ACEEE
American Council for an Energy-Efficient Economy
529 14th Street, N. W., Suite 600 Washington, D.C. 20045 202.507.4000 202.429.2248 www.aceee.org

November 6, 2015

U.S. Department of Energy
Buildings Technologies Program
Sent via email: ResFurnaces2014STD0031@ee.doe.gov

Re: Notice of Proposed Rulemaking for Energy Conservation Standards for Residential Furnaces, Docket EERE-2014-BT-STD-0031

We are writing to provide comments from the American Council for an Energy-Efficient Economy (ACEEE), on the Department of Energy's (DOE) Notice of Data Availability (NODA) on efficiency standards for residential furnaces. ACEEE is a non-profit research and education organization founded in 1980 that has been involved in the appliance standards program since its inception. We participated in negotiations leading to the 1987 legislation and subsequent amendments that underlie the program and have been active participants in most DOE appliance standards dockets.

In developing these comments we have consulted with several other organizations, and as a result these comments are also endorsed by the Appliance Standards Awareness Project (ASAP) and the Alliance to Save Energy (ASE).

In general we find the data and analysis in the NODA very helpful and are using it in discussions with other parties in an effort to try to reach a joint recommendation for submittal to DOE. However, we also recognize that developing a joint recommendation will not be easy and that in the meantime the DOE rulemaking needs to proceed. In these comments we discuss:

1. The new DOE analysis and additional information it would be useful for DOE to provide;
2. Our recommendations on what DOE should propose in the forthcoming SNOPR, based on the analysis in this NODA.

The DOE NODA Analysis

In the NODA analysis, DOE separately analyzes potential standards for small furnaces, evaluating a range of break points for separating small furnaces from the rest of the market. We had recommended this analysis in our NOPR comments and are happy to see that DOE speedily prepared and published it. Multiple other stakeholders representing diverse interests also suggested that DOE consider size-based equipment classes.

The data and analyses presented in the NODA demonstrate that, compared with a single nationwide furnace standard at 92 AFUE, creating a class of small furnaces demarcated by an appropriate breakpoint and subject to a less stringent efficiency requirement, has a positive effect on the outcome, by:

- increasing average consumer life-cycle cost savings at all efficiency levels examined;
- significantly increasing national energy saving and average net present value to consumers;

- substantially reducing the number of consumers who switch from gas heating to heat pumps or electric furnaces; and
- reducing by about one-third the percentage of households with net negative life-cycle costs, with an even larger reduction in the portion of low-income households negatively affected.

The NODA analysis generally looks reasonable to us. In particular, we support how DOE has incorporated an allowance for reduced oversizing into the analysis. In order to avoid the increased upfront costs of a condensing furnace, quite a few buyers, especially builders and landlords who bear upfront costs but do not themselves recoup operating savings, will reduce the amount of oversizing. This downsizing is particularly likely in warm climates where furnaces are commonly oversized in order to have a large blower for the cooling season. Manufacturers can combine large blowers with smaller furnace sections to meet this need.

However, we are unclear from the explanations provided whether three specific comments we made on the NOPR have been addressed. These comments are:

a. Make the Appendix 8L analysis using new venting technology the primary analysis;
b. Use a "shift" scenario rather than a "rollup" scenario for the main analysis, and;
c. Use the "low fuel switching" scenario for the main analysis.

Our prior comments provide the rationales and details for these suggestions.

In addition to these comments, we have two specific requests regarding this new analysis. First, in addition to the analysis DOE provides on shipments by furnace capacity, it would be useful for DOE to also specifically refer to an analysis that Oak Ridge National Laboratory is conducting for DOE on the size of furnace needed to serve typical new homes in various locations. This analysis is being used for the ASRAC process for residential central air conditioner and heat pump standards and would be useful to use in this rulemaking for the insights it provides into furnace sizing in different locales.

Second, while we support DOE's method of dealing with oversizing, we understand that some parties do not. DOE found that consumers oversize by about 70%. The NODA analysis assumes that consumers may reduce oversizing to 35% if doing so saves the upfront cost of switching to a condensing furnace. We think this assumption is reasonable. However, in order to aid negotiations that are seeking to reach consensus on this rulemaking, we recommend that DOE prepare several oversizing scenarios as follows: (1) buyers reduce oversizing by half if it avoids upfront costs (the NODA's scenario); (2) buyers reduce oversizing to 20% to avoid higher upfront costs (20% oversizing is the midpoint of what ACCA recommends according to DOE's response to AGA/APGA/AHRI question number 7); (3) no change in oversizing behavior due to standards (i.e. no shifting to smaller sizes to avoid buying condensing);[1] and (4) a value in-between scenario 1 and 3.

