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July 1, 2015

Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program, Mailstop EE-5B
1000 Independence Avenue SW
Washington, DC 20585-0121

Re: Energy Conservation Standards for Residential Boilers; Proposed Rule
Docket Number EERE-2012-BT-STD-0047

Dear Ms. Edwards:

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) is the trade association representing manufacturers of air-conditioning, space heating, water heating and commercial refrigeration equipment. The AHRI member companies that manufacture residential boilers account for at least 90% of all residential gas and oil boilers that are sold and installed in the U.S. We submit the following comments in response to the Department of Energy's (DOE) notice of proposed rulemaking (NOPR) regarding amended efficiency standards for residential boilers issued in the March 31, 2015 *Federal Register*. 80 Fed. Reg. 17,222. The analysis done for the NOPR indicates that trial efficiency levels that require condensing designs are not economically justified as minimum standards. We agree with that conclusion. However, we do not support the revised standards proposed for gas and oil boilers. Those proposed revised minimum AFUE levels are not economically justified and inadequately assess the potential vent system issues of minimum standards at those levels. The NOPR analysis has not accurately accounted for the increased costs of manufacturing and installing boilers at the proposed revised efficiency levels. The analysis also underestimates the reduced consumption of the baseline models provided with automatic means to adjust the boiler water temperature to the load. The proposed maximum standby and off mode loss standards are too high and have been determined with inadequate analysis of the standby and off mode energy consumptions of current boiler models.

SUMMARY OF COMMENTS

AHRI has identified several procedural issues with the residential boilers NOPR, primarily that: (1) the Proposed Revised Efficiency Test Procedure for Residential Furnaces and Boilers published in the Federal Register on March 11, 2015 (Proposed Test Procedure) has not yet been finalized, therefore DOE has insufficient basis upon which to analyze an amended standard; (2) the Proposed Test Procedure affects the measurement of AFUE for residential boilers, and therefore the analysis for this NOPR must be adjusted to accommodate that change; (3) the DOE has made several unreasonable assumptions in its analysis, and by this NOPR, has attempted to impermissibly shift its statutory burden of data production onto stakeholders; and (4) DOE's analysis of the social cost of carbon is flawed.

We have also identified the following technical issues with the proposed minimum AFUE standards for gas and oil residential boilers:

- The analysis does not account for the distribution and age of existing boiler installations in the U.S.
- The ability of the new boiler in a replacement installation to utilize the venting systems to which the old boiler is connected without modification is reduced significantly.
- The design change required to achieve the proposed minimum efficiency levels is mischaracterized and the resulting cost to manufactures is underestimated.
- The amount of energy savings is over estimated since baseline models use less energy than estimated in the analysis.
- The installation costs are too low, particularly with respect to the number of installations that will need rework of the venting system and the extent of the vent system modification that will be required.
- The NOPR analysis does not estimate properly the manufacturing cost for larger input boilers.
- The contribution of jacket losses is underestimated.

PROCEDURAL ISSUES

Legal and Practical Requirements Mandate that DOE Publish a Finalize Amended Test Procedure Before Promulgating an Amended Energy Conservation Standard.

DOE published the Proposed Test Procedure on March 11, 2015 and the NOPR to revise the residential boiler efficiency standards three weeks later, on March 31, 2015. Given the amendments included in the Proposed Test Procedure, AHRI requests that DOE delay the publication of the final amended efficiency standard for residential boilers until after the Proposed Test Procedure has been finalized and that DOE re-open the docket for further comment on the efficiency standard once the amended test procedure has been finalized.

AHRI has both legal and practical concerns about the tandem proposal of test procedure and standard revisions for the following reasons: (1) the proposed/non-final status of the test procedure inhibits stakeholders' fair evaluation of the standard; (2) DOE has failed to abide by its codified procedures by publishing the Proposed Test Procedure within weeks of the NOPR; and (3) DOE was required by statute to finalize the amended test procedure over six months ago.

First, it is axiomatic that a boiler manufacturer must test its equipment to determine how its products are affected by the proposed standard. When the test procedure used to make that assessment is in flux, it places the manufacturer in the position of spending time and resources to collect potentially useless data and undermines its ability to provide relevant input on the NOPR because the method by which that standard will be applied and the data was collected may change. The dilemma is aggravated when a manufacturer advocates for a change to the proposed procedure during the notice-and-comment process, as boiler manufacturers intend to do for the Proposed Test Procedure. DOE is required to give stakeholders the opportunity to submit meaningful comments, and the joint proposal of test procedures and standards diminishes that opportunity. *See* 42 U.S.C. §§ 6295(p)(2), 6306(a). Second, because DOE is well aware of the detriment that a tandem proposal for test procedure and standard presents to stakeholders, it codified a procedure designed to avoid this disadvantage. 10 C.F.R. § 430 SubPt B, App'x A (7)(b). DOE declared that it would finalize amended test procedures before introducing applicable amended standards. *Id.* In this instance, DOE has failed to abide by its own codified procedures. The Administrative Procedure Act (APA) requires agencies to abide by their policies and procedures, especially where those rules have a substantive effect. *U.S. v. Heffner*, 420 F.2d 809 (4th Cir. 1969); *Adams v. Bell*, 711 F.2d 161, 183 (D.C. Cir. 1983). The non-final test procedure has the substantive effect of increasing costs to stakeholders and diminishing their ability to comment on the

NOPR. Finally, under EPCA, DOE was required to finalize the Proposed Test Procedure on December 19, 2014—four months before it was proposed. *See* 80 Fed. Reg. 17,235, 42 U.S.C. § 6293(b)(1)(A). Had DOE met this statutory deadline, the amended test procedure would now be final, and stakeholders would have a genuine opportunity to assess the NOPR. By failing to meet its statutory requirements, DOE has jeopardized stakeholders’ rights to equitably comment on the NOPR. In order to cure this injury, AHRI is requesting that the DOE delay the finalization of the amended standard until after the Proposed Test procedure has been finalized and allow stakeholders to comment on the proposed standard, properly informed by data garnered from the final test procedure.

