UNITED STATES OF AMERICA
BEFORE THE
DEPARTMENT OF ENERGY

Energy Conservation Program: Energy Conservation Standards for Consumer Furnaces	**)** **)** **)**	**EERE-2014-BT-STD-0031** **RIN 1904-AD20** **87 Fed. Reg. 40590**

COMMENTS OF THE AMERICAN GAS ASSOCIATION

Dated: October 6, 2022

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ATTACHMENTS

I. EXECUTIVE SUMMARY

The American Gas Association ("AGA") submits these comments on the U.S. Department of Energy's ("DOE" or "Department") notice of proposed rulemaking, which proposes to amend the energy conservation standards for non-weatherized gas furnaces and mobile home gas furnaces (the "NOPR" or "Proposed Rule").[1] These comments address a series of important issues, summarized as follows:

1. Energy efficiency is critical to any successful emissions reduction plan and consumer energy affordability, which is why AGA has long supported improved building and appliance energy codes and standards that are technologically feasible, economically justified, and follow statutory requirements. AGA and its members complement those codes and standards by pursuing a customer-centered approach to energy efficiency improvements, focusing on those most vulnerable to energy costs. Indeed, AGA and its members have been at the forefront of efficiency gains, from the delivery of natural gas to its end use, achieving significant benefits for consumers, environmental improvements, and economic contributions. AGA believes that federal policy should recognize that improving energy efficiency in residential, commercial, industrial, transportation, and other natural gas applications is a cornerstone strategy for reducing greenhouse gas emissions.

2. Unfortunately, however, the Proposed Rule suffers from an array of economic, technical, and procedural flaws that will render it harmful to consumers, counterproductive to energy efficiency goals, and unlawful. As detailed in these comments:

    a. **The Proposed Rule is procedurally flawed.** DOE has not followed its own "Process Rule" that governs the rulemaking process by, among other things, failing to provide stakeholders sufficient time to evaluate and comment on the rule and its underlying technical analyses. Furthermore, DOE has been unresponsive to repeated attempts by AGA to address critical flaws in DOE's analysis. DOE has similarly failed to follow recommendations from the National Academies of Sciences, Engineering, and Medicine designed to improve the integrity of DOE rules. The Proposed Rule relies on flawed assumptions and technical and factual errors. Many of those defects, failings, and mistakes have been carried over from earlier proposals that have been the focus of significant prior comments that DOE has not meaningfully addressed. This flawed process is especially problematic and even more inexplicable given the far-reaching scope of this proposed rulemaking

[1] *Energy Conservation Program: Energy Conservation Standards for Consumer Furnaces*, EERE–2014–BT–STD–0031, RIN 1904–AD20, 87 Fed. Reg. 40590 (July 7, 2022). DOE extended the comment period for the NOPR to until October 6, 2022. *See Energy Conservation Program: Energy Conservation Standards for Consumer Furnaces*, 87 Fed. Reg. 52861 (August 30, 2022).

and the impacts that would be imposed on millions of households' energy service choices and costs.

b. **The Proposed Rule cannot be economically justified using the analytical methods employed in this rulemaking.**

i. AGA has identified material errors in the data and assumptions (or "inputs") in the life cycle cost spreadsheet that DOE has used to analyze the costs and savings. Furthermore, there are critical methodological defects at the core of DOE's model simulation used to evaluate the economic impacts of its proposed standard. Among the critical and consequential flaws is that DOE's analysis assumes consumers act with no economic self-interest when selecting a consumer gas furnace. This unsupported material assumption affects the assignment of furnace efficiencies to DOE's non-standards case from which DOE's analysis of any trial standard levels are evaluated. However, it's evident that consumers act with economic self-interest when selecting consumer furnace equipment, as the market shows increasing shares of condensing-only gas furnaces in areas of the country where condensing furnace equipment is economical.

ii. Moreover, AGA has conducted an analysis using DOE's life cycle cost model that shows an undeniably strong relationship between life cycle cost savings and the market share of condensing furnace equipment. In other words, consumers do act with rational self-interest when selecting furnace equipment. As a result of this critical modeling flaw, the NOPR significantly underestimates the costs and overstates the benefits of the proposed standards. These material errors and defects mean DOE's economic analysis is unsupportable when used to justify the proposed standards or as the basis to analyze other trial standard levels, void any purported savings of the proposed standards, and render the NOPR's assumptions and conclusions unreasonable, unsupported by substantial evidence, arbitrary, capricious, and contrary to law.

iii. The NOPR's economic analysis unlawfully claims that purported savings from pushing consumers to switch from natural gas to electric appliances are among its benefits. Indeed, the claimed savings from switching from natural gas to electricity accounts for more than half of the total life cycle cost savings that DOE estimates for non-weatherized gas furnaces. Meanwhile, Congress specified that the energy conservation standards would be fuel neutral and focus on maximizing the energy efficiency of certain products, not favoring one fuel source over another. DOE's own analysis shows that consumers switching to electricity will *increase* energy use overall.

iv. Even if DOE's economic analysis were not deeply flawed, DOE itself shows that its proposed standards place a profound and unacceptable burden

on millions of consumers, including low-income households, senior households, and small businesses.

