



October 14, 2015

Ms. Brenda Edwards  
U.S. Department of Energy  
Building Technologies Office  
Mailstop EE-5B  
Energy Conservation Standards for Residential Furnaces  
EERE-2014-BT-STD-0031  
1000 Independence Avenue SW  
Washington, DC 20585-0121

Re: Notice of Data Availability for Energy Conservation Standards for Residential Furnaces, Docket # EERE-2014-BT-STD-0031

Dear Ms. Edwards,

The Edison Electric Institute (EEI) appreciates the opportunity to submit comments on the Notice of Data Availability (NODA) that was released after the publication of the proposed rule for energy conservation standards for residential furnaces. *See Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces*, 80 *Fed. Reg.* 55,038 (Sept. 14, 2015).

EEI is the association that represents all U.S. investor-owned electric companies. Our members provide electricity for 220 million Americans, operate in all 50 states and the District of Columbia, and directly employ more than 500,000 workers. With more than \$106 billion in annual capital expenditures, the electric power industry is responsible for millions of additional jobs. Reliable, affordable, and sustainable electricity powers the economy and enhances the lives of all Americans. Many of our members are combination gas and electric companies, and provide services for both energy types.

EEI strongly supports the Department's energy conservation standards program for consumer products and certain commercial and industrial equipment. We believe that the program has been one of the most successful energy efficiency efforts ever created because of its focus on setting standards that are technically feasible and economically justified for a majority of consumers. The program's success can be largely attributed to its historical reliance on setting standard levels that ensure that customers who purchase the product save money.

On March 10, 2015, DOE published a Notice of Proposed Rulemaking (NPR) to amend energy conservation standards for residential non-weatherized gas furnaces and mobile home gas furnaces. 80 *Fed. Reg.* 13,119. After receipt and review of comments

from a number of interested stakeholders, DOE issued the above-referenced NODA to further examine the effect of alternative size thresholds for small furnaces. Consistent with our July 24, 2015, Comments (July 24 Comments) in this docket, EEI remains concerned that DOE's revised analysis in the NODA is still not likely to result in fuel and market neutral standards for new furnaces. In particular, DOE continues to overestimate the potential air pollutant and greenhouse gas (GHG) emissions related to increased use of electric home heating products. These comments focus primarily on the revised impact analysis shown in Tables III.1 and III.11, as well as DOE's continued use of the flawed Technical Support Document (TSD) from the original NOPR.

**A. DOE Must Incorporate Up-to-Date Information Regarding the Changing Generation Fleet When Conducting Long-term Assessments of Electricity Usage and Upstream Emissions.**

DOE must use updated information when analyzing national, utility, and emissions impacts for purposes of the residential furnace standard. Failure to use updated data continues to undermine the validity of DOE's analysis as it overestimates the reductions associated with electricity generation. As noted in our July 24 Comments, DOE's general approach to long-term assessments of the impacts of energy conservation standards on electricity usage and the related emissions from the power sector is fundamentally flawed. These flaws stem from a continued refusal to recognize and address significant and expected changes in the power sector that will alter demand for electricity and the composition of the electric generating fleet through the 30-year lifecycle of a new residential furnace. DOE's analysis ignores any assessment of the expected, and often already occurring, changes in electricity demand and generation, many of which are the result of new regulatory requirements.

As evidenced by the National Impact Analysis spreadsheet, DOE appears willing to make changes to the original data set updating the housing forecast, energy price, and energy use trends for example. While these updates are certainly appropriate and show a clear indication of DOE's willingness to utilize updated data in other areas of its analysis, DOE has not addressed the data issues raised in our July 24 Comments. For instance, DOE is still using the Energy Information Agency's (EIA) Annual Energy Outlook (AEO) 2014 information for modeling associated with electric generation. By definition, AEOs only address final environmental standards and do not include expected, but not yet final, new or amended environmental standards.<sup>1</sup> As a result, AEO 2014 does not account for the impact of the Environmental Protection Agency's (EPA) EPA Clean Power Plan (CPP), which will have a significant impact on the estimated upstream energy impact analysis and on the emissions analysis. This program, by EPA's own estimates, will reduce power sector GHG emissions by 32 percent below 2005