The Proposed Test Procedure, if Finalized as Proposed, Is Not Neutral and Will Require an Adjustment of the AFUE Standard Levels to Accommodate for the Test Effects.

Further complicating the concurrent proposal of test procedure and energy efficiency standard amendments is the legal requirement that the test procedure not have a substantive effect on energy efficiency standards. EPCA states: “In the case of any amended test procedure...the Secretary shall determine, in the rulemaking carried out with respect to prescribing such procedure, to what extent, if any, the proposed test procedure would alter the measured energy efficiency...of any covered product as determined under the existing test procedure.” 42 U.S.C. § 6293(e)(1). DOE has tentatively determined that the Proposed Test Procedure has no effect on measured AFUE. 80 Fed. Reg. 17,243. As is discussed in more detail below, AHRI disagrees with this tentative determination based on data we are collecting that shows that the Proposed Test Procedure changes the resulting AFUE measurement. One such change is the procedure for burner set-up that is used in the current test procedure. AHRI will address these changes in more detail in its comments on the Proposed Test Procedure. The issues identified in those comments must be resolved before this rulemaking proceeds.

The NOPR Does Not Adequately Address the Significant Safety Concerns Implicated by the New Standard.

The NOPR quotes 10 C.F.R. § 430 Subpart C, Appendix A 4(a)(4), 5(b): “If it is determined that a technology would have significant adverse impacts on health or safety, it will not be considered further.” AHRI members believe that increasing the minimum energy efficiency standards to 85% for gas hot water boilers and 86% for oil hot water boilers brings this issue into consideration. DOE “recognizes that efficiency levels within the non-condensing to condensing range could pose health or safety concerns under certain conditions....” 80 Fed. Reg. 17,242. In accordance with DOE’s stated policy, the existence of health or safety impacts should eliminate its consideration of a minimum efficiency standard appreciably above the current minimum standards for gas and oil boilers. The DOE has dismissed stakeholders’ concerns about safety with the assumption that contractors will install the equipment correctly in every case: “I mean, we assume that the installers know how to install the equipment.” EERE-2012-BT-STD-0047-0050 at 46:2-6. Regardless of what installers know, manufacturers must deal with the field experience that indicates the quality of installations varies over a wide range.

The critical point is that by eliminating options for residential boilers that operate at 82% AFUE, the DOE is increasing the likelihood that an 85% boiler will be installed incorrectly because of the challenging installation environments (50% of homes built before 1950 use boilers for heat; the majority of which are old homes in northeast urban areas)¹ and the increased costs of executing the safe installation (*See* Technical Issues at p. 9-10, *infra*). AHRI contends that if the confluence of unavailability of safer, more easily installed equipment causes even one consumer or contractor to improperly install an 85% gas

¹ U.S. Energy Information Administration, 2009 Residential Energy Consumption Survey available at <http://www.eia.gov/consumption/residential/data/2009/>

burning boiler such that it does not vent properly or otherwise operates unsafely, then the health and safety risks are significant, i.e., “not genuinely trivial.”² The parallel situation exists for oil boilers.

The DOE’s Reliance on Unreasonable Assumptions Impermissibly Shifts the Agency’s Burden of Production onto Stakeholders.

EPCA mandates that DOE meet specific factual thresholds before it can promulgate an energy efficiency standard. The NOPR acknowledges that “any amended standard for a covered product must be [1] designed to achieve maximum improvement in energy efficiency that is [2] technologically feasible and [3] economically justified.” 80 Fed. Reg. 17,231 citing 42 U.S.C. § 6295(o)(2)(A) and (3)(B). DOE must make its determination “to the greatest extent practicable” considering seven statutory factors, including manufacturer and consumer impact, savings in operating costs over the estimated average life of the covered products, and the impact of lessening competition. *Id.* When presented with a statutorily-mandated threshold showing, it is DOE that bears the burden, on the basis of substantial evidence, that the proposed standards are technically feasible and economically justified.³ As such, under EPCA it is impermissible for the DOE to shift the burden of data production onto the regulated industry.⁴ In the NOPR and at the April 30, 2015 public meeting, the DOE has effectively required industry to factually disprove baseless assumptions contained in the analysis, rather than collecting available information to support its analysis with substantial evidence.

As discussed in more detail below, the DOE has made several factual assumptions that are not substantiated by evidence, even though that evidence is available, such as the assumption that the estimated expected life expectancy of a condensing boiler is the same as a non-condensing boiler. 80 Fed. Reg. 17,256. Despite comments from industry asserting that the life expectancy of a condensing boiler is less than the 25 years assigned to those products based on the field experience of non-condensing boilers, DOE ignored these comments and relied instead on an irrelevant 4-page marketing pamphlet from the UK Energy Savings Trust containing no actual data, no reference to the lifetime of condensing boiler life expectancy and an express disclaimer that “This publication ... is for general guidance only and not as a substitute for ... professional expertise.”⁵ DOE has made several other unreasonable assumptions where publicly available information and manufacturer comments have been ignored.⁶ DOE has declared that unless industry undertakes the cost, time, and resources to conduct DOE’s research and analysis, its comments are without value. 80 Fed. Reg. 17,257-58 (“The commenters provided no data to support their opinion regarding a lower condensing boiler lifetime vis-à-vis non-condensing boilers. Therefore, for the NOPR, DOE did not apply different lifetimes...”); EERE-2012-BT-STD-0047-0050 at 194:18-20.