1. Before accounting for the errors and flaws previously mentioned, DOE's reports that 17% of consumers with a non-weatherized gas furnace will experience *higher* costs due to the proposed standards, including 15% of senior-only households, 14% of low-income households, and 20% of small-business consumers. For households with mobile home gas furnaces, 22% of consumers would be negatively affected by the proposed standard, including 15% of senior-only households and 13% of low-income households. These percentages reflect the impact on all natural gas consumers, not simply those that DOE considers to be affected by the Proposed Rule. Furthermore, the impacts on low-income consumers ignores owner-occupied units, and therefore significantly underrepresents the true impacts of the propose standards on low-income households. Given such significant impacts on some of the most cost-sensitive and vulnerable Americans, DOE's proposed standards cannot be considered economically justified.

2. However, DOE's presentation of the impacts of its rulemaking mask more profound and wide-reaching effects. A careful examination of DOE's life cycle cost analysis reveals that 29% of households with non-weatherized gas furnaces that are specifically affected by this rule will face negative impacts as a result of this proposed rule; 34% of all households in the South with non-weatherized gas furnaces affected by this rule will face higher costs; and 40% of all rule-affected low-income consumers nationally with non-weatherized gas furnaces will have higher costs forced on them. There are similarly high impacts on mobile home consumer subgroups. These impacts are unacceptable.

c. **DOE must establish separate product classes for condensing and non-condensing furnaces.** The Energy Policy and Conservation Act ("EPCA")[2] protects consumer choice by ensuring energy conservation standards are not "likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics" currently available to consumers. The Proposed Rule, however, would do exactly that. It would make conventional, non-condensing furnaces unavailable to consumers. Meanwhile, millions of American homes were designed with "atmospheric venting systems" that include chimneys, vents, and utility closets that cannot accommodate condensing furnaces. If non-condensing furnaces are eliminated from the market and made unavailable, those consumers would need to either remodel their homes to accommodate condensing furnaces or switch to less efficient electric appliances. That is not tenable. To be

[2] 42 U.S.C § 6291, *et seq.*

consistent with EPCA, DOE's past practices, and consumers' best interests, DOE should develop separate standards for condensing and non-condensing furnaces.

d. **The Proposed Rule would decrease energy efficiency and increase energy consumption for many consumers.** As noted above, the Proposed Rule would force many consumers to replace their conventional natural gas furnaces with electric appliances to avoid the enormous cost of remodeling their homes and installing the ventilation and plumbing equipment required to accommodate condensing appliances. DOE's own flawed analysis shows that millions of consumers would be pushed toward electric appliances. A careful review of DOE's analysis reveals that, in aggregate, consumers who switch from a non-weatherized gas furnace to an electric appliance will use more energy overall due to the proposed rule. One in three consumers that switch to electric appliances will pay more to heat their homes and use more energy than if they were able to replace their conventional furnace with a new conventional furnace. This increase in overall energy use more than offsets any energy efficiency gains from other consumers switching to electricity. That is, DOE's analysis shows that this rule will lead to fuel switching to electricity, increasing overall energy use for many consumers.

e. The Department is unlawfully promoting fuel switching. Congress designed the energy conservation standards to be fuel neutral and not favor one energy source over another. By considering fuel switching a benefit in some contexts and ignoring it in others, the Department improperly favors a single energy source, contrary to its authority and against consumers' interests.

f. The Department has failed to consider the impact on natural gas utilities from the Proposed Rule. DOE is required to analyze the "marginal impacts on electric and gas utility costs and revenues." While the NOPR explores some of the impacts on electric utilities, it performs only a cursory analysis of the effects on natural gas utilities. As DOE acknowledges, the Proposed Rule will drive millions of consumers away from efficient gas furnaces. Therefore, the Department must evaluate whether the loss of gas consumers negatively impacts natural gas local distribution companies and results in higher rates for remaining consumers. DOE must evaluate the negative effects on natural gas utility energy efficiency programs, which benefit millions of consumers and already provide rebates for gas furnaces in many instances. The effectiveness of gas utility energy efficiency programs, such as the rebates offered or claimable savings opportunities available, may be reduced. DOE should also better analyze the consequences of adding to further electric demand, including the potential to increase, rather than decrease, average and peak energy consumption, and emissions.

In short, AGA cannot support the Proposed Rule due to its unacceptably profound impacts on consumers, its analytical and procedural defects, its elimination of consumer energy choices, and its increased energy use. The Proposed Rule is ill-conceived, unlawful, analytically

unsupportable, and anti-consumer. DOE should rescind the Proposed Rule, follow the proper procedures, incorporate recommendations from the National Academies of Science, Engineering, and Medicine, and address the critical defects in its economic analysis. Once DOE addresses the critical material errors and methodological defects in its economic analysis, AGA encourages DOE and stakeholders to develop a solutions-oriented approach to energy conservation that ensures any proposed consumer furnace efficiency standards reduce energy use, protect consumers, and preserve the specific features to ensure continued availability of natural gas furnaces that function in homes designed with atmospheric venting systems.

II. IDENTITY AND INTEREST

AGA, founded in 1918, represents more than 200 local energy companies that deliver clean natural gas throughout the United States. There are more than 77 million residential, commercial, and industrial natural gas consumers in the U.S., of which 95 percent — more than 73 million consumers — receive their gas from AGA members. AGA is an advocate for natural gas utility companies and their consumers and provides a broad range of programs and services for member natural gas pipelines, marketers, gatherers, international natural gas companies, and industry associates. Today, natural gas meets more than one-third of the United States' energy needs.[3] AGA's members serve residential and commercial consumers, the majority of which use natural gas furnaces and therefore have a direct and vital interest in both the minimum efficiency standards for these products and the procedures used by DOE to adopt these standards.