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<sup>1</sup> See EIA, *AEO 2014, Legislation and Regulations: Recent Environmental Regulations in the Electric Power Sector* (Apr. 30, 2014).

levels by 2030.<sup>2</sup> The final CPP also includes incentives for early—2016-2021—deployment of renewables and certain end-use efficiency programs. As EIA noted in its analysis of the proposed CPP, which was projected to achieve lesser reductions, “the Clean Power Plan has a significant effect on projected retirements and additions of electric generating capacity. Projected coal plant retirements over the 2014-40 period, which are 40 GW in the AEO2015 Reference case (most before 2017), increase to 90 GW (nearly all by 2020)... [and] the Clean Power Plan increases projected renewable capacity additions in all cases.”<sup>3</sup> By ignoring the impact that the CPP will have on future electric production, DOE is vastly overstating the impacts of fuel switching from gas furnaces to electric heating products.

Recognizing that the AEO 2015, having been published on April 14, 2015, would also fail to reflect the full impacts of the CPP (which was not finalized until August 3, 2015), EEI respectfully requests that DOE consider information found in a recent EPRI/NRDC report on the benefits of electric transportation that provides important data regarding the recent and future trends in US grid emissions.<sup>4</sup> This three volume report provides important updated modeling information reflecting the current and future electric grid, which appropriately incorporates the rapid changes occurring as a result of various federal and state policies.<sup>5</sup> According to EPRI/NRDC, “electricity-grid emissions have recently been changing at an unprecedented rate” resulting in the “emissions intensity of grid electricity decreasing for CO<sub>2</sub>, and [it is] decreasing rapidly for SO<sub>2</sub> and NO<sub>x</sub>.”<sup>6</sup> It is only reasonable for DOE to use the most updated information possible when analyzing national, utility, and emissions impacts for setting appliance standards.

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<sup>2</sup> See EPA, *Clean Power Plan Fact Sheet* (Aug. 3, 2015), <http://www2.epa.gov/sites/production/files/2014-05/documents/20140602fs-overview.pdf>.

<sup>3</sup> EIA, *Analysis of the Impacts of the Clean Power Plan* (May 2015).

<sup>4</sup> See EPRI/NRDC, *Environmental Assessment of a Full Electric Transportation Portfolio, Volume 1: Background, Methodology, and Best Practices* (Sept. 17, 2015) (EPRI/NRDC Vol. 1), <http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?productId=000000003002006875>; see also, EPRI/NRDC, *Environmental Assessment of a Full Electric Transportation Portfolio, Volume 2: Greenhouse Gas Emissions* (Sept. 17, 2015) (EPRI/NRDC Vol. 2), <http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?productId=000000003002006876>; see also, EPRI/NRDC, *Environmental Assessment of a Full Electric Transportation Portfolio, Volume 3: Air Quality Impacts* (Sept. 17, 2015) (EPRI/NRDC Vol. 3), <http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?productId=000000003002006880>.

<sup>5</sup> EPRI/NRDC Vol. 1, Section 6: Modeling Methodology Best Practices for Large-scale Incremental Load Changes at 6-1 – 6-7.

<sup>6</sup> EPRI/NRDC Vol. 1 at 2-1.

**B. DOE's Process For Setting New Energy Conservation Standards Should Remain Consistent Across All Rulemakings.**

As discussed in EEI's July 24 Comments, DOE has not historically engaged in a fuel switching analysis for purposes of standards setting. Past rulemakings have focused on product switching within a class of products that use the same fuel, but not across fuel sources as presented in the TSD utilized for this NODA. The continued reliance on a TSD that includes a fuel switching analysis represents a change in the way that the Department analyzes the energy and emissions impacts of proposed standards. To ensure that DOE's process for setting new energy conservation standards is fair and is not arbitrary, similar fuel switching analysis should be included in future rulemakings that address electric products, to assess the extent to which increased standards will drive switching to alternative, competing gas (and/or other fuel) products. In the alternative, DOE could determine that it is not appropriate to conduct a fuel switching analysis for assessing any proposed or revised appliance conservation standard.