It is ironic that DOE permits unsubstantiated assumptions to form the basis of its determinations, as it has regarding a critical safety issue, but it holds the regulated industry to a higher standard of data production.

² DOE has defined “significant” as “not trivial” in other contexts, and as such the same definitions should be consistently applied when making health and safety considerations. 80 Fed. Reg. 17,236.

³ *See Indus. Union Dep’t, AFL-CIO v. API*, 448 U.S. 607, 652 (U.S. 1980) (“[the] Act indicates that [Congress] intended the Agency to bear the nominal burden of establishing the need for a proposed standard.”).

⁴ *Id.* (The Supreme Court vacated a rule promulgated by OSHA because the agency impermissibly imposed the burden of data production on industry, “thereby avoiding the Secretary’s threshold responsibility of establishing” its statutorily mandated threshold showing, and “[i]n so interpreting his statutory authority, the Secretary exceeded his power.”).

⁵ 59 Energy Efficiency Best Practice in Housing, Domestic Condensing Boilers—‘The Benefits and the Myths’ (2003) (Available at: <http://www.westnorfolk.gov.uk/pdf/CE52.pdf>).

⁶ Other unsubstantiated assumptions include: the price elasticity of a boiler is 0, based on an assumption derived from washing machine sales (80 Fed. Reg. 17257); the Proposed Test Procedure is neutral based exclusively on three tests (80 Fed. Reg. 17,243); and under-estimated costs of 85% boiler installation based on derivative modeling rather than real-world data (80 Fed. Reg. 17254).

At a minimum, DOE has a responsibility to explain the basis for its assumptions—such as why price analysis for washing machines and refrigerators is an acceptable substitution for residential boilers; this is particularly important when DOE’s factual assumptions favors its position and is contrary to the general economic theory that when prices go up, demand decreases. *See Gas Appliance Mfrs. Ass’n v. Dept. of Energy*, 998 F.2d 1041, 1047-48 (D.C. Cir. 1993) (If DOE assumes a basis for substituting markets/products, DOE is required to explain why and support its analysis with facts). DOE’s unsubstantiated position that boilers are somehow unique such that a price change will have no effect on demand overstates the benefits of energy savings projected in the NOPR.

Manufacturers and the regulated community have an interest in supplying DOE with relevant information so that DOE’s regulations are informed and less burdensome. However, industry cannot consistently bear the cost of disproving DOE’s baseless assumptions designed to justify ever increasing efficiency standards. AHRI agrees that data requests are reasonable when pertinent information exclusively resides with the stakeholder. However, DOE has a statutory duty to develop and research available information and may not require the regulated industry to bear the burden of data production. When DOE has failed to collect relevant available information in the past, courts “have applied a common sense test to such matters, saying ... it ‘may not tolerate needless uncertainties in its central assumptions when the evidence fairly allows investigation and solution of those uncertainties.’” *Gas Appliance Mfrs. Ass’n*, 998 F.2d 1041 at 1047 (requiring DOE to conduct real-world tests to support its assumptions); *see also National Lime Ass’n. v. Environmental Protection Agency*, 627 F.2d 416, 443 (D.C. Cir. 1980) (deficient assistance from industry was no defense to agency’s failure to produce and analyze relevant data required to support a threshold showing). AHRI requests that DOE thoughtfully consider all of its comments and fulfill its statutory obligation to investigate and resolve uncertainties when stakeholders’ comments indicate that DOE’s factual assumptions are without substantial support.

DOE’s Reliance on Social Cost of Carbon (SCC) is Misplaced and the Cost Benefit Analysis Incorporating Monetized Costs of Carbon is Flawed.

Provisional, Revisable, Imperfect and Incomplete Data such as the Monetization of SCC Cannot form the Basis for DOE’s Analysis

DOE itself acknowledges the uncertainty of its SCC claims repeatedly in the NOPR, including that the SCC estimates are “provisional.” 80 Fed. Reg. 17,264, 17,265 n.83, 17,266. Even the interagency group that developed the SCC recognized that the underlying models were “imperfect and incomplete.” 80 Fed. Reg. 17,266. DOE states that a recent report from the National Research Council noted that any assessment would suffer from uncertainty, speculation and lack of information. 80 Fed. Reg. 17,264, 17,266. One of the main reasons the analysis is uncertain is that it relies on Intergovernmental Panel on Climate Change (IPCC) analysis concerning climate sensitivity. But the IPCC has conceded that “[n]o best estimate for equilibrium climate sensitivity can now be given because of a lack of agreement on values across assessed lines of evidence and studies.” *IPCC, 2013: Summary for Policymakers* at 16 n.16, available at http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf.

The use of such analysis as the foundation of a proposed energy efficiency standard is not without real and irreparable harm to manufacturers, due to EPCA’s so-called “anti-backsliding” provision. 42 U.S.C. § 6313(a)(6)(B)(iii)(I). As DOE notes at page 17,232 of the NOPR, the “anti-backsliding” provision prohibits the Secretary from prescribing any amended standard that increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. So, when DOE states that “any value placed on reducing CO₂ emissions in this rulemaking is subject to change” (80 Fed. Reg. 17,287) and that happens, there will be no remedy for manufacturers for an energy efficiency standard that was adopted based upon that “provisional,” “revisable,” “subject to change” and, it turns out, erroneous analysis. While the SCC may be revisable, DOE has taken the position that its energy

efficiency standards are not. In fact, DOE cites uncertainties in estimating employment impacts in later years as basis for restricting its analysis to short term impacts (through 2023), yet relies on the SCC, which DOE admits is riddled with uncertainty, past the year 2100. 80 Fed. Reg. 17,227. For this reason alone, the use of the SCC in an energy efficiency standard cost benefit analysis under EPCA is entirely unfair and impermissible.