[3] For more information, please visit www.aga.org.

III. AGA SUPPORTS ENERGY EFFICIENCY & CONSERVATION EFFORTS

A. AGA and its Members Actively Invest in and Promote Energy Efficiency

AGA supports energy efficiency and conservation efforts, including the efficient use of natural gas in homes and businesses. AGA appreciates the opportunity to comment on the Department's Proposed Rule, which proposes to amend energy conservation standards for non-weatherized gas furnaces ("NWGF") and mobile home gas furnaces ("MHGF"). AGA supports energy efficiency and conservation efforts, which includes the efficient use of natural gas in homes and businesses.

Over the past two decades, millions of additional homes and businesses have connected to the U.S. natural gas delivery system. Even as the number of consumers has grown, natural gas use in the residential, commercial, and industrial natural gas sectors has been virtually unchanged, and on a per-customer basis, residential natural gas use has declined by more than 50% since 1970. This steady improvement in residential natural gas use per customer is a direct result of energy efficiency improvements, including tighter building envelopes, more efficient appliances and equipment, behavioral changes in energy consumption, and the effectiveness of natural gas utility efficiency programs. Furthermore, this continual improvement in energy efficiency has helped lead to a decline in overall carbon dioxide emissions as consumers use natural gas more efficiently and substitute away from more carbon-intensive energy sources.

AGA believes that federal policy should recognize that improving energy efficiency in residential, commercial, industrial, transportation, and other natural gas applications is a cornerstone strategy in reducing greenhouse gas emissions.[4] AGA and its members actively invest

[4] American Gas Association Climate Change Position Statement, available at https://www.aga.org/globalassets/aga_climate-change-document_final.pdf (last visited October 5, 2022).

in and promote energy efficiency. AGA has been at the forefront of energy efficiency efforts, and the record is clear. Natural gas utilities lead the way in supporting appliance efficiency standards.

Notably, AGA's and utilities' efficiency efforts predate the creation of the Department. For decades, AGA and the industry have played a positive and active role in supporting efficiency requirements for natural gas appliances. For example:

- Decades before the Department was formed and its predecessor, the Federal Energy Administration, came into being in the 1970s, AGA and its members supported and promoted minimum efficiency requirements for most natural gas appliances through voluntary standards developed through the consensus process accredited by the American National Standards Institute ("ANSI").

- The ANSI-accredited standards committees that developed and maintained the voluntary standards for gas appliances comprised a broad cross-section of representatives from various private and public identities, including consumers, manufacturers, utilities, installers, governmental, testing laboratories, *etc*. AGA was the Secretariat of the ANSI-accredited standards that oversaw the standards development process and complied with the stringent standards development procedures required by ANSI, including provisions that encouraged an open and transparent standards development process.

- Most ANSI-accredited safety and performance standards for natural gas appliances historically included a minimum efficiency requirement that the appliances had to meet to comply. For example, the minimum efficiency requirement for natural gas furnaces was a 75 percent thermal minimum efficiency-based level (referred to as a flue loss) based on an energy output over energy input measurement. In addition, there was a requirement for consumer furnaces, that heat loss transmitted from the unit's cabinet, referred to as a "jacket loss," not exceed 5 percent.

- Detailed test methods for measuring and confirming these efficiency requirements were included in the ANSI-accredited standards. In the case of natural gas furnaces, products could not be listed as being designed certified to meet these efficiency requirements until the furnaces were tested by an independent third-party testing agency verifying compliance by actual tests.

- Gas appliances that met the ANSI-accredited standards requirements were permitted to include a seal of design certification approval and a listing in the third-party certification testing laboratories directory identifying that the model has met the ANSI-accredited standards provisions. The third-party testing laboratories, including at that time the AGA Laboratory, included an annual follow-up testing program that randomly

tested models from manufacturers' inventories or in the market to verify compliance with the applicable ANSI standard.

- Many states, local jurisdictions, military specifications, *etc.*, required that gas appliances bought or installed be in compliance with the ANSI-accredited standards with verification by a label or listing from an independent third-party testing agency.

- With the passage of EPCA[5] at the federal level, the efficiency requirements in the ANSI-accredited standards for natural gas appliances were phased out of the ANSI-accredited standards for natural gas appliances because of the legislation. The federal regulations preempted the efficiency requirements in the ANSI-accredited standards. However, the support for energy efficiency by the natural gas industry did not end there. Efficiency test methods developed by the National Bureau of Standards ("NBS") now known as the National Institute of Standards and Technology ("NIST") took the test methods from the ANSI-accredited standards for natural gas appliances and incorporated and expanded the efficiency measurement to an annual efficiency measurement that is still incorporated in most DOE federal test methods in place today.

It is also important to note that the efficiency requirements and certification programs outlined above were all voluntary. The costs to conduct the programs were borne by the natural gas industry and absorbed by the industries involved. No federal funds were used in support of the programs. History demonstrates that AGA and the natural gas industry support appliance efficiency requirements.