**C. DOE Should Not Continue to Utilize the Flawed TSD and Accompanying Analysis From the Original NOPR.**

As noted in the July 24 Comments, DOE's TSD, to the extent that it addresses fuel switching is flawed, which results in an overestimation of the amount of fuel switching to electric heating and the emissions impacts of increased use of electricity for home heating. DOE has not addressed the analytical flaws in the TSD and accompanying fuel switching analysis from the NOPR. DOE should revise the TSD and issue a new NOPR appropriately reflecting the information provided below.

**1) DOE's Analysis Ignores the Fuel Switching Impacts of Already Enacted Electric Heat Pump Efficiency Standards.**

The NODA ignores the documented impacts of the increases in heat pump efficiency standards in 2006 and 2015, which resulted in significant fuel switching from high efficiency and zero site emission heat pumps to lower efficiency and high emission fossil fuel heating systems. According to the U.S. Census Bureau, installations of heat pumps (air source and geothermal) in completed single family homes peaked in 2006 (when new efficiency standards took effect), and declined precipitously from 546,000 heat pumps in 2006 to 171,000 in 2011.<sup>7</sup> At the same time, conversions from non-gas heating systems to gas heated homes have increased significantly since 2006, according to a September 2015 American Gas Association (AGA) report.<sup>8</sup>

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<sup>7</sup> United States Census Bureau, *Type of Heating System Used in New Single-Family Houses Completed*, <https://www.census.gov/construction/chars/pdf/heatsystem.pdf>.

<sup>8</sup> See, American Gas Association, *Got Growth? Defining US Gas Utility Growth in an Era of Efficiency and Natural Gas Resource Abundance* (EA 2015-04).

Conversions of Existing Homes to Natural Gas Heat										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Actual Survey Sample of Conversions to Natural Gas 1/	49,704	48,166	29,905	34,475	47,728	47,843	39,562	35,245	42,535	68,135
As of % of New Customers 2/	17%	12%	41%	18%	14%	35%	40%	40%	43%	55%
1/ AGA Residential Natural Gas Market Survey, various years.										
2/ Reported conversions from AGA survey as a percent of total new customers.										

DOE cannot simply ignore, as it has done during the electric heat pump rulemaking, the market shift from electric heat pumps to gas furnaces that appears to have a direct correlation to the implementation of the more rigorous standards for electric heat pumps. DOE's failure to adequately consider the impact of the stringent electric heat pump standards seems even more egregious given the unsubstantiated reliance on fuel switching concerns to justify a lower standard for gas furnaces when, in fact, there has been no data presented to indicate that such switching would take place.

**2) DOE Fails to Consider the Future Impacts of Non-fuel Neutral Efficiency Standards Such as The Electric Heat Pump Efficiency Standards.**

In the Spring 2015 Unified Regulatory Agenda, DOE proposed that a final action (final rule) would be completed for residential central air conditioners and heat pumps by May, 2016.<sup>9</sup> The Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) working group for the negotiated rulemaking for residential central air conditioners and heat pumps has a current deadline of December 2015. As a result, it is very likely that new and increased energy efficiency standards for residential heat pumps will be effective in May 2021 (at the latest). Therefore, if DOE is going to engage in a fuel switching analysis, it would be unreasonable for DOE not to look at future impacts of further increases in the stringency of standards for central air conditioners and heat pumps when performing its fuel switching analysis for gas furnaces. Any analysis reasonably must include the impact of the past efficiency increases for heat pumps (and other competitive heating products as argued above) and the increase in heat pump efficiency standards that are likely to take place by 2021, if not sooner.

If DOE is looking for data points regarding the potential future impacts of their standards, the National Association of Home Builders (NAHB) Home Innovation Research Lab conducts a builder/remodeler omnibus survey once every month or every couple of months.<sup>10</sup> The August 2015 survey results highlight the impacts of non-fuel neutral efficiency standards on future decision making. For example, the NAHB survey

<sup>9</sup> See, The Regulatory Information Service Center, *Spring 2015 Unified Regulatory Agenda*, <http://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201504&RIN=1904-AD37>.

