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On CEC's Analysis of Efficiency Standards and Test Procedures for Commercial & Industrial Fans & Blowers

Additional submitted attachment is included below.

August 6, 2018

Mr. Alejandro Galdámez
California Energy Commission

Re: Analysis of Efficiency Standards and Test Procedures for Commercial and Industrial Fans and Blowers
California Energy Commission
Publication Number: CEC-400-2018-014-SD
Docket Number 17-AAER-06

Dear Mr. Galdámez,

These comments are submitted by Lochinvar, LLC. in response to the California Energy Commission's Analysis of Efficiency Standards and Test Procedures for Commercial and Industrial Fans and Blowers.

Lochinvar, LLC, headquartered in the Nashville, Tennessee area, is a leading manufacturer of residential and commercial high efficiency boilers, water heaters and pool heaters. Lochinvar has been in the business of manufacturing boilers and related products since 1939 and became a wholly owned subsidiary of A. O. Smith Corporation in 2011.

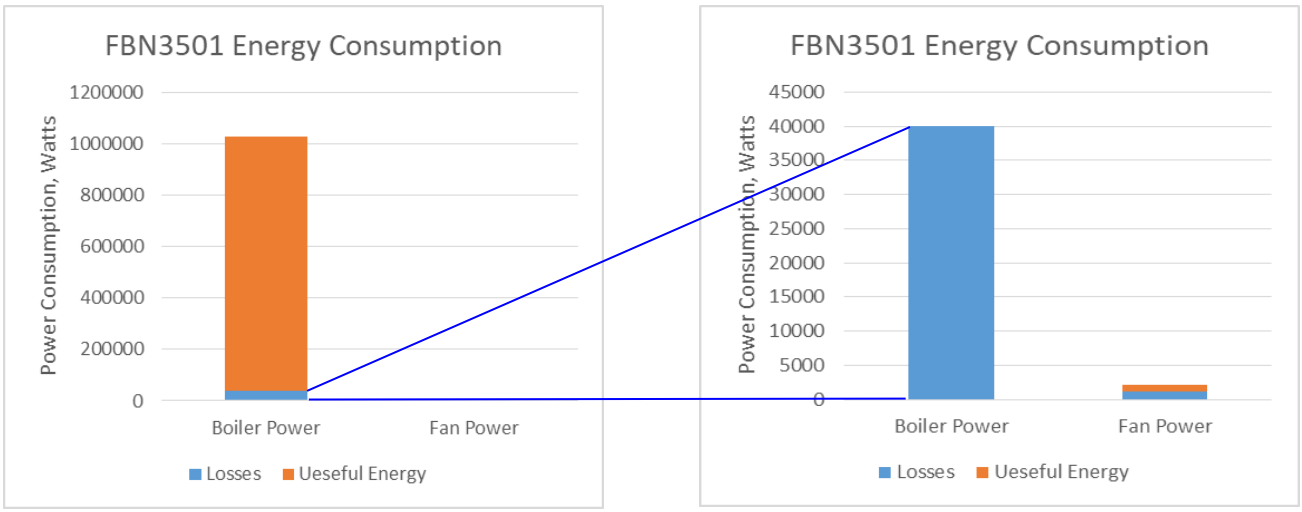
The inclusion of fans used for combustion air (referred to in the proposed rule as "imbedded fans") in commercial water heaters and boilers in the proposed rule is expected to increase energy consumption for the affected products and increase the cost of the affected products by at least 10%. We recommend excluding imbedded fans in water heaters, pool heaters and boilers.

The electrical power consumption of fans used to provide air for combustion in gas fired equipment is a small fraction of the energy consumed. As an example, a 3,500,000 Btu/hr burner uses a fan with a maximum power input of 2,200 watts for combustion air supply.

