On letterhead

July 10, 2015

Address

Re: ACEEE comments in docket xxx

Dear xxx,

We are writing to provide comments from the American Council for an Energy-Efficient Economy (ACEEE), on DOE’s Notice of Proposed Rulemaking (NOPR) 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 general we support the DOE proposal but suggest it be modified in several ways. In these comments we:

1. Discuss the DOE proposal and our suggested modifications
2. Discuss some acceptable alternatives to our preferred set of standards
3. Comment on several additional issues raised in the docket.

**The DOE Proposal and Suggested Modifications**

In the NOPR DOE proposes a national standard for both unweatherized furnaces and mobile home furnaces at 92% AFUE. DOE proposes this value based on the many benefits such a standard will provide including energy savings, positive national net present value benefit, positive impacts on consumers, emissions reductions and the estimated monetary value of the emissions reductions.

We recommend three modifications to DOE’s analysis and proposed standards:

1. Make the Appendix 8L analysis using new venting technology the primary analysis;
2. Establish a separate product class for small furnaces (tentatively those with an input capacity of 50,000 Btu/hour or less) and leave the standard for these units at 80% AFUE;
3. Increase the recommended standard to 95% AFUE (TSL 4) for larger furnaces.

*Appendix 8L Analysis*

In Appendix 8L DOE analyzes a lower-cost approach for venting a condensing furnace in homes with a non-condensing gas water heater. This technology is now being marketed by a major venting manufacturer and our understanding is that other manufacturers have developed their own products and are getting UL certification. Many products will be widely available long before this new standard takes effect. [Harvey, anything to add/correct?]

*Small Product Class*

As noted in DOE’s analysis, a significant majority of homes will have lifecycle cost benefits from condensing furnaces but there will be some consumers who find condensing furnaces to have higher lifecycle costs. For example, at TSL 3 (92% AFUE), DOE found that 10% of consumers in the north will experience net costs while in the south this figure is 31% (TSD Table 8.5.3). We think it would be useful to reduce the number of “losers” and suggest that a good way to do this would be to establish two size classes for non-weatherized gas furnaces, one for small furnaces and one for larger furnaces.[[1]](#footnote-1) Homes with smaller furnaces generally have lower heating loads since the homes are either small or well weatherized. We believe that many of the “losers” will have small furnaces and recommend that DOE specifically examine this issue and estimate the economics of different standard levels as a function of furnace size, as expressed in Btu per hour of input.

Based on an analysis we discuss below, we tentatively recommend that a separate product class be established for furnaces of 50,000 Btu/hour or less and that the standard for these small furnaces remain at AFUE 80%. We believe that the percentage of “winners” will be much higher above this size threshold but look to DOE to definitively examine this issue. We also note that if a size threshold is established, most homes in the deep south will be able to use non-condensing furnaces, as, from our analysis, it appears that only a limited number of homes in the deep south need larger furnaces (and we suspect many of these homes will be very large homes with owners having above-average incomes). A size threshold will also affect a more limited number of homes in the north. And a size threshold provides another option for some households with very high installation costs – if they weatherize their home and get the needed capacity below 50,000 Btuh, they can avoid the extra installation cost of a condensing furnace. Furthermore, a size threshold may be an easier to enforce than regional standards.

To arrive at our 50,000 Btuh dividing line we examined data on space heating natural gas consumption by state from the 2009 Residential Energy Consumption Survey (RECS). Using this data as well as data on average heating degree days and design temperature by state, we were able to back out the average heating capacity needed in each state. Our analysis is attached and indicates that in most of the states in the southeast, the average needed furnace capacity is under 20,000 Btuh. Thus our tentative recommendation for a 50,000 Btuh cutoff covers a large majority of homes in the south.

*AFUE 95%*

In the NOPR DOE proposes TSL 3 (92% AFUE) but notes the many benefits of TSL 4 (95% AFUE). DOE tentatively rejects TSL 4, despite its larger benefits, based on concerns about manufacturer impacts. We recommend that DOE reconsider TSL 4 and believe that this reconsideration will find TSL 4 justified. DOE finds that TSL 4 will result in more energy savings (4.11 vs. 2.78 quads), more consumer benefits ($21.5 vs. 16.1 billion at a 3% discount rate, $4.0 vs. 3.1 billion at a 7% discount rate) and more emissions reductions (e.g. 206 vs 137 MMT of CO2). If small furnaces are eliminated from the calculations, as we recommend above, we believe the incremental benefits of TSL 4 will be even greater.

We also note that all major manufacturers have 95% AFUE models and our understanding is that these units make up a substantial portion of residential condensing furnace sales.