<sup>10</sup> Along with other interested stakeholders, EEI helps to fund these reports.

shows the impact of increasing the efficiency standards, and thus increasing the price, of air source heat pumps:

*IF YOU WERE PLANNING TO INSTALL A HEAT PUMP IN A NEW HOME AND THE PRICE OF A HEAT PUMP INCREASED BY \$XXX, BUT INSTALLATION COSTS REMAINED STEADY, HOW LIKELY WOULD YOU BE TO SWITCH TO SOME OTHER TYPE OF HEATING SYSTEM RATHER THAN PAY THE \$XXX PRICE INCREASE FOR THE HEAT PUMP?*

Top 2 Boxes (Definitely, Probably)

Total U.S.

\$250	8.3%
\$500	24.1%
\$1,000	43.5%

The survey also asked builders/remodelers to identify what type of heating system they would be most likely to install instead of an electric heat pump. Of all of the options offered (including “other”), the most common answer was a gas furnace. Nationally, 75.5% of the builders surveyed said that they would install a gas furnace instead of a heat pump. On a regional basis, the percentages varied from 68.8% in the South to 100.0% in the West.

Based on this information, the potential switching rates from heat pumps to gas furnaces for new homes could be estimated at follows:

Table 1 - Total U.S. Results

Estimated Price Increase (\$)	Builders that would Switch (%)	Switching Builders Choosing a Gas Furnace (%)	Estimated Heat Pump to Gas Furnace Switching Rate for New Homes (%)
\$250	8.3%	75.5%	6.27%
\$500	24.1%	75.5%	18.20%
\$1,000	43.5%	75.5%	32.84%

Table 2 – Northeast Census Region Results<sup>11</sup>

Estimated Price Increase (\$)	Builders that would Switch (%)	Switching Builders Choosing a Gas Furnace (%)	Estimated Heat Pump to Gas Furnace Switching Rate for New Homes (%)
\$250	10.0%	83.3%	8.33%
\$500	20.0%	83.3%	16.66%
\$1,000	60.0%	83.3%	49.98%

Table 3 – Midwest Census Region Results

Estimated Price Increase (\$)	Builders that would Switch (%)	Switching Builders Choosing a Gas Furnace (%)	Estimated Heat Pump to Gas Furnace Switching Rate for New Homes (%)
\$250	10.5%	85.7%	9.00%
\$500	26.3%	85.7%	22.54%
\$1,000	36.8%	85.7%	31.54%

Table 4 – South Census Region Results

Estimated Price Increase (\$)	Builders that would Switch (%)	Switching Builders Choosing a Gas Furnace (%)	Estimated Heat Pump to Gas Furnace Switching Rate for New Homes (%)
\$250	9.0%	68.8%	6.19%
\$500	25.4%	68.8%	17.48%
\$1,000	44.8%	68.8%	30.82%

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<sup>11</sup> EEI has provided both the national and regional results due to DOE’s consideration of regional variations in the ongoing heat pump efficiency standard rulemaking process.

Table 5 – West Census Region Results

Estimated Price Increase (\$)	Builders that would Switch (%)	Switching Builders Choosing a Gas Furnace (%)	Estimated Heat Pump to Gas Furnace Switching Rate for New Homes (%)
\$250	0.0%	100.0%	0.00%
\$500	16.7%	100.0%	16.70%
\$1,000	33.3%	100.0%	33.30%

If the proposed rule for heat pumps results in an estimated cost increase that is different from the values shown, the Department can use linear or “best curve fit” interpolation to appropriately estimate the switching rates. For additional information, DOE could also consider the cost information in the TSD being utilized in that negotiated rulemaking for residential central air conditioners and heat pumps. In particular, Chapter 8 shows estimated consumer price increases of \$68 to \$1,577 for split system electric heat pumps (Table 8.2.28).

Absent any explanation or justification, DOE has elected to analyze fuel switching as a one-way street, gas to electric. In order to provide a comprehensive analysis, DOE should incorporate the impacts of current and future efficiency standards on both sides of the equation that are likely to be in place by 2021.

