hp

Airflow (cfm)

Total Pressure (in.wg)
Technical Feasibility

<table>
<thead>
<tr>
<th>Fan Model</th>
<th>Design BHP</th>
<th>FEI</th>
<th>Operation Cost ($/yr)</th>
<th>Weight (lbs)</th>
<th>Housing Width</th>
<th>Budget Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sq Inline 30”</td>
<td>5.33</td>
<td>0.62</td>
<td>$1,363</td>
<td>571</td>
<td>46”</td>
<td>$3,300</td>
</tr>
<tr>
<td>Sq Inline 42”</td>
<td>2.92</td>
<td>1.12</td>
<td>$758</td>
<td>735</td>
<td>58”</td>
<td>$4,050</td>
</tr>
<tr>
<td>Mixed Flow 27”</td>
<td>2.77</td>
<td>1.18</td>
<td>$719</td>
<td>611</td>
<td>41”</td>
<td>$6,700</td>
</tr>
<tr>
<td>EQB-27</td>
<td>2.83</td>
<td>1.16</td>
<td>$734</td>
<td>451</td>
<td>41”</td>
<td>$3,900</td>
</tr>
</tbody>
</table>
Technical Feasibility

• The figures on slides 11 and 12 represent two different centrifugal stand-alone fans

• The same technical feasibility is applicable to stand-alone fans and embedded fans since:
  – When tested outside of the embedded unit, it will perform exactly the same as a stand-alone fan
  – Current design practices for some embedded fans is driven by space available and not efficiency
  – For some embedded fans, the system is built around the fan (i.e. air chillers)
Technical Feasibility

- We received additional information on the FEI compliance on Unitary Rooftop units

<table>
<thead>
<tr>
<th>Fan Example in a Unitary Rooftop</th>
<th>TSP</th>
<th>FEI (EL1)</th>
<th>FEI (EL2)</th>
<th>FEI (EL3)</th>
<th>FEI (EL4)</th>
<th>FEI (EL5)</th>
<th>FEI (EL6)</th>
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<tbody>
<tr>
<td>CFM 29000</td>
<td>8.8</td>
<td>1.3</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
<td>1.0</td>
<td>0.9</td>
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<tr>
<td>CFM 43500</td>
<td>5.0</td>
<td>1.4</td>
<td>1.3</td>
<td>1.3</td>
<td>1.2</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>CFM 58000</td>
<td>1.3</td>
<td>1.5</td>
<td>1.4</td>
<td>1.3</td>
<td>1.2</td>
<td>1.1</td>
<td>0.9</td>
</tr>
</tbody>
</table>

% Fail:
- 0%
- 11%
- 89%
Savings Methodology

• California Energy Commission staff used operating costs for different fans at the different efficiency levels as calculated in DOE’s third NODA

• The calculation is based on the difference in operational cost between a non compliant fan and one operating at efficiency level 3
## Cost Effectiveness

**Stand-alone Fans**

<table>
<thead>
<tr>
<th>Fan Type</th>
<th>Per Unit Electricity Savings (kWh/yr)</th>
<th>Per Unit Incremental Cost ($)</th>
<th>Average Lifetime (yr)</th>
<th>Per Unit Average Annual Savings ($/yr)</th>
<th>Life Cycle Net benefit ($/unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial Cylindrical Housed</td>
<td>1,155</td>
<td>399</td>
<td>29</td>
<td>169</td>
<td>2,839</td>
</tr>
<tr>
<td>Panel</td>
<td>500</td>
<td>53</td>
<td>28</td>
<td>85</td>
<td>1,542</td>
</tr>
<tr>
<td>Centrifugal Housed</td>
<td>408</td>
<td>33</td>
<td>27</td>
<td>69</td>
<td>1,236</td>
</tr>
<tr>
<td>Centrifugal Unhoused</td>
<td>130</td>
<td>39</td>
<td>27</td>
<td>22</td>
<td>365</td>
</tr>
<tr>
<td>Inline Mixed Flow</td>
<td>1,131</td>
<td>689</td>
<td>27</td>
<td>192</td>
<td>2,830</td>
</tr>
<tr>
<td>Radial</td>
<td>2,211</td>
<td>221</td>
<td>30</td>
<td>323</td>
<td>6,111</td>
</tr>
<tr>
<td>Power Roof Ventilators</td>
<td>927</td>
<td>595</td>
<td>30</td>
<td>157</td>
<td>2,489</td>
</tr>
</tbody>
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## Cost Effectiveness
### Embedded Fans