In the NOPR, DOE expresses concerns about the impacts on manufacturers of TSL 4, noting that their required investments will be $88.5 million for TSL 4 vs. $55.0 million for TSL 3, a difference of $33.8 million. This is a relatively modest difference for an industry with a value of roughly $1 billion. Furthermore, if small furnaces remain at 80% AFUE, this difference in capital and conversion costs will go down. And by setting a standard for larger furnaces of 95% AFUE, DOE will make up some of the lost energy savings by leaving the standard for small furnaces unchanged.

**Acceptable Alternatives**

While we recommend a nationwide standard of 95% AFUE, with an exception for small furnaces, there are several other options we would consider acceptable “second best” solutions. First, while we prefer a 95% standard for reasons discussed above, a 92% standard with the small furnace exception would also be acceptable. Such a standard would have lower energy and consumer cost savings but would also decrease the impacts on manufacturers (because they would have opportunity to “up sell” to 95% AFUE) and might be more politically acceptable to a broad range of stakeholders.

We would also not object if DOE were to propose a regional standard based on heating degree days in order to have a lower required AFUE in the deep south. The economics of condensing furnaces are less compelling in places like Florida, Alabama, Mississippi and Texas and we recognize the political issues of requiring extensive use of condensing furnaces in the deep south. As discussed above, we think an exception for small furnaces would address this issue, but another viable option is to establish a lower regional standard for states with less than 2000 or 3000 heating degree days. The exact cutoff should be based on an economic analysis of states with less than 2000, 2000-3000, 3000-4000 and 4000-5000 heating degree days.

And while we do not recommend a size cutoff for mobile home furnaces, we would not object to such a cutoff if needed for the deep south. Since mobile homes are much smaller than most “stick built” homes, the size cutoff for mobile home furnaces would need to be much lower.

**Comments on Additional Issues**

We are aware that AGA and GTI are submitting a major report for the record proposing several substantial changes to DOE’s analysis. We have only recently received this report and have not been able to fully review it but wish to provide some preliminary comments for the record. We also recognize that impacts on low-income consumers and fuel switching are significant issues in this docket and we want to provide our thoughts on these issues.

*AGA/GTI Analysis*

AGA and GTI have just released an analysis that they are providing for the record. We have only just received the analysis [AGA now tells us 7/7 or 7/8] and in the time available have not been able to fully review it. However, we recognize that the comment period is closing and therefore we feel a need to put our preliminary views about their analysis in the record.

[All of this is very preliminary and will be revised when we get their analysis]

The AGA/GTI analysis makes three major changes to the DOE analysis and based on these changes, arrives at very different economic results. The three changes are:

1. Factor site-specific economics into whether a house has a condensing or non-condensing furnace in the baseline.
2. Increase the costs of condensing furnaces based on current costs.
3. Increase the market share of condensing furnaces in the base case.

Based on our preliminary review, AGA/GTI may be partly correct on the first issue but is incorrect on the other two.

On the first issue, AGA/GTI are correct that site-specific economics should enter into the decision on what furnace a specific modeled house has in the basecase. We have not been able to fully examine their correction, but worry that they are overcorrecting, assuming more influence of site-specific economics on decision-making than is in fact the case. Many factors influence the choice of furnace by either the builder, contractor or homeowner and rational economics is only one of these factors.

On the second issue, DOE correctly uses estimated future costs rather than historical costs, since once a standard takes effect, the market share of complying products increases. Due to economies of scale and cost-reduction opportunities during product redesign, after a standard takes effect, costs are generally less than historical costs when efficient products had a substantially lower market share. Furthermore, even though DOE uses projected future costs, DOE has a long history of overestimating these future costs and thus it is more likely that costs will be less than DOE estimates rather than more than DOE estimates. For example, a 2013 ACEEE study compared the projected and actual costs of nine appliance and equipment efficiency standards, finding that across the nine rulemakings, DOE estimated an average increase in manufacturer’s selling price of $148. On average the actual change in price was a decrease in manufacturer’s selling price of $12. Looking at the midpoint (median) change, DOE estimated $108 across the nine rulemakings and the actual midpoint cost was an increase of only $10. All of the nine products’ actual costs were less than what DOE estimated. Looked at another way, DOE estimated that the new standards would increase product prices by an average of 35% but average actual prices did not change after adjusting for inflation. Several alternative analysis approaches were also used and found similar results.[[2]](#footnote-2)

And, on the third issue, the market share of condensing furnaces has been flat in recent years, as shown by the data AHRI recently provided for the record (e.g. market shares of 47.8%, 47.1%, 47.6% and 48.5% in 2011-2014). DOE projects that the condensing market share will range from 45% in 2021 slowly increasing to 61% in 2050 (TSD p. 10-6). Based on the recent flat trend we would recommend holding the market share steady at 48% throughout the period, which would increase the energy savings of the standard and not decrease them as AGA/GRI suggests.