B. Natural Gas Utilities Across the Country Have Energy Efficiency Programs

AGA member companies invested $1.6 billion to support energy efficiency programs in 2019 and budgeted $1.7 billion for 2020.[6] The pace of annual natural gas utility energy efficiency investments has increased consistently since AGA began tracking data in 2007. The acceleration of energy efficiency deployment in the residential, multi-family, commercial, and industrial sectors, and programs targeted at low-income consumers, reflects the commitment of the natural gas utility industry toward improvements in energy efficiency, consumer energy affordability,

[5] Energy Policy and Conservation Act, 94 P.L. 163, 89 Stat. 871 (December 22, 1975).
[6] *See* https://www.aga.org/research/reports/natural-gas-efficiency-programs/

access to reliable energy, and greenhouse gas emissions reductions. Natural gas savings in North America from these programs amounted to just about 500 million therms or 49.96 trillion Btu, the equivalence of 2.64 million metric tons of avoided CO2 emissions in 2019 alone.[7] These programs reach nearly 7 million residential consumers, more than 380,000 low-income consumers, nearly 140,000 multi-family consumers, more than 130,000 commercial consumers, and 41,000 separate industrial program consumers. The 120+ gas utility ratepayer-funded energy efficiency programs offered span every region in the U.S., providing guidance and funding around weatherization, technical assessments, training, and existing and new building programs for equipment replacement and upgrades, *e.g.*, appliances, doors, windows, and thermostats, building retrofits, commercial foodservice, process equipment, energy management systems, and custom process improvements.[8] The industry is educating and doing outreach as one of its most adopted programs across each sector. The industry will continue to leverage these established gas energy efficiency programs to accelerate its contribution to the economy-wide decarbonization efforts and goals.

Natural gas utilities across 40 states have a natural gas efficiency program.[9] Some programs are voluntary utility programs, and others are funded via the state regulatory process. Specifically, a 2019 survey shows that 69 natural gas utilities in 28 states have some form of regulatory funding for efficiency programs.[10] Such programs take many forms and could be part of a regulatory program, a legislative bill, or both.[11] While many natural gas efficiency programs have been in place for years, the breadth and depth of programs continue to grow. Various goals

[7] *See* https://www.aga.org/globalassets/eereport-part-2-final.pdf (last visited October 5, 2022).
[8] *See* https://www.aga.org/globalassets/energy-efficiency-report-partone.pdf (last visited October 5, 2022).
[9] Natural Gas Efficiency Programs Report Natural Gas Efficiency Program Characteristics 2019 Program Year, March 2022, available at https://www.aga.org/globalassets/energy-efficiency-report-partone.pdf (last visited October 5, 2022).
[10] Natural Gas Efficiency Regulatory Requirements and Cost Recovery Treatment, April 2022, available at https://www.aga.org/globalassets/eereport-part-3-final.pdf (last visited October 5, 2022).
[11] *Id*.

drive efficiency program funding requirements within the U.S., including promoting energy conservation, reducing customer bills, and reducing low-income consumers' cost burden.[12]

According to an AGA survey of utilities with efficiency programs, 88 percent have residential efficiency programs, 77 percent have commercial, 68 percent have low income, 25 percent have multi-family programs, and 9 percent have separate industrial programs.[13] As noted above, during 2019, enrollments in natural gas efficiency programs reached more than 6.6 million residential consumers, over 380,000 low-income consumers, about 137,000 multi-family consumers, over 130,000 commercial consumers, and 41,000 separate industrial program consumers.[14]

As part of the aforementioned efforts, many AGA member natural gas utilities provide rebates and incentive programs to consumers to promote installing high-efficiency natural gas furnaces. AGA's local natural gas utility ("LDC") members offer customer incentives for condensing furnaces, including incentives for furnaces at 95% Annual Fuel Utilization Efficiency ("AFUE") or above.[15] Therefore, the share of high-efficiency natural gas furnaces continues to climb due to many consumer-perceived economic advantages of high-efficiency furnaces.

C. LDCs Have a Proven Track Record of Reducing GHG Emissions

It is important to note that LDCs have a proven track record of reducing greenhouse gas ("GHG") emissions. AGA and its members are committed to reducing GHG emissions through smart innovation, new and modernized infrastructure and advanced technologies that maintain

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[12] *Id*.
[13] Natural Gas Efficiency Programs Report Natural Gas Efficiency Program Characteristics 2019 Program Year, March 2022, available at https://www.aga.org/globalassets/energy-efficiency-report-partone.pdf (last visited October 5, 2022).
[14] *Id*.
[15] *See* American Gas Association, Summary Report of AGA Membership Survey on Efficiency Levels of Residential Natural Gas Furnace Incentive Programs at 1 (June 2015), *available at* https://www.aga.org/sites/default/files/summary_report_of_aga_membership_survey_on_natural_gas_furnace_costs_and_installations.pdf (last visited October 5, 2022).

reliable, resilient, and cost-effective consumer energy service choices. With direction and guidance from policymakers and regulators, the natural gas utility industry continuously invests in modernizing the nation's natural gas delivery infrastructure to distribute safe, reliable, and cost-effective energy and improve customer efficiency.

Climate change is a defining challenge across the globe, and natural gas, natural gas utilities, and the delivery infrastructure are essential to meeting our nation's greenhouse gas emissions reduction goals. As companies continue to modernize natural gas infrastructure and connect homes and businesses to the system, new opportunities arise to achieve low-cost GHG emissions reductions by leveraging new and existing natural gas infrastructure, advanced technologies, and the nation's abundant natural gas resources.