3,500,000 Btu/hr fuel input = 1,026,000 watts

2,200 watts /1,026,000 watts = 0.2%

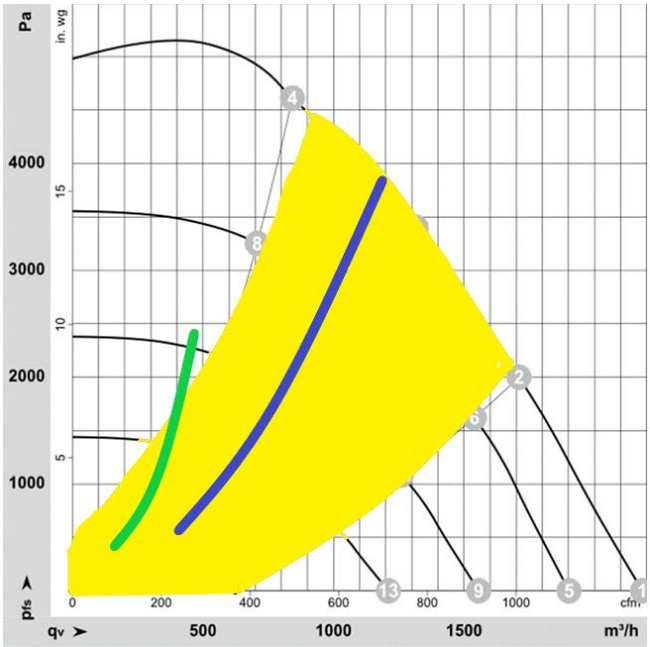
The electrical power input to the combustion fan is about 0.2% of the total energy input to the burner (this is typical for combustion systems). In other words, if the fan is made 50% more efficient the fan energy savings will be 0.1% of the energy consumed by the boiler or water heater. If the limitations on fan use cause the boiler or water heater to lose more than 0.1% efficiency the net energy consumption is increased. The example is based on an actual product and is scalable, meaning that proportion of fuel energy and fan energy is a relatively constant ratio as size increases or decreases.



Depiction of Fan Energy in Proportion to Fuel Energy in a Commercial Boiler

The proposed fan rule threatens two design features that Lochinvar and other boiler and water heater manufacturers use to enhance real world efficiency; high efficiency heat exchanger design and high turndown rates. Additionally, future design options will be limited by the fan rule.

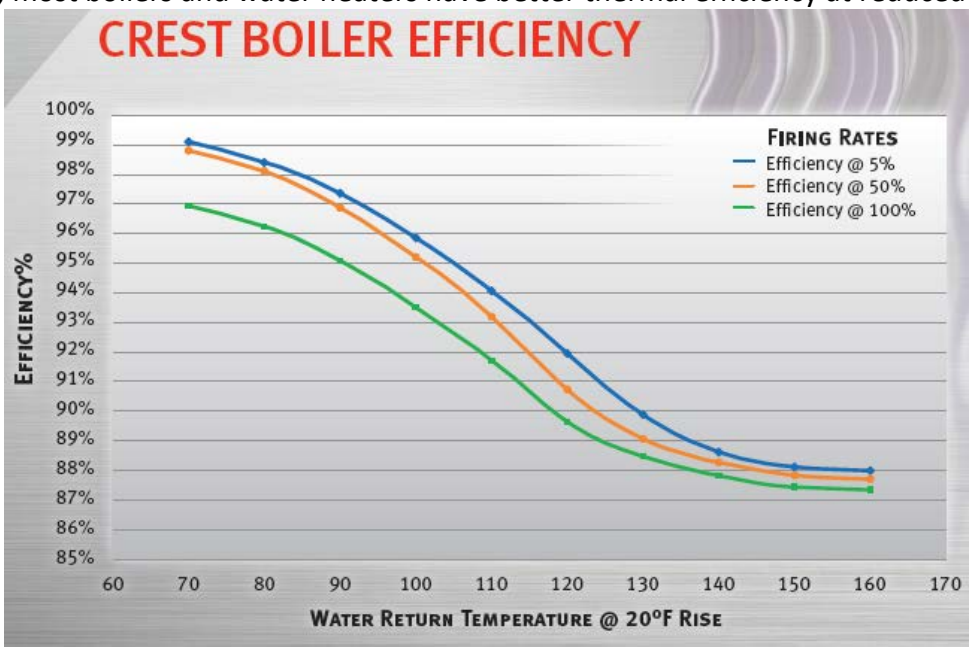
The affected fans used by Lochinvar all employ ECM motors and are high performance products. In spite of the relatively broad operating window of our combustion fans, we have determined that some of our operating conditions will fall outside the allowable fan curves. The boiler used in the example below uses an air throttling valve to allow the boiler greater turndown. The longer blue curved line shows operation with the air throttling valve open and the shorter green curve shows the operation with the throttling valve closed. All the area where the curves extend outside the shaded area show operational range that would no longer be allowed due to the proposed fan rule.



