PG&E CASE Report
Revise Default EER in ACM

PG&E Codes and Standards Enhancement (CASE) Project
December 17, 2007
Title 24 Committee hearing
Federal Air Conditioner Efficiency

- Central Air Conditioners < 65,000 Btu/h
  - Federal efficiency standard “covered” equipment
- Single phase air conditioners and heat pumps manufactured after Jan 2006 at least SEER 13
- SEER – seasonal energy efficiency ratio
- Pre-empted from state regulation
EER vs SEER

- **SEER (seasonal energy efficiency ratio)** measured at 82ºF and under part load
  - Not representative of peak conditions or typical conditions in eastern part of state
- **EER (energy efficiency ratio)** rated at 95ºF ambient temp at full load output
  - Test conditions used to rate capacity of air conditioner
  - Representative of typical conditions in CA hot dry climates in central valley
  - More representative than SEER of peak demand conditions
  - Manufacturer not required to report or label EER
ACM Model of temperature dependent efficiency, EERt

- RACM Equation R4-38
- SEERnf
- EER11nf
- EER10nf

Current default
Slope = 0.12/°F

Proposed Default & Typical AC Performance

Ambient Air Temperature

82°F
95°F

Update EER in ACM
### CEC and ARI databases of SEER

13 central air conditioners

<table>
<thead>
<tr>
<th>EER Bin</th>
<th>CEC #</th>
<th>CEC % Total</th>
<th>CEC % Cumulative</th>
<th>ARI #</th>
<th>ARI % Total</th>
<th>ARI % Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td>148</td>
<td>0.4%</td>
<td>0.4%</td>
</tr>
<tr>
<td>10.0 to 10.5</td>
<td>14</td>
<td>1.9%</td>
<td>1.9%</td>
<td>1,141</td>
<td>3.4%</td>
<td>3.8%</td>
</tr>
<tr>
<td>10.6 to 10.9</td>
<td>62</td>
<td>8.6%</td>
<td><strong>10.5%</strong></td>
<td>1,997</td>
<td>6.0%</td>
<td><strong>9.8%</strong></td>
</tr>
<tr>
<td>11.0 to 11.3</td>
<td>283</td>
<td>39.3%</td>
<td>49.8%</td>
<td>22,516</td>
<td>67.1%</td>
<td>76.9%</td>
</tr>
<tr>
<td>11.4 to 11.6</td>
<td>88</td>
<td>12.2%</td>
<td>62.0%</td>
<td>4,178</td>
<td>12.5%</td>
<td>89.4%</td>
</tr>
<tr>
<td>11.7 to 11.9</td>
<td>74</td>
<td>10.3%</td>
<td>72.3%</td>
<td>2,587</td>
<td>7.7%</td>
<td>97.1%</td>
</tr>
<tr>
<td>12.0 to 12.9</td>
<td>200</td>
<td>27.7%</td>
<td>100.0%</td>
<td>964</td>
<td>2.9%</td>
<td>99.99%</td>
</tr>
<tr>
<td>13 and more</td>
<td>0</td>
<td>0.0%</td>
<td>100.0%</td>
<td>3</td>
<td>0.01%</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>721</td>
<td>100%</td>
<td><strong>Total</strong></td>
<td>33,534</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Only 10% of models have EERs less than 11.
Distribution of EERs for SEER 13 air conditioners sold in CA

Default EER compared to EER of SEER 13 Sold
Statewide California - Interviews representing 100,000 sales

No reported sales by largest distributors of equipment < 11 EER.
Results of Distributor Survey

- Current base case is SEER 13/EER 10
- Contacted distributors on EER sales data
  - Responsible for 100,000 units/yr
- All reported SEER 13 sales are EER 11+
- When a SEER13/EER11 unit is specified and EER verified, unearned credit is given
- CTZ 15 - 7% unearned compliance margin
EER 11 savings and impact on compliance margin by climate