**3) Any Thorough Review of Fuel Switching Should Include An Analysis of “Spillover Effects” With Other End-use Appliances**

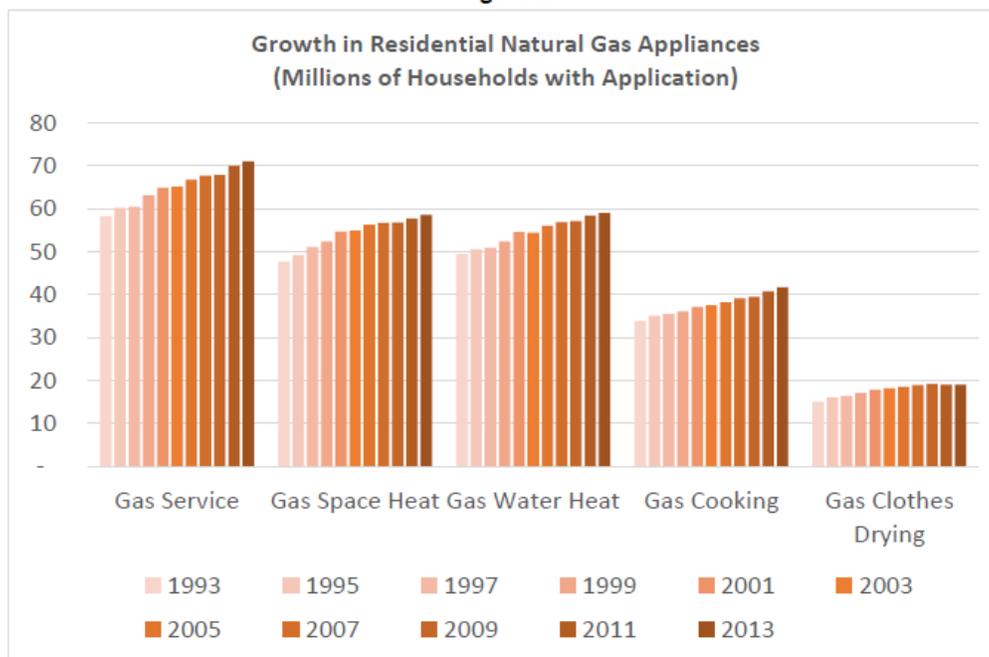
DOE should consider the possibility that switching from high-efficiency heat pumps to lower efficiency gas furnaces may also lead builders to switch from high-efficiency and zero-emission electric water heaters, electric cooking equipment, and electric dryers to lower efficiency and higher emitting gas appliances.

According to the September 2015 AGA report, there may be a strong correlation between gas furnace installations and installations of other gas appliances (especially water heaters and cooking equipment): “In many cases, the past two decades of growth (Figure 2) have featured additional natural gas space heating with an additional 10.9 million homes reporting natural gas space heating applications and 9.6 million more homes with water heaters. One third of new additions were for cooking and clothes drying given 7.86 million homes with natural gas cooking were added and nearly 4 million homes adding natural gas clothes dryers.”<sup>12</sup>

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<sup>12</sup> American Gas Association, *Got Growth? Defining US Gas Utility Growth in an Era of Efficiency and Natural Gas Resource Abundance* (EA 2015-04), p. 4.