The fan rule would force us to not allow California boilers to close the air throttling valve. Altghough part of the green curve is within the allowable range, the point where the low operating range ignites the burner is outside the allowable window. The effect of the rule would be elimination of operation with the throttling valve closed. The revised operating range of the boiler would change from 25:1 turndown to 5:1 turndown. The loss of turndown ratio reduces the ability of the boiler to match the heating load.

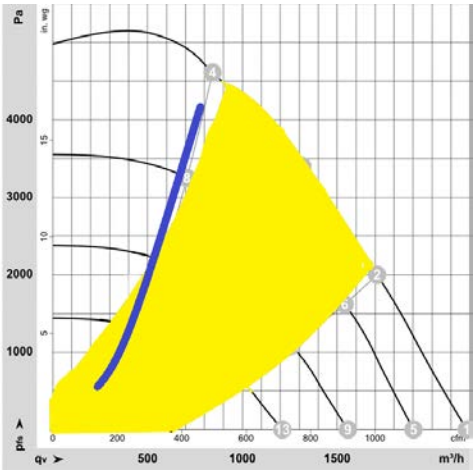
Modulation or turndown for heating products allows the unit to throttle the heat input to match the demand for heating. Matching the input to the output reduces or eliminates standby and off mode energy loss. Load matching is promoted by ASHRAE 90.1, the Consortium for Energy Efficiency (CEE) and the American Consortium for an Energy-Efficient Economy (ACEEE).[1] If standby losses for a heating system exceeds just 0.1% of the system input, then load matching saves more energy than the combustion fans consume.

Additionally, most boilers and water heaters have better thermal efficiency at reduced firing rates.



In addition to standby and off mode savings, turndown can improve the thermal efficiency by 1% to 2%. Allowing high turndown saves 10 to 20 times more energy in fuel than the fan consumes. Loss of turndown means loss of energy savings.

Moreover, the fan regulation could entirely eliminate some of the highest efficiency products from the California market. Boiler and water heater heat exchangers are designed to maximize surface area in contact with combustion gasses and to create turbulence in that flow. These features create a more steep resistance curve. The highest efficiency heat exchangers we offer have step curves that will go outside the allowable fan window.



These high resistance products rated at 98% thermal efficiency will not be allowed due to the fan rule, but an 85% thermal efficient product will be allowed because their curve falls within the fan's optimal efficiency. Here again, the loss of fuel efficiency vastly outweighs the possible fan efficiency gains.

While we have used our products as examples in these comments, the same concerns apply to all manufacturers of high efficiency, high turndown boilers, water heaters and pool heaters. This affects the industry as a whole.

Applying the proposed fan rule to combustion blowers in water heaters, pool heaters and boilers will increase energy consumption in California. Imbedded fans for boilers and water heaters should be excluded from the final rule.

Lochinvar, LLC. appreciates the opportunity to provide these comments. If you have any questions regarding this submission, please do not hesitate to contact me.

Regards,

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[1] Boiling Down Complexity: Innovative Program Approaches to Optimize Efficient Commercial Boiler Systems, by *Joanne O'Donnell, Consortium for Energy Efficiency, published in 2012 ACEEE Summer Study on Energy Efficiency in Buildings*