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>TDV % Savings</th>
<th>TDV kBtu/sf</th>
<th>TDV kBtu/home</th>
<th>Savings kWh/yr</th>
<th>Peak kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.35</td>
</tr>
<tr>
<td>2</td>
<td>1.00%</td>
<td>0.6</td>
<td>1533</td>
<td>36</td>
<td>0.34</td>
</tr>
<tr>
<td>3</td>
<td>0.10%</td>
<td>0</td>
<td>57</td>
<td>2</td>
<td>0.36</td>
</tr>
<tr>
<td>4</td>
<td>0.20%</td>
<td>0.1</td>
<td>233</td>
<td>4</td>
<td>0.26</td>
</tr>
<tr>
<td>5</td>
<td>0.00%</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>0.25</td>
</tr>
<tr>
<td>6</td>
<td>0.00%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.27</td>
</tr>
<tr>
<td>7</td>
<td>0.10%</td>
<td>0</td>
<td>44</td>
<td>1</td>
<td>0.27</td>
</tr>
<tr>
<td>8</td>
<td>1.00%</td>
<td>0.4</td>
<td>950</td>
<td>18</td>
<td>0.26</td>
</tr>
<tr>
<td>9</td>
<td>2.10%</td>
<td>1</td>
<td>2381</td>
<td>51</td>
<td>0.36</td>
</tr>
<tr>
<td>10</td>
<td>3.20%</td>
<td>2</td>
<td>4752</td>
<td>121</td>
<td>0.39</td>
</tr>
<tr>
<td>11</td>
<td>3.40%</td>
<td>2.9</td>
<td>7144</td>
<td>156</td>
<td>0.38</td>
</tr>
<tr>
<td>12</td>
<td>2.20%</td>
<td>1.5</td>
<td>3613</td>
<td>75</td>
<td>0.34</td>
</tr>
<tr>
<td>13</td>
<td>4.10%</td>
<td>3.5</td>
<td>8565</td>
<td>274</td>
<td>0.36</td>
</tr>
<tr>
<td>14</td>
<td>3.90%</td>
<td>3.5</td>
<td>8584</td>
<td>227</td>
<td>0.41</td>
</tr>
<tr>
<td>15</td>
<td>7.10%</td>
<td>7.6</td>
<td>18499</td>
<td>688</td>
<td>0.42</td>
</tr>
<tr>
<td>16</td>
<td>0.40%</td>
<td>0.4</td>
<td>878</td>
<td>17</td>
<td>0.38</td>
</tr>
</tbody>
</table>
Statewide first year energy savings

- Conservative - assumes only 10% take HERS credit in all climates
  - Only calculated for res, more if include nonres
- Energy 1.6 GWh/yr (2% of total res savings)
- Demand 3.7 MW (12% of total res savings)
- 940 tons/yr CO₂ emissions
- Annual savings 10 times as much at the end of 10 years
- All from a minor change to the ACM
Cost-effectiveness

- This measure does not require a special air conditioner.
  - The minimally compliant air conditioner will still comply
- This measure does not require efficiency levels higher than the prescriptive levels
  - As long as prescriptive requirements are cost-effective, so is this change
The EER used for calculating the energy consumption of a SEER rated standard central air conditioner shall be the lesser of the EER rating of the air conditioner used in the proposed design or the default EER calculated in Equation R4-41 for the SEER value meeting the Appliance Efficiency Regulations minimum requirements.

- **RACM Section 4.7.1 Cooling System Energy**

  **Equation R4-41**

- **Strike**
  - \( \text{SEER} < 11.5 \quad \text{EER} = 10 - \left( 11.5 - \text{SEER} \right) \times 0.83 \)
  - \( \text{SEER} \geq 11.5 \quad \text{EER} = 10 \)

- **Replace with**
  - \( \text{SEER} < 12.7 \quad \text{EER} = 0.455 + \text{SEER} \times 0.83 \)
  - \( \text{SEER} \geq 12.7 \quad \text{EER} = 11.0 \)
Proposed Change Nonres ACM

Equation N2-2 EER67,95 = From Manufacturer Data [when available]

Strike

\[
\begin{align*}
\text{SEER} < 11.5 & : & 10(11.5 - \text{SEER}) \times 0.83 & \quad \text{[default to SEER <11.5]} \\
\text{SEER} \geq 11.5 & : & 10 & \quad \text{[default to SEER \geq11.5]}
\end{align*}
\]

Replace with

\[
\begin{align*}
\text{SEER} < 12.7 & : & 0.455 + \text{SEER} \times 0.83 & \quad \text{[default to SEER <12.7]} \\
\text{SEER} \geq 12.7 & : & 11 & \quad \text{[default to SEER \geq12.7]}
\end{align*}
\]