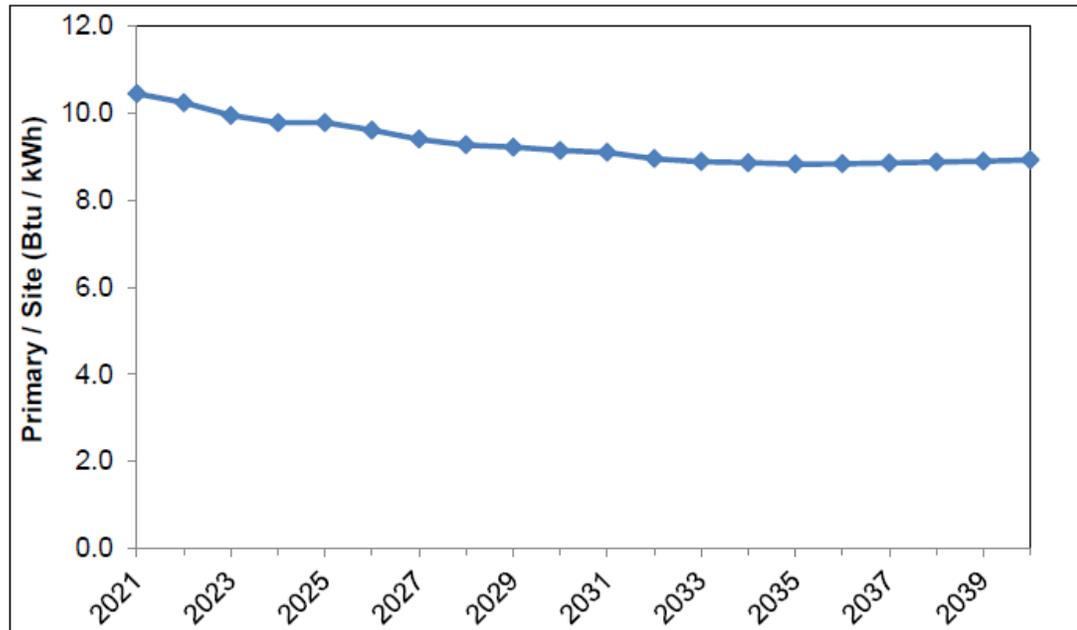
Figure 2



Because DOE has elected to assess the impact of switching from gas furnaces to electric heating systems on other end-use appliances (primarily water heaters), they should be thorough and extend that analysis to include the impacts of switching from heat pumps to gas furnaces on the use of other end-use appliances as well. If DOE is going to assess fuel switching as part of the analysis in support of revised furnace standards, it is unreasonable to conduct what is really only half of the necessary review.

**D. The “Site to Source” values shown in the TSD and Spreadsheet Are Overstated and Have Not Been Appropriately Updated.**

As part of the fuel switching analysis, DOE used a “site to source” use factor that is flawed. As part of the TSD, DOE published the following graph, depicting the “site to source” conversion factor that was used, which is based on the National Energy Modeling System’s (NEMS) model and used AEO 2014 inputs:



**Figure 10.5.1 Primary to Site Energy Use Factor for Non-Weatherized Gas Furnace and Mobile Home Gas Furnace Electricity Use, 2021-2040**

As discussed in our July 24 Comments, the conversion factor estimates depicted in Figure 10.5.1 are overstated for the following reasons: 1) they do not account for the changes that are occurring now and in the future due to the CPP; 2) they reflect a national number, which ignores the significant variation in electric generation by power pool region; and 3) they incorrectly “assign” of a fossil fuel heat rate to renewable electric generation. Further, inexplicably, the accompanying spreadsheet shows the conversions factor actually increasing slightly from 2035 to 2040 (from 8.971 to 9.059), without explanation and shows no improvement from 2040 on. This post 2035 increase does not comport with the expected fuel mix that will be generating electricity post-2030.

In addition, DOE continues to use an annualized number for an appliance that only operates primarily during the winter season. In terms of seasonality, this is especially important when considering the amount of wind electricity being generated now and in the future. According to EIA data, capacity factors and electricity output are higher in the winter months than in the summer months.<sup>13</sup> In northern states, the differences between winter and summer production are quite significant. Assuming that these seasonal appliances run year round overstates their energy use. Further, if DOE is going to use annualized data, it should recognize that winter usage often corresponds with the use of more renewables.

<sup>13</sup> EIA, *Electric Power Monthly* (Sept. 24, 2015)

[http://www.eia.gov/electricity/monthly/epm\\_table\\_grapher.cfm?t=epmt\\_6\\_07\\_b](http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_6_07_b)

Finally, any estimated upstream “losses” analysis regarding the production of electricity should properly account for new Federal regulations and increases in the use of renewable electric generation.