In February 2022, AGA published a study titled "*Net-Zero Emissions Opportunities for Gas Utilities*"[16] to provide a comprehensive and rigorous analysis demonstrating the multiple pathways that exist to reach a net-zero future, and the role natural gas, gas utilities and delivery infrastructure will play in advancing decarbonization solutions. The study presents a national-level approach that leverages the unique advantages of gas technologies and distribution infrastructure and the foundational role of natural gas energy efficiency. The study underscores the range of scenarios and technology opportunities available as the nation, regions, states, and communities develop and implement ambitious emissions reduction plans. The key findings in the study include:

- Pathways that utilize natural gas and the vast utility delivery infrastructure offer opportunities to incorporate renewable and low-carbon gases, provide optionality for stakeholders, help minimize customer impacts, maintain high reliability, improve overall energy system resilience, and accelerate emissions reductions.

[16] "Net-Zero Emissions Opportunities for Gas Utilities," AGA, February 8, 2022, available at https://www.aga.org/research/reports/net-zero-emissions-opportunities-for-gas-utilities/ (last visited October 5, 2022). The study is appended at Attachment A.

- The ability of natural gas infrastructure to store and transport large amounts of energy to meet seasonal and peak day energy use represents an important and valuable resource that needs to be considered when building pathways to achieve net-zero GHG emissions goals.

- Continued utilization of natural gas and the vast utility delivery infrastructure can increase the likelihood of successfully reaching net-zero targets while minimizing customer impacts.

- The U.S. can achieve significant emissions reductions by accelerating the use of tools available today, including high-efficiency natural gas applications, renewable gases, methane reduction technologies, and enhanced energy efficiency initiatives.

- Large amounts of renewable and low-carbon electricity and gases, and negative emissions technologies, will be required to meet an economy-wide 2050 net-zero target.

- Supportive policies and regulatory approaches will be essential for natural gas utilities to achieve net-zero emissions.

Natural gas and its direct use in homes and businesses has been a cornerstone of America's energy economy for more than a century and will be needed in the future. Today, hundreds of millions of Americans rely on natural gas to heat their homes, power their businesses, and manufacture goods. An emphasis on climate change and reducing emissions has complemented the natural gas utility industry's focus on safety and reliability and enabled a steep decline in methane emissions. These commitments continue, and as our nation moves towards a lower-carbon economy and embraces new fuels and technologies, the natural gas utilities are ready to meet these changes and will remain foundational to the country's future.

All this is to say that the natural gas industry is ready, willing, and able to support cost-effective, consumer-friendly measures to increase efficiency standards. AGA and its members have no aversion to the energy conservation standards program or economically justified and technically feasible measures to improve appliance efficiency rates. Unfortunately, as described below, the Proposed Rule does not fit the bill. The numerous flaws, unsupported assumptions, inaccuracies, and technical errors that underpin the NOPR would render a final rule unlawful.

Furthermore, DOE's own analysis shows that its proposed rule will profoundly and negatively affect millions of Americans, particularly low-income, senior-only households, and small businesses. AGA urges the Department to address the issues discussed herein and work with stakeholders to propose revised standards that comply with the Department's legal, procedural, and technical obligations.

IV. BACKGROUND

In 2007, DOE issued a final rule that amended the energy conservation standards for residential furnaces to a minimum level of 80% AFUE.[17] Before the rule could be implemented, a group of states and efficiency advocates challenged the rule in court. In 2009, the U.S. Court of Appeals for the Second Circuit granted a motion filed by DOE to voluntarily remand the matter to the agency. The remand did not vacate the energy conservation standards set forth in the 2007 final rule, and during the remand, the standards went into effect as originally scheduled.

In 2011, DOE simultaneously issued a direct final rule ("DFR")[18] and a notice of proposed rulemaking to amend the energy conservation standards for residential central air conditioners and consumer furnaces. The DFR would have established a 90% AFUE minimum standard for furnaces in states with more than 5,000 annual heating degree days and an 80% AFUE minimum standard for states with less than 5,000 annual heating degree days. The DFR was consistent with a "Consensus Agreement" that DOE entered into with certain stakeholders. Stakeholders not included in the "Consensus Agreement" opposed the proposal on procedural and technical

[17] *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces and Boilers*, 72 Fed. Reg. 65136 (Nov. 19, 2007).
[18] *See Energy Conservation Program: Energy Conservation Standards for Residential Furnaces and Residential Central Air Conditioners and Heat Pumps*, 76 Fed. Reg. 37408 (June 27, 2011).

grounds. The matter ultimately went to the U.S. Court of Appeals for the District of Columbia Circuit, which invalidated the rule as it pertained to non-weatherized gas furnaces in 2014.[19]

In March 2015, DOE issued a notice of proposed rulemaking proposing a national minimum efficiency standard of 92% AFUE.[20] In 2016, DOE published a supplemental notice of proposed rulemaking that proposed separate standards for small and large non-weatherized gas furnaces.[21]