<table>
<thead>
<tr>
<th>Fan Type</th>
<th>Per Unit Electricity Savings (kWh/yr)</th>
<th>Per Unit Incremental Cost ($)</th>
<th>Average Lifetime (Yr)</th>
<th>Per Unit Average Annual Savings ($/yr)</th>
<th>Life Cycle Net Benefit ($/unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial Cylindrical Housed</td>
<td>362</td>
<td>187</td>
<td>18</td>
<td>61</td>
<td>657</td>
</tr>
<tr>
<td>Panel</td>
<td>102</td>
<td>56</td>
<td>21</td>
<td>17</td>
<td>211</td>
</tr>
<tr>
<td>Centrifugal Housed</td>
<td>380</td>
<td>178</td>
<td>18</td>
<td>65</td>
<td>709</td>
</tr>
<tr>
<td>Centrifugal Unhoused</td>
<td>130</td>
<td>47</td>
<td>17</td>
<td>22</td>
<td>243</td>
</tr>
</tbody>
</table>
Statewide Energy Savings

• Stand-alone fans:
  – First year: 50 GWh
  – After full stock turnover: 1,400 GWh/year

• Embedded fans:
  – First year: 24 GWh
  – After full stock turnover: 430 GWh/year
Conclusions

• Cost-effective
  – Calculated savings include a discount rate of 3%
• Technically feasible to achieve
• First year energy savings (~74 GWh)
• Energy savings after full stock turnover (~1800 GWh/year)
  – Compare:
    • Battery chargers: 2,200 GWh/year
    • State-regulated LEDs: 859 GWh/year
    • Portable electric spas: 218 GWh/year
Conclusions

• First Year Savings
  – ~$183 million

• Savings after stock turnover:
  – ~$529 million per year
  or
  – ~$4.8 billion cumulative savings for California consumers
Stand-alone Fans Discussion

• Definition
  – All covered stand-alone definitions

• Exemptions
  – Circulating fans
  – Energy Commission staff did not include emergency fans due to concerns on how they are identified
Stand-alone Fans Discussion

• Test procedure
  – Basic model testing
  – Energy Commission is seeking more information, examples, and data on the implementation of fan laws for testing and/or reporting
Embedded Fans Discussion

• Embedded fans definition
  – Comments on the definition for embedded fans
  – Energy Commission is seeking definitions for embedded fans that would prevent loopholes in regulations
Embedded Fans Discussion

• Scope
  – Energy Commission is accepting substantiated comments to define the scope of embedded fans
Embedded Fans Discussion

• Test Procedure
  – Energy Commission staff is seeking engineering data and information supporting whether or not the test procedure is representative for embedded fans
Embedded Fans Discussion

- Energy Savings
  - Preliminary calculations received show significant energy savings for California
  - Energy Commission staff is accepting data and analysis supporting a different conclusion for embedded fans
Embedded Fans Discussion

• Cost effectiveness
  – Energy Commission staff has received comments on additional costs associated with embedded fans
  – Energy Commissions is requesting data and itemized information on cost increases
Comments

• Comments due by 5:00 p.m. on July 31, 2018
• To submit electronically:
  – Go to http://www.energy.ca.gov/appliances/2017-AAER-06-13/17-AAER-06.html
  – Click on “Submit eComment”
• To send a hard copy:
  California Energy Commission
  Dockets Office, MS-4
  Re: Docket No. 17-AAER-06
  1516 Ninth Street
  Sacramento, CA  95814-5512
• To send a digital copy: docket@energy.ca.gov include docket number 17-AAER-06 and indicate Commercial and Industrial Fans and Blowers in the subject line
Thank you!

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Efficiency Division
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