The Use of Monetized SCC as Determined on a Global Basis for the World Population is Outside of DOE's Regulatory Authority Under EPCA.

EPCA's focus is exclusively on benefits accruing within this nation. It is *not* an international statute and it is not an environmental statute.⁷ EPCA authorizes DOE to conduct a national analysis of energy savings. There are no references to global environmental impacts in the statute. Hence, it is unlawful for DOE to rely on SCC figures at the global level. Global analysis is entirely foreign to EPCA Section 6313(a)(6)(B)(ii); *see especially id.* § 6313(a)(6)(B)(ii)(VI) (referencing weighing of “the need for *national* energy conservation”) (emphasis added). Note as well that EPCA originally arose out of the 1970s oil embargo and nothing in its subsequent amendments suggests a different statutory focus other than trying to improve the energy economics of the United States. To try to reframe EPCA into a globally oriented statute is to ignore that legislative history and evolution.

DOE specifically asserts that it had environmental rulemaking power in the NOPR. 80 Fed. Reg. 17,237 (“The proposed standards also are likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with energy production.”). This statement is located under section E.1.f., “Need for *National Energy Conservation*” (emphasis added). In so doing, and by relying on global values, DOE has inserted environmental factors to such an extent that it is no longer determining energy efficiency “based solely on the energy consumed at the point of use”⁸ as required by EPCA. By relying on this factor in the cost-benefit analysis, which Congress did not intend DOE to consider, DOE acted arbitrarily and capriciously under the APA. DOE might attempt to argue that environmental factors can be considered in light of Section 6295(o)(2)(B)(i)(VII) (“other factors the Secretary considers relevant”), but in this rulemaking DOE did not consider emissions costs as ‘other factors.’” 80 Fed. Reg. 17,237.

Furthermore, even if inclusion of environmental factors as additional factors is authorized, DOE should not be able to analyze *global benefits* but look only to *national costs*. DOE's analysis contains a fundamental mismatch. The SCC is measured not just for consumers of products purchased in U.S. markets, but in reality across the entire global population, yet DOE's analysis of costs to consumers counts as consumers only those who make purchases of the covered products in the domestic market. DOE implicitly acknowledges this by repeatedly noting that two issues that should be considered:

First, the national operating cost savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, while the value of CO₂ reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use different timeframes for analysis. [2020-2049 for costs, “well beyond 2100” for SCC benefits]. 80 Fed. Reg. 17,227. In making this statement, DOE also notes that “adding the value of consumer savings to the values of emission reductions provides a valuable perspective.” *Id.* But it is much more than that. It is

⁷ Compare DOE's list of SCC damages (net agricultural productivity, human health, increased flood risk) at 80 Fed. Reg. 17,264 to EPCA's list of factors the Secretary must consider (economic impact on manufacturers and consumers of the product, operating cost savings, direct energy savings, lessening of competition or utility, need for energy conservation) at 42 U.S.C. § 6313(a)(6)(B)(ii).

⁸ 76 Fed. Reg. 51,281, 51,282 (“the Energy Policy and Conservation Act (EPCA) . . . requires that such measures be based solely on the energy consumed at the point of use.”).

used as an additional, separate factor that dominates what is clearly EPCA's focus on national costs and energy savings. For example, on page 17226 of the NOPR DOE summarizes "national economic benefits in costs" in Table I.6 – yet it includes CO₂ reduction, which is clearly measured on a global scale. The SCC analysis is the key driver of DOE's economic justification, and it is irreparable when it is used to set standards and later turns out to be wrong. As such, it is not a basis for substantial evidence under EPCA.

Even assuming DOE had the authority to turn EPCA into an environmental statute, there is also no reason why America's contribution to climate change cannot be based on an analysis that compares costs to benefits on an apples-to-apples basis (*i.e.*, nationally). In fact, as noted above, DOE states explicitly that the interagency group that developed SCC determined that a range of discount rates should be used to calculate domestic effects.⁹ DOE's departure from the statutory mandate in light of that ability is arbitrary and entirely without basis.

DOE' Cost Benefit Analysis is Flawed Because it Measures Benefits Over a Time Period that Exceeds Three Times the Period for Which it Measures Costs.

While DOE bases its manufacturer impact analysis ("MIA") and industry net present value ("INPV") analysis on a 30-year period, it notes that the benefits from SCC extend beyond the year 2100. 80 Fed. Reg. 17,227. In the NOPR, DOE also argues that costs and benefits include benefits to customers that accrue after 2050 from equipment purchased in 2020-2049, *see* 80 Fed. Reg. 17,226 Table 1.6, and accounts for incremental variable and fixed costs incurred by manufacturers due to amended standards, some of which may be incurred in preparation for the rule. What benefits can possibly accrue to customers for equipment that is no longer expected to be in use and does not account for the additional costs of purchasing and installing new equipment? While it makes sense to include the R&D and other costs manufacturers will incur in order to comply with the amended standards, DOE provides no justification for the exclusion of any costs that manufacturers might incur after 2050, in measured harmony with the manner and time period that DOE uses to measure the benefits. These time frames for measuring the benefits of the proposed standard are so imbalanced that DOE's entire cost benefit analysis is unreliable.

DOE wrongly assumes that SCC values will increase over time.

This is contrary to historical experience and to economic development science. The more economic development that occurs, the more adaptation and mitigation efforts are both undertaken by humanity and that a population living in a growing economy can afford to undertake. Adaptation and mitigation analysis is well known in climate science circles and we see no indication in this rulemaking that DOE paid any attention to this issue. *See, e.g., IPCC, Supplementary material to Chapter 18: Inter-relationships between adaptation and mitigation, Climate Change 2007: Impacts, Adaptation and Vulnerability, available at <https://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter18sm.pdf>.* Adaptation/mitigation is treated in the Interagency Working Group analysis but one of the three models used does "propagate forward" damage, though the other two do not. *Compare* Interagency Working Group on SCC, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866* at 5-6 (Feb. 2010), *available at* <http://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf> *with id.* at 7 (indicating that developed countries can eliminate 90% of the economic impacts of climate change and that developing countries can eventually eliminate 50% of the economic impacts of climate change).