In 2019, the American Public Gas Association ("APGA"), Spire, Inc., the Natural Gas Supply Association ("NGSA"), AGA, and the National Propane Gas Association ("NPGA") submitted a Petition for Rulemaking to DOE. The petition asked DOE to issue an interpretive rule confirming that energy conservation standards that would effectively limit the market for natural gas or propane furnaces or water heaters to products using condensing technology would, contrary to EPCA's requirements, result in the "unavailability of in the United States in any covered product type (or class) of performance characteristics . . . that are substantially the same as those generally available in the United States at the time of the finding".[22] In response to the petition, DOE published a final interpretive rule, in January 2021, determining that, in the context of residential furnaces, commercial water heaters, and similarly-situated products/equipment, the use of non-condensing technology and associated venting constitute a performance-related "feature" under EPCA that cannot be eliminated through adoption of an energy conservation standards and required the establishment of separate product classes for condensing and non-condensing natural gas appliances.[23] DOE, therefore, withdrew the March 2015 proposed rulemaking and September

[19] *See American Public Gas Association v. DOE*, 2014 U.S. App. LEXIS 7733 (April 24, 2014).
[20] *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces*, 80 Fed. Reg. 13120 (March 12, 2015).
[21] *Energy Conservation Program: Energy Conservation Standards for Residential Furnaces*, 81 Fed. Reg. 65719 (Sept. 23, 2016).
[22] 42 U.S.C. § 6313(a)(6)(B)(iii)(II).
[23] *Energy Conservation Program for Appliance Standards: Energy Conservation Standards for Residential Furnaces and Commercial Water Heaters*, 86 Fed. Reg. 4776 (Jan. 15, 2021) ("January 15, 2021 Interpretive Rule").

2016 supplemental notice of proposed rulemaking because their focus on efficiency levels only achievable by condensing natural gas appliances would have made those performance-related features unavailable.[24]

In December 2021, DOE published a final interpretive rule that reversed the January 2021 interpretive rule.[25] The December 2021 DOE reversal wrongly asserted that "non-condensing technology (and the associated venting) does not provide unique utility to consumers separate from an appliance's function of providing heated air or water, as applicable."[26] In 2022, AGA, along with APGA, Spire, Inc, and Thermo Products, filed a joint petition for review of the December 2021 final interpretive rule in the U.S. Court of Appeals for the District of Columbia Circuit.[27] This case is currently in abeyance because certain DOE rulemaking proceedings, including the instant proceeding, may have a bearing on the appeal.

On July 7, 2022, DOE published the NOPR, proposing to require a 95% AFUE standard for all non-weatherized residential gas furnaces and mobile home gas furnaces and ignoring the distinctions between the important performance characteristics and features that conventional (or non-condensing) provide consumers.[28] On July 25, 2022, AGA, APGA, and NPGA, Spire Inc., Spire Missouri Inc., and Spire Alabama Inc. (collectively, "Spire") requested DOE extend the comment period in this proceeding to ensure that stakeholders had the ability to develop meaningful comments.[29] DOE rejected the request on July 28, 2022.[30] On August 11, 2022, AGA,

[24] *Energy Conservation Program for Appliance Standards: Energy Conservation Standards for Residential Furnaces and Commercial Water Heaters; Withdrawal,* 86 Fed. Reg. 3873 (Jan. 15, 2021).
[25] *Energy Conservation Program for Appliance Standards: Energy Conservation Standards for Residential Furnaces and Commercial Water Heaters*, 86 Fed. Reg. 73947 (Dec. 29, 2021) ("December 29, 2021 Interpretive Rule").
[26] *Id.*
[27] *See* American Gas Association, *et al.* v. DOE, D.C. Cir. No. 22-1030.
[28] *Energy Conservation Program: Energy Conservation Standards for Consumer Furnaces*, EERE–2014–BT–STD–0031, RIN 1904–AD20, 87 Fed. Reg. 40590 (July 7, 2022).
[29] AGA, *et al*., Extension Request, July 25, 2022 (Attachment B).
[30] DOE Letter Rejecting the Extension Request, July 28, 2022 (Attachment C).

APGA, NPGA, Spire, and Atmos Energy Corporation ("Atmos") requested that DOE hold a workshop to discuss fundamental defects in DOE's model and extend the comment period accordingly.[31] The request for the workshop included several examples of issues with the Life Cycle Cost ("LCC") model and noted that problems with the model were preventing stakeholders from meaningfully commenting on important aspects of the proposal because they could not make the model work, and the model produced absurd results.

On August 30, 2022, DOE scheduled a webinar for September 6, 2022, and extended the comment period until October 6, 2022.[32] DOE also issued a revised version of the LCC spreadsheet on August 30, 2022. Before the webinar, AGA, APGA, NPGA, Spire, and Atmos, filed a detailed letter that included a list of matters and questions that DOE should address at the event.[33] At the September 6 webinar, DOE did not address the substantive matters and questions concerning the LCC model and instead generally provided instruction on the operation of the LCC spreadsheet. On September 13, 2022, AGA, APGA, NPGA, Spire, and Atmos filed a letter thanking DOE for holding the webinar on the LCC model and reiterated the critical topics for the agency to address before the comment period closes that DOE did not address during the webinar.[34] The September 13 letter reiterated the points raised in the prior letters concerning the LCC model and also raised additional concerns. The Department has not addressed those concerns or provided sufficient time to meaningfully comment on the proposal.

[31] AGA, *et al*., Workshop Request, August 11, 2022 (Attachment D).
[32] *Energy Conservation Program: Energy Conservation Standards for Consumer Furnaces*, 87 Fed. Reg. 52861 (August 30, 2022).
[33] AGA, *et al*., Letter Regarding the Workshop Topics, August 29, 2022 (Attachment E).
[34] AGA, *et al*., Letter Following the Workshop, September 13, 2022 (Attachment F).

