<table>
<thead>
<tr>
<th><strong>Docket Number:</strong></th>
<th>21-IEPR-06</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Title:</strong></td>
<td>Building Decarbonization and Energy Efficiency</td>
</tr>
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<td><strong>TN #:</strong></td>
<td>239650</td>
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<tr>
<td><strong>Document Title:</strong></td>
<td>Presentation - Quality, Efficiency &amp; Performance</td>
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<tr>
<td><strong>Description:</strong></td>
<td>2.A Mike MacFarland, Energy Docs Home Performance</td>
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<tr>
<td><strong>Filer:</strong></td>
<td>Raquel Kravitz</td>
</tr>
<tr>
<td><strong>Organization:</strong></td>
<td>Energy Docs Home Performance</td>
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<td>9/9/2021</td>
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A three-pronged method to improve the quality of HVAC installations while increasing code compliance

California Energy Commission
September 10, 2021

Mike MacFarland, Energy Docs Home Performance Contractor
CSLB 742178
Ways to improve the quality of HVAC installations while increasing code compliance:

1. Create a *measured* performance pathway that *reduces* regulation
2. Transform the inspection paradigm and *simplify* it using technology
3. Suggest that warranties are only honored on *legal* installations
1. Create an alternate ”Measured Performance” compliance pathway that reduces regulation

✓ Utilities support “Certified High Performance HVAC” installations through contractor rebates, verification and directory listings

✓ Installers become excellent by being able to finally test and learn from their installations through feedback

✓ Customers don’t have to pay for 3rd party testing when systems meet Certified High Performance HVAC Metrics
Certified High Performance HVAC Metrics Summary

- System Efficiency Minimums are SEER 15, EER 12.5, AFUE= 0.92
- Air Conditioner sizing minimum of 800 SF per ton AC Capacity
- Furnace maximum sizing of 18 BtuH per SF of conditioned floor area
- Minimum airflow of 450 CFM per ton at minimum of 4.0 CFM per Watt
- Maximum of 3% duct leakage to outside
- Minimum of 85.0% delivered efficiency as measured at supply & return grilles
- Maximum of 5 Pascal room pressure difference throughout home
- Maximum of 3 degree F temperature difference between warmest and coldest room
- 62.2 minimum ventilation at 2.2 CFM/W for HRV, 5 CFM/Watt exhaust only minimum
### Delivered Efficiency Evaluation for Heat Pumps

<table>
<thead>
<tr>
<th>System Sizing and Required Performance Reference Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>The system designer must certify that the design is capable of meeting all performance targets and meets or exceeds Manual J, D, S, T, and any other applicable codes.</td>
</tr>
</tbody>
</table>

### Sample Heat Pump heating test

<table>
<thead>
<tr>
<th>Ambient Temp (°F)</th>
<th>Indoor Temp (°F)</th>
<th>Return Temp (°F)</th>
<th>EER Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>72</td>
<td>85</td>
<td>1.00</td>
</tr>
<tr>
<td>34</td>
<td>72</td>
<td>85</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### CO2 Total (Indicated airflow)

| CO2 Total | 516.0 |

### Delivered EIR

<table>
<thead>
<tr>
<th>Delta S60 - Weighted Return Temp</th>
<th>Delta S50 - Weighted Return Temp</th>
<th>Delta S40 - Weighted Return Temp</th>
<th>Delta S30 - Weighted Return Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>(delta t) x 1.08 x CFM x Flow Correction</td>
<td>(delta t) x 1.08 x CFM x Flow Correction</td>
<td>(delta t) x 1.08 x CFM x Flow Correction</td>
<td>(delta t) x 1.08 x CFM x Flow Correction</td>
</tr>
</tbody>
</table>

### Equipment Test Conditions

<table>
<thead>
<tr>
<th>Measured System Pair (Watts)</th>
<th>Measured CO2 EIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.0</td>
<td>21.190</td>
</tr>
</tbody>
</table>

### System Data

| CO2 Equivalent (lbs) | 13.0 |

### System Design

| CO2 Flow Rate (lbs/min) | 21.190 |

### System Efficiency

| EER (Ratio) | 1.00 |

### Signed by:

By signing below, I __________ (Last Name) certify that I am the lead installing technician on this project and performed all measurements listed herein. I certify that all numbers listed herein have been measured, are true, and are of the best ability of my equipment and self to accurately measure and calculate. 

_________ (Signature) (Company Name)

By signing above, a copy of the ACCA Manual J, D, S, and T "as built" forms to this form, with the system designer’s name and signature.
Other devices create the alternate measured performance compliance pathway:

- Last cycle that ran sufficiently long to be tested
- FID Results
- Every cycle analyzed, Continuous commissioning
2. Transform the permit and inspection process using technology.

- Explore ways to virtually inspect installations using video and images
- Facetime
- Skype
Paradigm Shift- Inspectors are **Teammates** not **Adversaries**

Inspectors are encouraged to adopt the attitude of *coming alongside the workforce as an assistant towards code-compliant installations* rather than an attitude of being an inspector or judge of minimum compliance.

Field inspectors need to be incentivized to complete permit inspections same day.

Building Departments need to place a high value on tracking the percentage of successful inspections for each day.

**Your inspector is succeeding if they’re saying things like:**

“Text me a picture of that installed fuse (smoke detector, etc) by 4pm today we’ll get this finished up.”

“Let’s connect by Facetime between 4 and 5 today and we’ll get this signed off.”
2. Transform the inspection process with technology

- Explore ways to help contractors manage scheduled appointments and help installers be ready for appointments.
  - “Inspector tracker” systems with estimated time of arrival like what package delivery services use.
  - These systems would greatly benefit in correction visit scenarios.
3. **Suggest to equipment manufacturers they warranty equipment installed in CA only when it is a legal installation.**

All equipment changeouts require a permit, warranties should too.

Evaluate and streamline the processes for simple, single component changes (like replacing an outdoor unit) to bring them into compliance.

- These must be able to be scheduled and signed off on same day
- Perhaps trade off a requirement (like 3rd party) for a benefit (like downsizing at least 1 ton AC).
- Success will be obvious when you’re seeing regular permits pulled
Further Ways to Incentivize and Improve Quality

Base HVAC retrofit permit fees only on fixed units = same for all

Any company that provides extensive commissioning services & ACCA Standard V Quality Installations- MUST charge more than standard.

A competitive disadvantage created for doing the job properly.

Customer has to pay more fees for the work to be done better?

Retrofit permit fees should ALWAYS be based on units and NEVER with a contract cost “kicker”.

https://www.acca.org/viewdocument/hvac-quality-installation-specification-english
Improving the quality of HVAC installations while increasing code compliance:

1. Suggest that equipment warranties are only honored on legal installations
2. Transform the permit and inspection process using new attitudes and technology
3. Create a measured performance path that reduces regulation and boosts performance