⁹ 80 Fed. Reg. 17,265-66.

DOE's use of SCC violates EPCA Section 6313(a)(6)(A)(ii)(II) and Section 6313(a)(6)(B)(ii)(I)-(VII) by Giving Emissions Savings Disproportionate Weight

EPCA requires that DOE consider seven different factors in determining whether the benefits of a proposed standard exceed its burdens. There is no indication in the statute or otherwise that Congress intended this to be anything other than a roughly equal weighting of factors where no particular factor is king over all the others. Yet through DOE's inclusion of energy efficiency savings tied to global indirect emissions and SCC reductions that are provisional, revisable, imperfect, and incomplete, and that extend well beyond the life of the equipment and even the relevant period for measuring benefits relative to costs, it has formulated an amount of energy savings that is unsupportable and insurmountable for those who would question the rule. This is true even if all of the other factors point in the direction of significant or even extreme burdens to customers and manufacturers. This is not the kind of balancing of factors that Congress envisioned, and nothing in Executive Order No. 12866 is to the contrary — costs and benefits of intended regulation must be considered *to the extent permitted by the law* — which in this case is the statutory seven-factor analysis in which no one factor is given weight over the others.

DOE's SCC Analysis Fails the Information Quality Act's Standards of Decision Making Based on Sound Science and as Such is not Clear and Convincing Evidence

The Information Quality Act (IQA)¹⁰ is contained in the Treasury and General Government Appropriations Act for FY 2001. The IQA provides in relevant part that the Office of Management and Budget (OMB) and the federal agencies must establish guidelines “for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by Federal agencies.” IQA Section (a) & (b)(2)(A). There are several areas in which the interagency process used to develop SCC did not comply with the mandates of the IQA.

First, the interagency process was not transparent. The agencies involved were disclosed but not which of their personnel participated, or whether outside consultants were used. This violates the OMB guidelines. Second, the SCC estimates were not subjected to peer review. As noted above, DOE states in the NOPR that the National Resource Council (part of the National Academies of Science) criticized the models the interagency process used as “suffer[ing] from uncertainty, speculation, and lack of information about (1) future emissions of GHGs; (2) the effects of past and future emissions on the climate system, (3) the impact of changes in climate on the physical and biological environment, and (4) the translation of these environmental impacts into economic damages.” 80 Fed. Reg. at 17264, 17266. Third, in order to translate certain predicted climate-change effects into economic damages, the interagency SCC analysis relies on arbitrary damages functions. As such, the SCC analysis violates EPCA.

DOE Must Use the Most Recently Available Data.

The NOPR references the fact that DOE relied on the Annual Energy Outlook 2013 (“AEO 2013”), not on the Annual Energy Outlook 2014 (“AEO 2014”). *See, e.g.*, 80 Fed. Reg. 17, 256 n.53. But the NOPR was published in March 2015, whereas the AEO 2014 became available between April and May 2014. *See* AEO 2014, *available at* [http://www.eia.gov/forecasts/aeo/pdf/0383\(2014\).pdf](http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf) (dated on its cover “April 2014”). Although there may be reasons why the 2014 AEO was not referenced, the 2015 AEO is now available. The information in that most recent AEO should be incorporated into the analysis for this rulemaking.

By DOE's own concessions, use of the AEO 2014 data would significantly reduce the environmental benefits resulting from reductions of CO₂, SO₂, and Hg, among other emissions:

¹⁰ Pub. L. 106-554, § 515, 114 Stat. 2763 (Dec. 21, 2000). The IQA is also set out at 44 U.S.C. § 3516.

Emissions factors based on the Annual Energy Outlook 2014 (AEO 2014) . . . indicate that a significant decrease in the cumulative emission reductions of carbon dioxide, methane, nitrous oxide, sulfur dioxide, nitrogen oxides and mercury from the proposed standards can be expected if the projections of power plant utilization assumed in AEO 2014 are realized. For example, the estimated amount of cumulative emission reductions of CO₂ are expected to decrease by 36% from DOE's current estimate (from 1,085 Mt to 697Mt) based on the projections in AEO 2014 relative to AEO 2013. The monetized benefits from GHG reductions would likely decrease by a comparable amount.

We expect the 2015 AEO data has a similar effect.

79 Fed. Reg. at 58,950 n.7. DOE indicates that the analysis will be updated with the AEO 2014 data, but, because DOE has yet to update the analysis, stakeholders are deprived of the opportunity to comment on the relevant information during the comment period. This is not consistent with the theory or practice of notice and comment rulemaking. “[One] purpose of notice-and-comment provisions under the APA . . . is ‘to ensure that affected parties have an opportunity to participate in and influence agency decision making at an early stage, when the agency is likely to give real consideration to alternative ideas.’” *Nat’l Ass’n of Clean Water Agencies v. EPA*, 734 F.3d 1115, 1148 (D.C. Cir. 2013) (quoting *N.J., Dep’t of Env’tl. Prot. v. EPA*, 626 F.2d 1038, 1049 (D.C. Cir. 1980)).¹¹ DOE’s proposed course of action denies stakeholders the ability to adequately review and comment on DOE’s analysis. We know that DOE’s benefits will drop by more than one third in the case of the most important greenhouse gas and we know that DOE will need to revise the analyses it built on top of that analytical foundation. But what AHRI does not know is the precise impact of those changes on the analysis. AHRI must see the ensuing analysis using the most up-to-date inputs so that they can frame their comments around it. Undeniably, AHRI’s and its members’ rights to comment cannot be effectively eliminated by shunting them away from the only stage where the opportunity for filing comments matters, which is now — at the proposed rule stage.