V. COMMENTS

A. Introduction

AGA and its members, as noted above, support energy efficiency and conservation efforts that are technologically feasible, economically justified, and consistent with the law. As discussed herein, DOE's analysis of the economic justification and energy savings that underpin the NOPR suffers from significant methodological and data flaws. Even accepting DOE's analysis at face value, DOE's modeling shows that the Proposed Rule is not economically justified and would impose significant costs on American consumers, especially low-income, senior-only households, and small businesses.

The Proposed Rule would also harm consumers. DOE's own analysis evidences that the Proposed Rule would leave many consumers worse off—particularly seniors and low-income consumers, consumers in warmer climates, and consumers replacing furnaces in existing homes. Critically, DOE's data evidences that the proposal will have a negative impact and result in higher overall costs for: 17% of all non-weatherized gas furnace consumers, including 15% of senior-only households, 14% of low-income households, and 20% of small business consumers. Notably, for consumers with mobile homes, 22% of all consumers would be negatively impacted, along with 15% of senior-only mobile home households and 13% of low-income mobile home households. In the replacement market, *i.e.*, where consumers are seeking to replace an existing furnace, 16.6% of all households would see a net cost increase. However, these percentages mask even more substantial impacts when AGA examined only consumers affected by this rule. In this case, 29% of rule-affected consumers will face negative impacts. Furthermore, when regional differences in impacts are accounted for, 34% of all households in the South with non-weatherized gas furnaces affected by this rule will face higher costs due to this proposed rule. For low-income households (including owner-occupied and renter-only households), 40% of low-income non-

weatherized gas furnace consumers nationally affected by this rule will be negatively impacted. As is demonstrated, there are many ways to report the profoundly negative impacts of this rule. Therefore, DOE should not find a standard economically justified when such a significant share of consumers will be rendered worse off. The Proposed Rule is not economically justified, as required by EPCA.

Furthermore, AGA cannot support regulatory outcomes that drive uneconomic and inefficient fuel switching. The Proposed Rule would cause homeowners to shift from non-condensing natural gas furnaces that have an 80% fuel conversion efficiency to electric heat sources that use electricity from largely fossil-fired generating plants. Those plants have a typical 30-50% fuel conversion efficiency, which is a significant loss of efficiency and manifestly unsound economic and environmental policy.[35]

Indeed, DOE has recognized the importance of considering the full-fuel-cycle impacts of its efficiency regulations as a basis to assess the potentially counterproductive effects of fuel-switching caused by its regulations.[36] DOE's own analysis estimates that its Proposed Rule would drive 15.6% of affected consumers to shift to electric heat who would otherwise have the option to purchase non-condensing natural gas furnaces. DOE's own analysis estimates that its Proposed Rule would drive 15.6% of affected consumers to shift to electric heat who would otherwise have the option to purchase non-condensing natural gas furnaces. Such fuel switching increases primary energy consumption and is inconsistent with EPCA.

Moreover, the Proposed Rule and the LCC model contain severe errors that impact the entire analysis. DOE's own flawed analysis shows significant adverse impacts due to the proposed

[35] U.S. Energy Information Administration, "More than 60% of energy used for electricity generation is lost in conversion," July 21, 2020, available at https://www.eia.gov/todayinenergy/detail.php?id=44436 (last visited October 5, 2022).
[36] *See, e.g.,* NOPR, 87 Fed. Reg. at 40593, n.5.

standards and thus does not support a conclusion that the proposed standards would be economically justified. Even with errors that overestimate the benefits and understate the costs, the NOPR's LCC analysis shows that many consumers would be worse off under the proposed standard. In 2020, approximately 59.2 million households had gas or propane space heating; therefore, DOE's proposal to eliminate an affordable heating option will negatively affect millions of consumers. While DOE projects that 43.3% of American consumers would not be impacted by the proposed standard 16.6% of households would face higher costs.

The negative consequences are exasperated by the NOPR's failure to recognize that condensing furnaces are appropriate for many consumers, but not for others, by proposing a separate product class for non-condensing furnaces. EPCA precludes DOE from setting standards that would make products with performance characteristics important to American consumers unavailable. As addressed in more detail below, to ensure the availability of options, while also promoting efficiency gains within different products classes, EPCA authorizes DOE to create separate product classes for products with different performance features. Conventional, non-condensing gas furnaces provide consumers with performance characteristics and features that are distinct from those of condensing furnaces. Most notably, non-condensing furnaces can be vented through masonry chimneys found in much of the nation's existing housing stock, while condensing furnaces cannot. The NOPR would make non-condensing furnaces unavailable to those consumers. As a result, the proposed standards would prevent many homeowners from replacing a broken natural gas furnace without incurring significant building renovation costs. For many, such as those that experience the need for an unplanned replacement of a broken furnace during the middle of winter, such renovations will be impracticable and infeasible.