Our prior NOPR comments also discussed the report filed in this docket by GTI/AGA. In these previous comments, we supported two changes but rejected two other changes. We see that

[1] We understand that some parties are recommending such a scenario, based in part on the fact that oversizing did not end when the federal standard of 78% AFUE took effect. However, that situation was very different since reducing oversizing then didn't affect the required AFUE. A 78% furnace was required, regardless of the amount of oversizing. In the situation of a size breakpoint in the current rulemaking, significant up-front cost can be avoided by installing a smaller non-condensing furnace.

DOE agreed with us and has revised the analysis to use data on condensing furnace market share from 2010-2014 to determine the condensing unit market share going forward.[2] It does not look like DOE has yet addressed the second change -- to factor site-specific economics into whether a house has a condensing or non-condensing furnace in the baseline. We recommend that DOE do so in the SNOPR analysis. Our specific suggestions on how to do this are contained in our NOPR comments.

On the other hand, as we recommended, DOE did not increase the costs of condensing furnaces based on current costs nor change the fuel switching algorithm to substantially increase the number of homes that fuel switch. We presume that GTI/AGA will repeat their arguments in favor of these latter two changes. Our rationales for rejecting these changes are contained in our NOPR comments and continue to apply.

Likewise, our NOPR comments about the small number of difficult to retrofit homes continue to apply. Furthermore, if small furnaces are allowed to remain non-condensing, the already small number of difficult to retrofit homes will decrease. However, as discussed below, we are concerned about the potential growth of new homes in this category, depending on where the cut-off is set for condensing vs non-condensing furnaces.

Finally, we agree with DOE's analysis regarding low-income homes. As DOE shows in Table III.6 of the NODA, only 11-13% of low-income consumers experience net cost with a furnace standard levels of 92-95% AFUE if small furnaces are allowed to remain at 80% AFUE. The remaining 87-89% of low-income consumers either benefit or are unaffected. Furthermore, even this low rate of negative impacts is overstated. As DOE notes in footnote 16, about 60% of low-income households either rent or live in public housing, and therefore the higher cost of a condensing furnace is paid in large part by the landlord and not the low-income tenant. DOE should update this analysis in the SNOPR to reflect the portion of low-income consumers who do not fully bear upfront costs.

The Forthcoming SNOPR

In the NODA, DOE indicates that the next step in this rulemaking may be an SNOPR. In the SNOPR, we recommend that DOE propose:

1. That a separate product class be established for small furnaces, defined as an input capacity of 50,000 - 55,000 Btu/hour or less.
2. That for all other furnaces, DOE propose a 95% AFUE standard.

We discuss the rationales for these two recommendations in the sections below. We also recommend that DOE issue the SNOPR as soon as possible, since there will be another chance to comment on the SNOPR. Given the long-delays in finalizing this standard, we do not need a long period before the SNOPR. Furthermore, the sooner an SNOPR comes out, the sooner all the parties will have both an updated analysis and proposed standard level, facilitating discussions on reaching a consensus among parties. Many parties are hoping that a revised analysis and SNOPR proposal will support their case. Once we have the SNOPR, all the parties will be able to see how DOE is planning to resolve outstanding issues.

[2] However, we note that the market share of condensing furnaces has been pretty flat over the period. We recommend that DOE assume a flat condensing unit market share throughout the analysis period.

Set the Dividing Line between Small and All Other Furnaces at 50,000 Btu/hour (or in any case no higher than 55,000 Btu/hour)

In our previous comments on the NOPR, we recommended a dividing line of 50,000 Btu/hour for the category of small furnaces. While we continue to support this as a reasonable cut-off level that helps to maximize national energy savings and net present value, at a maximum DOE should set the cut-off no higher than 55,000 Btu/hour, for the following reasons.

First, a cutoff higher than 50,000 to 55,000 Btu/hour would exempt too many units, substantially cutting into the energy and economic benefits achieved by the national standards. Table II.2 in the NODA illustrates this point. With the boundary at 50,000, 14% of furnace shipments are in the small furnace class and with a boundary at 55,000 this increases to 15%. But at the next potential dividing line (60,000 Btu/hour), this percentage jumps to 32%, and further increases to 38% for a dividing line of 65,000 Btu/hour. If 53% of furnace shipments are now condensing, and 32% are small furnaces that are allowed to remain non-condensing, then this rule will only affect a small portion of sales, resulting in only modest energy- and dollar-saving impacts.

For energy saving, this point is also illustrated in Table III.8. Setting the dividing line at 60,000 Btu/hour instead of at 50,000 or 55,000 reduces energy savings by 0.6-0.8 quads for standards at 92-95% AFUE. And at a dividing line of 65,000 Btu/hour, savings decline by 1.1-1.4 quads relative to a dividing line of 50,000-55,000 Btu/hour. For consumer net economic benefits, Tables III.9 and III.10 show that economic benefits are maximized with a boundary of 50,000 or 55,000 Btu/hour. At higher dividing lines, benefits decrease by hundreds of millions to billions of dollars depending on the discount rate chosen.