It is thus incumbent on DOE to issue a supplemental notice of proposed rulemaking that revises the analysis based on AEO 2015 data so that AHRI may comment upon the analysis done using the most up-to-date inputs.

TECHNICAL ISSUES

Table HC 6.3 in the 2009 Residential Energy Consumption Survey indicates that 110.1 million housing units in the US that used space heating equipment. Of those, about 11 million housing units use a gas or oil-fired hydronic heating system (steam or hot water). About 6 million of those housing units with hydronic heating systems were built before 1950. Another 2.6 million units were constructed in the next 10 years with hydronic heating systems. So just over 3 out of every 4 housing units in the U.S that are heated by a boiler are over 55 years old and more than half of those housing units heated by a boiler are over 65 years old. This presents a unique circumstance for residential boilers in that these products are being installed the vast majority of the time in older homes with venting systems and chimneys built to codes from another era and installation sites in the home that are much more likely to have limited options of accommodating the installation requirements of modern design boilers.

¹¹ APA Section 553 concerning notice-and-comment rulemaking is “one of Congress’s most effective and enduring solutions to the central dilemma it encountered in writing the APA reconciling the agencies’ need to perform effectively with the necessity that ‘the law must provide that the governors shall be governed and the regulators shall be regulated, if our present form of government is to endure.’” *Am. Bus Ass’n v. United States*, 627 F.2d 525, 528 (D.C. Cir. 1980) quoting S. Doc. No. 248, 79th Cong., 2d Sess. 244 (1946).

It should be noted that using the same 2009 RECS survey data, the DOE analysis estimates that 16.6 million buildings use a residential boiler for space heating. This appears to be a significant overestimation that results in an inflated national energy savings estimate.

In the Northeast Census region, there are 20.8 million housing units using space heating equipment. About 8 million of those housing units use a gas or oil fired boiler for their heating equipment. So about 73% of all U.S. boiler installations are found in a region that only has about 19% of the housing units in the U.S. In that same Northeast Census region, 6.9 million housing units were built before 1950 and another 3.4 housing units were built in the next 10 years.

Although the 2009 RECS data does not tell us precisely how many homes in the Northeast Census region built before 1950 or 1960 have hydronic heating systems in them, these various bits of information clearly establish that most boilers are installed in the Northeast Census region and they are likely to be servicing housing units more than 55 years old. Given this unique situation, an analysis that uses national data or simulates households across the U.S. is not adequately evaluating the market for residential boilers in the U.S. The average square footage of the housing units built before 1950 in the Northeast was about 1425 ft². The average square footage for housing units built between 1950 and 1959 was 1722 ft². These are not large residences.

More than 10 years ago comments were submitted by GAMA that noted flaws in the application of the Monte Carlo methodology in analyzing the impact of revised standards on consumer life cycle costs. At that time it was noted that the 10,000 runs using a random set of variables was not statistically significant. Information from a recently completed study conducted by the Gas Technology Institute (GTI) has identified a critical flaw in the Monte Carlo methodology. Specifically since the methodology is completely random, it fails to acknowledge that the purchase of heating, cooling and water heating equipment by consumers is a reasoned, economic-based decision considering various factors important to the consumer. These factors may vary but the ultimate decision on what unit is purchased is based on some logic underscored by the consumer's economic situation. It is not random. A significant review of the Monte Carlo methodology is being conducted for us for the rule making to revise the minimum efficiency standards for residential furnaces. The results of that review will be included in our comments we will be submitting next week on that rulemaking. The issues and concerns raised on that aspect of the analysis will also apply to this rulemaking.

In the case of residential boilers, the use of RECS national data for a product disproportionately installed in homes more than 65 years old and concentrated in a single region of the U.S. compounds the inaccuracy of the analysis. Although the TSD created a subset of buildings that used a boiler for its heating system, that subset of buildings does not reflect the majority of boiler installations in older homes in the Northeast part of the U.S.

The typical residential boiler installation is in an older home. The venting system to which that boiler is connected was designed and installed in accordance with the installation codes that existed when the home was built; e.g. codes from the 1940s or 1950s. That venting system likely was a combination of a vent connector and unlined masonry chimney or a complete metal vent system using Type B or Type L venting, depending on the type of boiler. Undoubtedly, the vent system was sized and configured using principles that assumed a certain level of energy in the vent gases. The typical boiler manufactured 50 or 60 years ago was less efficient than current models and the vent gases were hotter than those generated by an 82% AFUE boiler, let alone boilers with AFUEs of 85% or 86%. Additionally the older gas boilers had standing pilots that kept the vent system warm. The vent systems constructed in older homes under the circumstances just described may be of total length and configuration such that the system is now too long or too large to properly vent an 85% or 86% AFUE boiler because the vent gases have insufficient energy to move the vent gases through the entire vent system by natural draft under the various conditions that occur while the boiler is operating during a heating season. Manufacturers are keenly aware of the need to have boiler designs that are robust enough to operate safely and properly when connected to the

diverse venting systems that exist in the older homes in which boilers are predominately installed. This field circumstance underscores our position that boilers with AFUE ratings in the 83.5% to 87% range result in near condensing installations. The analysis should recognize that a Category II or IV vent system may be needed for gas boiler in this AFUE range even though it is unlikely that there will be any condensation occurring in the heat exchanger. The installation codes that apply to gas and oil boilers today are significantly different from those that existed 50 or 60 years ago. The venting requirements in the current codes are more detailed and specific as the size and configuration of the system. The installation codes recognize that boilers operating at steady state efficiencies in the mid-80s represent the near condensing range of efficiency and that the venting requirements are determined accordingly. Since the AFUEs considered in the analysis are in this near-condensing AFUE range, it has underestimated the increased installation cost for vent system rework or upgrade at the 84% and 85% AFUE levels for gas hot water boiler models and at the 86% AFUE level for oil hot water boiler models.

