NEWPORT VENTURES

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April 12, 2012

CALIFORNIA ENERGY COMMISSION
Dockets Office
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512

Re: Docket Number 12-BSTD-01

Dear CEC Staff:

We appreciate the opportunity to provide comments on the proposed language for the 2013 Building Energy Efficiency Standards. This comment addresses the proposed fan efficacy requirements for central fan integrated systems in Section 150.1(c)10, as follows:

> **10. Central Fan Integrated Ventilation Systems.** Central forced air system fans used in central fan integrated ventilation systems shall demonstrate, in Air Distribution Mode, an air-handling unit fan efficacy ~~watt draw~~ less than or equal to 0.58 W/CFM~~.~~ as confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix RA3.3.

Energy and Power Consumption of CFI Systems
The commission has done well to address the fan efficacy of CFI systems specifically. Unlike exhaust-only systems, with best in class efficacies as low as 0.07 W/CFM of ventilation air, the efficacy of CFI systems is much poorer. For example, a CFI system for a 3 ton unit that delivers 150 CFM while in operation would provide ventilation air at 4.1 W/CFM of ventilation air:

$$\left(\frac{350\ cfm\ total\ air}{ton}\right)(3\ tons)\left(\frac{0.58\ W}{cfm\ total\ air}\right)\left(\frac{cfm\ total\ air}{150\ cfm\ ventilation\ air}\right) = 4.1\ \text{W/CFM}.$$

This CFI efficacy is ~57 times less efficient than best in class exhaust-only systems. Of course, CFI units are able to provide "free" ventilation during operation of the heating or cooling system, but this "free" ventilation run time is only likely to occur about 15%-40% of the time, depending on many factors. Based on user preference and system design, a CFI ventilation system may be programmed to run between 40%-90% of the hours in a year. When this scheduled run time doesn't overlap with intermittent operation of the heating and cooling system, then use of the central fan is not "free", but is consuming up to 57 times more energy per CFM of ventilation air while demanding power that is orders of magnitude higher (e.g., 609 W for a 3 ton CFI system versus < 10 W for a best in class exhaust fan).

Recommendations for Improving the Energy Performance of CFI Systems
CFI ventilation systems deserve special consideration because ironically, the less the central system operates for heating and cooling (i.e., the better performing the home is), the more energy is consumed by the CFI system for ventilation. As stated previously, the energy consumption of CFI systems is a function of several factors, including: climate, indoor thermostat set points, size of the central heating and cooling systems, heating and cooling load of the home, size/length of outdoor air duct, available static pressure in the central fan's return duct, and the fractional on-time selected by the system designer/contractor. The impact of selecting these

variables without consideration to energy performance can be significant. Of these variables, the Energy Commission has currently addressed two: fan efficacy and fractional-on time. Fractional on-time is now forbidden to be 100%, but may be any other value (e.g., up to 99%), and fan efficacy is required to be exactly the same as for a central fan that does not integrate ventilation, at ≤ 0.58 W/CFM.

The most direct option for verifying energy savings for CFI systems is to require them to have improved fan efficacy. Instead of allowing CFI systems to have the same efficacy as non-CFI fans, CFI fans should be held to a higher standard since their annual run times can be much longer. Requiring CFI systems to have fans with higher efficacy motors can easily save upwards of 1,000 kWh per year when considering the use of the fan for ventilation and space conditioning. Additionally, in climate zones where whole house fans (WHF) are now prescriptively required, ventilation fan energy savings can be even higher, as operation of the WHF reduces the amount of "free" ventilation provided by the CFI (and CFI controls are not currently smart enough to recognize and credit the operation of the WHF towards ventilation). Finally, a higher performance fan would have the benefit of reduced cooling load (less waste heat from the fan motor) and the opportunity to operate higher efficiency and lower cost equipment to offset the heating load increase associated with the higher efficacy fan.

To address the issue of fan efficacy for CFI systems, the 2012 International Energy Conservation Code now requires CFI systems to be powered by electronically commutated motors (R403.5.1). Further, the 45 day language for Title 24, Part 6, Section 140.4(c)4 now requires that commercial HVAC fan motors that are ≥ 1/12 hp and < 1 hp be electronically commutated motors or have a minimum motor efficiency of 70% (also applies to evaporator fans in coolers and freezers per Section 120.6.(a).3.A). This requirement was found to be justified from an energy savings and cost effectiveness perspective.[1] Further, this range of capacities overlaps with typical central fan units found in residential units, so this requirement should be easily transferred to residential CFI units.

Summary

Because CFI ventilation systems can have such a large impact on residential energy use and power demand, their regulation should receive greater attention. The simplest and most easily verified opportunity for saving energy with these systems is the specification of a better efficacy central fan. Requiring CFI fan motors to be electronically commutated or have a minimum motor efficiency of 70% could have the effect of saving over 1,000 kWh and cutting central fan power demand by about half in each house using one of these systems. This proposed change is both feasible and impactful, while ensuring that CA keeps pace with the provisions of the 2012 International Energy Conservation Code. Proposed language to implement this change is as follows:

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[1] Electronically Commutated Motors (ECMs) in Series Fan Powered Terminal Units. http://www.energy.ca.gov/title24/2005standards/archive/documents/2002-08-27_workshop/presentations/2002-08-27_BCMOTOR.PDF.

Section 150.1(c)10:

10. Central Fan Integrated Ventilation Systems. Central forced air system fan~~s~~ motors used in central fan integrated ventilation systems shall be electronically commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with NEMA Standard MG1-2006 at full load rating conditions. ~~demonstrate, in Air Distribution Mode, an air-handling unit fan efficacy less than or equal to 0.58 W/CFM as confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix RA3.3.~~

Section 150.0(o)

(o) **Ventilation for Indoor Air Quality.** All dwelling units shall meet the requirements of ASHRAE Standard 62.2. Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings. Window operation is not a permissible method of providing the Whole-Building Ventilation airflow required in Section 4 of ASHRAE Standard 62.2. ~~Continuous operation of central forced air system air handlers used in central fan integrated ventilation systems is not a permissible method of providing the whole-building ventilation airflow required in Section 4 of ASHRAE Standard 62.2.~~

Additionally, all dwelling units shall meet the following requirements:

1. **Field Verification and Diagnostic Testing.**

A. **Airflow Performance**. The Whole-Building Ventilation airflow required by Section 4 of ASHRAE Standard 62.2 shall be confirmed through field verification and diagnostic testing in accordance with the procedures specified in Reference Residential Appendix RA3.7.

B. Central Fan Integrated Ventilation Systems. Where a central fan integrated ventilation system is used to provide the Whole-Building Ventilation airflow required in Section 4 of ASHRAE Standard 62.2, a design for continuous operation of the central forced air system air handlers used in central fan integrated ventilation systems is not permitted. Central forced air system fan motors used in central fan integrated ventilation systems shall be electronically commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with NEMA Standard MG1-2006 at full load rating conditions.

Again, we are grateful for the opportunity to provide comments and we thank you for your thoughtful consideration.

Sincerely,

Mike Moore

Mike Moore, P.E.