A second reason for setting the cut-off point at 50,000 Btu/hour for a separate class of small, non-condensing furnaces that are less efficient has to do with the impact on building energy code requirements for new homes. As DOE is aware, until recently the IECC model energy code for new homes, under the "performance" path for code compliance, allowed the furnace efficiency above the minimum national standard to be traded off against longer-lasting code requirements for energy-saving insulation and air-tight building envelopes and ducts. In the growing number of cases where a condensing furnace would have been installed in a new home anyway, due to market pressures and buyer expectations, this code provision in effect meant that any savings from a more efficient furnace would be lost through a less efficient building envelope. One analysis by the Energy-Efficient Codes Coalition suggested, that, in effect, equipment-envelope trade-offs could result in a home in a northern state built with an envelope suitable for a much warmer climate.[3]

Since this loophole was eliminated in the 2009 IECC, builders have repeatedly pressed to reinstate it and to pressure states to add back this weakening provision when adopting the model energy code. Similar envelope-weakening trade-offs for above-standard-efficiency HVAC equipment, water heaters, and even appliances remain in place in the model energy code as part of a new "Energy Rating Index" (ERI) path for code compliance – and DOE itself is considering a proposal to reinstate a form of HVAC-equipment-vs-envelope-efficiency trade-off in the 2018 model energy code. Such a proposal (which we oppose) would be highly problematic so long as the base-case for furnace efficiency in both new and existing homes

[3] ICF International. *Review and Analysis of Equipment Trade-offs in Residential Energy Codes*. Sept., 2013.

remains at 80 AFUE, since states are prohibited by law from adopting a code that would set a higher level of efficiency as the base case for "covered products" such as furnaces.

Given that new homes tend to have lower heating loads than existing homes of the same size, it is important that the cut-off for allowing an 80 AFUE furnace be set low enough to avoid a large fraction of new homes with non-condensing furnaces being added to the stock each year. The higher the cut-off, the greater the number of new homes with conventional 80 AFUE furnaces that will remain difficult or costly to retrofit with condensing units when the furnace does need to be replaced.

Set the Standard for All Other Furnaces at 95% AFUE

Using the 50,000 - 55,000 Btu/hour dividing line discussed above, as shown in Table III.11, both energy savings and net consumer benefits are significantly higher for a 95% AFUE standard than for a 92% AFUE standard. A 95% standard saves 4.1-4.2 quads, vs. only 2.9 quads for a 92% standard (Table III.8). At a 7% discount rate, a 95% standard has net consumer benefits of $4.6 billion, which is $1.1 billion higher than for a 92% standard (Table III.9). At a 3% discount rate, the 95% standard saves consumers $5.2-5.3 billion more than a 92% standard (Table III.10).

Setting a standard at 95% AFUE becomes even more important if DOE sets the size-cutoff at higher levels than we recommend. The higher the breakpoint between small and other furnaces, the lower the energy savings. The combination of 92% AFUE and a high size cutoff would reduce energy savings substantially (e.g. savings of only 1.8 quads at a size cutoff of 65,000 Btu per hour, significantly less than the NOPR proposal which would save 2.6 quads).

In the NOPR, DOE rejected a 95% standard based on concerns about manufacturer impacts. As discussed in our NOPR comments, we understand that all major manufacturers have 95% AFUE models and, from the shipment data included in AGA's NOPR comments, these units of approximately 95% AFUE make up a larger portion of current furnace sales (23%) than units of approximately 92% AFUE (13%). Also, the difference in capital conversion costs between 92% and 95% standards was small, and by eliminating capital conversion costs for small furnaces, the difference will be even smaller. Furthermore, it looks to us that the manufacturer impact analysis treats fuel switching to heat pumps as lost income to manufacturers which we believe is incorrect, since most if not all furnace manufacturers also sell heat pumps. Our rationales for these points are described in more detail in our NOPR comments.

Conclusions

In conclusion, we commend DOE for conducting these additional analyses and issuing this NODA. We recommend that DOE refine its analyses to incorporate new venting technologies, a shift of some post-standard sales to 96-98% AFUE units, and a lower rate of fuel switching. We recommend that DOE speedily issue an SNOPR, and in this SNOPR propose a standard of 95% AFUE for furnaces with an input capacity above 50,000 or at most 55,000 Btu/hour.

We look forward to the completion of this rulemaking in the first part of 2016. The standard has been set at non-condensing levels of performance since they were first enacted in 1987 and a requirement to move the substantial majority of furnaces to condensing levels of efficiency is long overdue.

Please let us know if you have any questions about these comments.

Sincerely,

Steven M. Nadel
Executive Director

Harvey M. Sachs
Senior Fellow

Andrew deLaski
Executive Director
Appliance Standards Awareness Project

Kelly Speakes-Backman
Senior Vice President
of Policy and Research
Alliance to Save Energy