In the case of oil boilers, a minimum flue gas temperatures on the order of 350 F is typically required to produce adequate chimney draft for safe venting of combustion gases, and to minimize boiler, vent system, and chimney corrosion damage over time. The National Fire Protection Association standard NFPA-31 - Standard for the Installation of Oil-Burning Equipment, 2011 Edition, Annex E, shows venting tables for oil fired equipment. Oil boilers with an 86% AFUE will require a combustion efficiency of about 87%. Interpolating between Tables E.5.4(a) and E.5.4(b) shows that the flue gas temperature is 335 F. This is below the 350 F specification commonly accepted by many manufacturers as the lowest flue gas temperature for safe chimney venting.

The analysis has not accurately assessed the number of replacement installations that will require some work of the venting system and the cost of that vent work. The information presented at the April 30, 2015 public meeting indicated that chimneys serving boilers needed to be relined only if either the building was built before or the boiler was installed before 1995. A consequence of this premise is that the estimated percentage of installations that will require lining is small. Illogically, that information indicated that the percent of chimneys requiring relining decreased as the AFUE increased. Because boilers are disproportionately installed in homes built before 1995, the basis for the estimates of replacement installations needing relining must be directly tied to an assumption that most existing boilers were installed since 1995. The analysis appears to assume further that for any replacement boiler installed since 1995 where a chimney was part of the venting system, that chimney was relined. That assumption is based on the requirements in the National Fuel Gas Code (NFGC) covering venting systems using a masonry chimney. DOE has not considered the complete NFGC requirement nor assessed how it has been implemented in the field. Section 12.6.4.2 in the 2015 edition of the NFGC requires chimneys to be lined with the following exception:

“Existing chimneys shall be permitted to have their use continued when an appliance is replaced by an appliance of similar type, input rating, and efficiency where the chimney complies with 12.6.4 and the sizing of the chimney is in accordance with 12.6.3.”

This exception gives the installer the latitude to forego lining the chimney if the replacement boiler is essentially the same as the unit being replaced. The original minimum 80% AFUE requirement for gas hot water boilers has been in effect since 1992. Given this exception, it is likely that many of the boiler installed since 1995 in venting systems using a chimney have unlined chimneys because the installer made a determination that the new boiler was essentially the same as the old boiler. Taking this one step further, it may be even easier to decide that a 82% AFUE boiler is the same as the old 80% AFUE unit it is replacing. If the chimney was not lined before it is likely it will not get lined now. This situation becomes significantly less likely at AFUEs of 84 or 85%. At a proposed minimum of 85% it is very likely that the boiler’s installation instructions will require the chimney to be lined and that specified liner may be stainless steel. In that case even chimney having a clay liner will require added work.

We have contracted the Gas Technology Institute (GTI) to study the performance of vent systems when connected to boilers operating at the efficiencies considered in the DOE analysis. Although that research project has not been completed in time for inclusion in these comments, the project is scheduled to be completed within the next 3 weeks. We will provide a supplemental comment to submit the results of that study once it is completed.

DOE assumes that the only design change necessary to achieve the proposed revised minimum AFUE levels is to increase the heat exchange area. DOE estimates that the increased manufacturers' cost to produce these higher efficiency models is less than \$14 for a gas hot water boiler; almost \$150 for a gas steam or oil hot water boiler and almost \$365 for an oil steam boiler. This analysis of the design changes required is incomplete in that it fails to recognize the additional changes that may be necessary to achieve the proposed minimum AFUE levels. In some cases models may become bigger to accommodate the larger heat exchanger. A larger model will require more material for the jacket and other design modifications. Manufacturers will add features or design changes to maintain the boiler model's capability to be connected to the variety of venting systems in the field and operate safely. One such change acknowledge by DOE is to convert the model to have "fan-assisted draft." The analysis assumes that this percentage will remain unchanged at each efficiency level. We continue to disagree with that assumption. At an 85% minimum efficiency level it is likely that the majority of models will utilize a fan assisted design since that change may be the best way for the manufacturer to provide models which the company will be confident can work safely and properly on existing venting systems. In conjunction with that change, these draft inducer models will require the use of stainless steel venting material for some parts of the vent system. We cannot provide precise estimates of how many models would change to fan-assisted draft since such information borders on being member's production or marketing plans, which they keep confidential. Regardless, the point is the manufacturers' cost to produce models meeting the proposed revised efficiency levels will be greater than estimated in the NOPR.

Table CE 4.6 in the 2009 RECS survey indicates that the average annual space heating energy consumption for a housing unit in the Northeast using natural gas is 62.1 million Btus and 72.5 million Btus if the unit is using fuel oil. The DOE analysis estimates the following average annual energy consumptions:

Boiler Type	Annual Consumption (Million Btu)
Gas Hot Water	95.3
Gas Steam	98.1
Oil Hot Water	98.1
Oil Steam	99.9

DOE's estimates are almost twice the RECS national average annual space heating energy consumption for housing units using natural gas of 51.4 million Btus and almost 40% higher than the RECS national average annual space heating energy consumption for housing units using fuel oil of 70.3 million Btus. More significantly, the estimates used in the analysis also are appreciably greater than the 2009 RECS data specific to the Northeast census region. It is not possible to attribute this large difference to the inclusion of CBECS data for residential boilers used in commercial buildings. If that were the case, the analysis would be imposing significant costs on residential consumers based on benefits that are only likely to occur in commercial buildings. In overestimating the energy use the analysis directly overestimates the energy savings resulting from the proposed revised minimum standards.