**E. DOE Cannot Reasonably Justify a Separate Standard for Small and Large Furnaces With Only the Baseless and Unsubstantiated Claim that the Small Furnace Standard Produces Greater Savings Due to Less Fuel Switching.**

Table III.11 in the NODA compares the national energy savings of a single standard for all furnaces versus a separate standard for large and small furnaces. While EEI has no issue with the Department’s proposal to enact separate standards for large versus small furnaces, the only support for such a proposals appears to be an overly broad and unsupported conclusion regarding the efficiency of electric heating units. DOE states that “the national energy savings are higher in the case of a separate standard for large and small furnaces *mainly* because there is less switching from gas to electric heating.” 80 *Fed. Reg.* at 55,044 (emphasis added). In addition, footnote 17 incorrectly states “[i]n terms of FFC energy, switching from gas to electricity increases energy use considerably because of the losses in thermal electricity generation.” *Id.* As discussed in detail below, both of these statements lack any type of statistical or analytical foundation in the NODA and, furthermore, are incorrect.

In reality, there is significant evidence demonstrating that electric heating is in fact more efficient than gas heating. Currently, the minimum gas furnace has an efficiency of 78 Annual Fuel Utilization Efficiencies (AFUE).<sup>14</sup> Whole house electric furnaces have an efficiency of between 95 and 100 AFUE, which represents an efficiency increase between 21% and 28%.<sup>15</sup> Broadening this divide is that fact that with an electric furnace there is no need for a chimney or flue, which reduces the amount of heat loss considerably, and further lowers the annual energy used to heat the dwelling unit.

Another significant energy conservation benefit of electric heating is that consumers can use zoned electric heating systems, which save even more energy (as much as 20-25%), due to increased thermostatic controls of separate areas. As noted on DOE’s own web site: “Mini splits have no ducts, so they avoid the energy losses associated with the ductwork of central forced air systems. Duct losses can account for more than **30%** of energy consumption for space conditioning, especially if the ducts are in an unconditioned space such as an attic.”<sup>16</sup>

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<sup>14</sup> 10 CFR § 430.32(e)(1)(i).

<sup>15</sup> DOE, Furnaces and Boilers, <http://energy.gov/energysaver/furnaces-and-boilers>.

<sup>16</sup> DOE, Ductless, Mini-Split Heat Pumps, <http://energy.gov/energysaver/articles/ductless-mini-split-heat-pumps> (*emphasis added*).

In fact, even consumers that switch to air source heat pumps would save more energy. The current minimum efficiency of an air source heat pump is 8.2 HSPF, which correlates to a COP of 2.4—which is 3.08 times more efficient than a gas furnace.<sup>17</sup> There are even some air source heat pumps with heating efficiency as high as 13.0 HSPF, or 4.88 times more energy efficient than a gas furnace.<sup>18</sup> Consumers that switch to geothermal heat pump systems have even more energy savings. Many geothermal heat pump systems have COP values that are above 4.0 or 5.0 or 6.0, making these systems at least 5.12 to 6.4 to 7.7 times more energy efficient than gas furnaces.<sup>19</sup>

As a result, in a majority of cases, the significant increase in end-use heating efficiency will more than compensate for any upstream electric production losses; even in cases such as this one where DOE has significantly overstated those losses. In the absence of any supporting evidence, DOE cannot reasonably rely on an unsubstantiated concern about the possible impacts of fuel switching to support the small furnace standard without providing stakeholders with a chance to review the supporting analysis. Further, DOE should correct its analysis accordingly to appropriately reflect the energy efficiency of electric heating units.

Thank you for your review and consideration of our comments. Please contact Steve Rosenstock (202-508-5465, [srosenstock@eei.org](mailto:srosenstock@eei.org)) if you have any questions about EEI's comments.

Respectfully submitted,



Steve Rosenstock, P.E.  
Senior Manager, Energy Solutions

cc: Rick Tempchin, EEI  
Emily Fisher, Esq., EEI  
Adam L. Benshoff, Esq., EEI

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<sup>17</sup> 10 CFR § 430.32(c)(3).

<sup>18</sup> Air-Conditioning, Heating, and Refrigeration Institute, *Directory*, <https://www.ahridirectory.org/ahridirectory/pages/dgx/defaultSearch.aspx>.

<sup>19</sup> *Id.*