*Concerns About Difficult to Retrofit Homes*

Several commenters on the record have expressed concerns about high costs to retrofit condensing furnaces into some houses. While we recognize there are some such homes, from the checking we have done, we believe them to be fairly small in number. We base this on the following observations:

In Canada, national standards require condensing furnaces and there are also similar standards in several provinces. We reached out to Natural Resources Canada, and they reached out to their mortgage agency, and neither has found any significant implementation problems with the Canadian standard. We also checked with the US furnace OEM who might have the largest market share in Canada, and they report essentially no pushback.

Likewise, Great Britain has a national condensing standard (mostly boilers and not furnaces). We reached out to….[awaiting reply].

We have also heard particular concerns expressed about the costs to retrofit condensing furnaces in Philadelphia row houses. We reached out to a major weatherization program in Philadelphia about this issue. They have installed many condensing furnaces in Philadelphia row houses, and while they have found some challenges, they have also developed moderate cost solutions to these problems as follows:

Problem: there is no place to vent horizontally directly from the basement either due to:

1. it’s below grade;

2. the only available termination location is at a public walkway; or

3. vent locations are too close to other openings to the building.

Solution options for all:

a. Locate vent at perimeter wall in rear (or piano key area walls) that meets the clearance requirements; create wood frame/finish box to cover the vent - $150 - $200.

b. If no wall area is suitable, run vent/outside Air intake up from basement through floor and then out through the wall on first floor. Terminate air intake at first floor location, run flue up exterior wall exposed and terminate above roof line per code; create wood frame/finish box to cover the vent - $250 - $350.

c. If chimney is abandoned, run vent and intake up chimney as chase, terminate at top with suitable cap - $0.

*Impacts on Low-Income Consumers*

One issue deserving attention is the impact of new furnace standards on low-income households. Low income households, like other households, will benefit from the energy and life-cycle cost savings of higher efficiency furnaces. However, higher efficiency furnaces cost more and many low-income households are short on capital or access to financing. Regarding this issue we have a few observations.

First, the majority of low-income households are renters and not home owners, and thus in many cases the capital costs will be borne by the owners. As shown in the table below, at household incomes below $50,000 per year, renters outnumber owners. Yes, these costs will often be passed on in rents, but absent price gouging by landlords, the annual energy bill savings should be greater than the higher rent since the higher efficiency standards are cost-effective on a life-cycle basis. Looked at another way, these standards will benefit the majority of low-income households, because without these standards, many or even most landlords will install a less efficient furnace.

Renters and Owners as a Function of Income



Source: All but the last column are 2013 data from the US Census American Community Survey. ACEEE calculated the last column.

Second, since most households will benefit from higher efficiency furnaces, including a clear majority of low-income households, it doesn’t make sense to set a lower standard for all just so a few benefit. This leads to our third point -- states and utilities can step in and help low-income owners who lack capital by providing financing. Many states have energy efficiency financing programs and some utilities also have such programs. On-bill-financing can be a particularly attractive strategy and we hope that many of the gas utilities who are expressing concerns about low-income homeowners will provide them with financing if there is not already a state program that does so.

*Fuel Switching*

DOE’s fuel switching analysis has a significant impact on the economic results, reducing the energy savings substantially. We are concerned that DOE’s analysis is too sensitive to fuel switching and believe that fewer homeowners and builders will switch fuels than DOE estimates – many decision-makers will not make an investment at the 3.6 year payback threshold that DOE uses. Furthermore, if DOE adopts our suggestion for a lower standard for small furnaces, we believe that fuel switching shown in DOE’s analysis will decline substantially, as a significant number of the households that DOE shows as fuel switching will now be able to purchase an 80% AFUE gas furnace. Also, if DOE adopts our suggestion to base the analysis on new venting technology, the number of households switching fuels to avoid orphaned water heaters will also go down.

**Conclusions**

In conclusion, we recommend that DOE refine its analyses to use new venting technologies and to establish a small furnace threshold, below which 80% AFUE furnaces be allowed. For the remaining furnaces, a standard of 95% is most justified.

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

Sincerely,

Steven Nadel Harvey Sachs

Executive Director Fellow

**Attachment: Analysis of Average Furnace Capacity Needed in the South**



1. We do not suggest this for mobile home furnaces as the percentage of “losers” for mobile home furnaces is much lower since installation costs are less of an issue with these products. Also, in the deep south, since most new mobile homes already have air conditioners, installing a high-efficiency heat pump may be a better option than installing an air conditioner and a furnace since the incremental costs of a heat pump relative to an air conditioner are modest and heating loads are low. [↑](#footnote-ref-1)
2. <http://aceee.org/research-report/e13d> . [↑](#footnote-ref-2)