This miscalculation is increased by DOE's underestimation of the benefit of the "automatic means" that is now provided with residential boilers. Section 7.3.1.3 in the TSD provides the calculation for adjusting the AFUE to account for the benefit of the automatic means. However, Table 7.3.5 shows the adjustment for single-stage non-condensing boilers results in only a 0.05% AFUE improvement, which is based on the improvement of steady-state efficiency with a 2 °F reduction the return water temperature. We had previously commented that DOE needs to factor in the benefit of the automatic means. Studies have shown that this device or control feature does reduce the energy consumption of boilers in the field. DOE assumed that the entire benefit from automatic means is from an increase in steady-state efficiency from reduced water temperature. A main benefit of automatic means, especially for single-stage boilers, is that it prevents the operation of the boiler if the automatic means determines that the load can be met with residual heat in the boiler, thereby preventing the operation of the boiler for these demands almost entirely. This will also reduce the off-cycle losses from the boiler as less residual heat is left in the boiler over the course of the heating season. A conservative estimate of the savings from automatic means would be 5%, a more realistic range is 5 to 8%. The current DOE assessment of the benefit of the automatic means must be corrected to consider other factors that improve the efficiency of boilers equipped with automatic means.

Just on the basis of using the lower annual energy consumption shown in the 2009 RECS survey for the Northeast and a 5% energy savings from the use of the automatic means, the estimated average annual energy consumption values in Table 7.4.1 become much lower. They reduce to the range of 52.5 to 50 million Btus for gas boilers and the range of 60.6 to 56.4 million Btus for oil boilers. The estimated energy savings resulting from the proposed minimum AFUE standards reduce to the following:

Boiler Type	Annual Energy Savings (Million Btu)
Gas Hot Water	1.8
Gas Steam	1.9
Oil Hot Water	1.3
Oil Steam	2.8

The energy savings benefits to consumers of these proposed revised standards are about 40% less than DOE's estimates for gas boilers and about 33% less than DOE's estimates for oil boilers.

Because the analysis has not recognized the significant effect of the proposed minimum AFUE standards on how the suitability of existing vent systems will be evaluated when a replacement boiler complying with those standards is installed, the analysis underestimates the installation costs of these boilers. We are conducting a survey of contractors who install residential boilers to provide information from the field on actual installation costs. The compilation of those survey results will be forwarded to DOE within the next 2 weeks.

The combination of lower energy savings and higher installation costs will significantly increase the payback period such that the proposed minimum AFUE levels in the NOPR will not be economically justified. It is our intent to provide a recommendation for alternative revised minimum standards for residential boilers. However we cannot provide that recommendation until we have seen the results of this survey.

As we noted at the April 30, 2015 public meeting, the analysis does not adequately evaluate the effect of revised efficiency standards on larger input boilers. It is well recognized that boilers are a very small

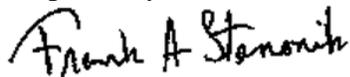
segment of the U.S. residential heating market. Larger input boilers are the smallest segment of the residential boiler market. For these larger input models, there is no economy of scale. Because relatively so few are manufactured, the costs of components are higher. The units are physically larger and weigh more so their shipping costs are larger. The information developed by the tear down analysis cannot be validly scaled up to these models which have input rates 2 to 2.5 times more than the baseline models.

DOE assumes that 35% of residential gas boilers and 53% of residential oil boilers are installed in unconditioned spaces. We question the validity of these estimates when considered in the context of where in the U.S. most boilers are installed. To the extent that boilers in homes in the Northeast census region are installed in unconditioned spaces, the unconditioned space is likely some part of the home, e.g. a basement, rather than a space such as a garage that is separated from the dwelling. The jacket loss from a boiler installed in an unconditioned basement is still adding heat to the interior of the structure. The jacket loss does heat the unconditioned space and reduces the temperature difference between that space and the conditioned space in the floor above it. Although that heat is not going directly to the conditioned space, it is not totally wasted energy. The analysis should be redone to recognize that. Furthermore, the jacket losses assumed in DOE's analysis randomly favor condensing boilers. DOE assumes that jacket losses for high-mass boilers are equal to the jacket loss factor, C_j , for boilers installed as isolated combustion systems (ICS), but decides to assume that C_j for low-mass boilers is a tenth of this value, i.e. 0.24, instead of using the value provided in ASHRAE 103-2007 for finned-tube boilers, 0.5. This assumption assumes that condensing boilers, which account for a greater proportion of low-mass boilers, will have less jacket loss than those assumed in the test procedures without justification. Additionally, these jacket loss factors are only one portion of the total jacket loss, which is the jacket loss factor multiplied by the jacket loss measured during steady-state operation. Assuming these factors, DOE has made a determination that the jacket loss is equal to 1.0%, which is the default jacket loss used if this value is not measured by test. The 1.0% value is a conservative estimate, and DOE should evaluate the total jacket losses with a more representative jacket loss value; a value closer to 0.5% would be more appropriate.

The proposed maximum standby and off mode electrical power consumption standards were determined on a component analysis methodology which did not include any analysis of the standby and off mode energy consumptions of current boiler models. Information from our members indicates that some boiler models have standby and off mode energy consumptions significantly above the baseline values used in the analysis. It should be noted that depending on how they are counted, accessories can influence the final standby power consumption, which might impact the decisions about which accessories are provided with the boiler. For example, outdoor temperature reset controls, which are used by many equipment manufacturers to comply with DOE design requirements, were not included in the baseline model analysis. We recommend that DOE recalibrate this analysis with a higher baseline reflective of current models.

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

Respectfully Submitted,



Frank A. Stanonik
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