Moreover, consumers are already adopting condensing-only gas furnace equipment, rendering DOE's rule unnecessary. A large number of higher-efficiency condensing furnaces are shipped and installed every year throughout the United States, and the market share of condensing furnace equipment has steadily increased over time. New home designs accommodate condensing technology, and during major or whole house renovations, homeowners install condensing furnaces or other high-efficiency units when appropriate. The current existing high-level adoption of condensing technology makes a new rule forcing market adoption across the entire United States unnecessary and counterproductive.[37]

AGA proposes that DOE and stakeholders develop energy conservation standards for residential furnaces that support the continued increase in market penetration of high-efficiency natural gas furnaces where practical and economical, without adopting a rigid policy that affirmatively harms significant subsets of consumers, drives up energy consumption for many consumers, and increases associated emissions. Within the broader portfolio of energy efficiency and energy affordability options available to consumers and utilized within the market, there are currently mechanisms available to meet the goals of increasing the use of high-efficiency furnaces while mitigating counterproductive results including: (1) rebate, incentive, and other non-regulatory programs to promote use of condensing furnaces; and (2) use of separate product classes to mitigate adverse impacts of a standard that would eliminate a vast number of furnaces from the market. A tailored approach to improving consumer space heating energy efficiency including improvements in consumer furnace efficiency that includes stakeholder input is more appropriate than DOE's proposal to force universal adoption of a technology that is not universally beneficial, cost effective, or even feasible.

[37] DOE should fully explain and justify the need for the Proposed Rule, in light of the fact that market appears to be encouraging the adoption of condensing technology, thereby rendering the proposal unnecessary.

B. The Proposed Rule Suffers from a Series of Procedural Errors that Render it Unlawful

The first fundamental problem with the NOPR is that it does not follow the procedural requirements under the EPCA, the Administrative Procedure Act ("APA"), and the Department's own rules.

1. The Department has Not Followed its Own Process

The Department has established procedural standards, known as the Process Rule, to foster fair and transparent rulemaking.[38] The Process Rule's procedures are intended to, among other things, increase predictability, eliminate problematic options early in the process, ensure thorough analysis of impacts, and guarantee the use of transparent and robust analytical methods.[39] While the Department asserts that it may deviate from the Process Rule in some circumstances, by its own terms, the Department may only do so "when necessary" and after providing stakeholders an explanation for why the deviation is necessary.[40] The NOPR, without explanation, cause, or reason, fails to adhere to the Process Rule and therefore fails to meet the Department's rulemaking standards.

The Process Rule pledges that the Department will use transparent, robust analytical methods, that can be reproduced by the public. Section 1(f) notes that "[t]he Department seeks to use qualitative and quantitative analytical methods that are fully documented for the public and that produce results that can be explained and reproduced, so that the analytical underpinnings for policy decisions on standards are as sound and well accepted as possible."[41] The NOPR, however, completely fails to do so. As noted in an August 11, 2022 letter requesting a public workshop and

[38] 10 C.F.R. Part 430, Subpt. C, Appendix A.
[39] *Id.*
[40] *Id.* § 3(a).
[41] 10 C.F.R. Part 430, Subpt. C, Appendix A § 1(f).

an extension of the comment period,[42] the LCC model used for the NOPR and provided to the public is broken. The model that DOE originally made publicly available produces summary table results that were inconsistent with those in the Technical Support Document ("TSD") for the NOPR.[43] Although DOE made a revised version of its LCC spreadsheet available on August 24, 2022, and DOE appeared to address a narrow technical issue in its LCC spreadsheet that led to the inconsistency between the as-presented life-cycle cost spreadsheet and the high-level summary of impacts presented in the TSD, the LCC model spreadsheet still possesses several incorrect assumptions, methods, errors.[44] AGA, *et al*., reiterated that fundamental defects and other identified problems persisted with the revised LCC spreadsheet in letters dated August 29, 2022, and September 13, 2022, and asked DOE to allow stakeholders to ask DOE staff questions that may explain or resolve some of the concerns with the LCC model.[45] DOE has not done so, and the "qualitative and quantitative methods" behind the LCC model and the "underpinnings for policy decisions on [the standards]" remain far from fully documented, reproducible, explained, and sound.

Similarly, the Process Rule promises that "there will be no less than 75 days for public comment on the NOPR."[46] In direct contravention of this promise, the Department initially allowed stakeholders only 60 days to comment. While AGA recognizes that DOE issued a short extension after making the revised LCC spreadsheet available, that extension does not afford stakeholders sufficient time to thoroughly analyze all of the complex, technical underpinnings of DOE's modeling. DOE has rejected repeated pleas that the comment period is not long enough to allow

[42] *See* Attachment D.
[43] Attachment D at 2.
[44] *Id*. at 2-3 (elaborating on the market share data and false assumptions).
[45] *See* Attachments E and F.
[46] Process Rule at § 6(f).

for meaningful comment on the array of technical issues, even if the models and other technical support materials did not suffer from deficiencies.[47] In a rule as complex as this, which includes profound and far-reaching impacts on the energy service options and costs for millions of consumers, it is questionable whether 75 days, the minimum contemplated by the Process Rule, would even be sufficient.

The Department's deviation from the Process Rule, especially without any explanation, is arbitrary and capricious and threatens the validity of the entire rule and the integrity of the rulemaking process. Among other things, the NOPR's failure to follow the Process Rule makes it impossible for stakeholders to fully test the methods underlying the rule or address obvious technical flaws including errors in the LCC spreadsheet, which is a necessary predicate for any discussion about the merits of DOE's proposed standards. DOE's flawed process further hampers stakeholders from evaluating compliance with other aspects of EPCA's and the Process Rule's requirements, including whether the NOPR's design options "have payback periods that exceed the median life of the product" or "result in life-cycle cost increases relative to the base case."[48] The Department should correct these deficiencies by allowing stakeholders access to "quantitative analytical methods that are fully documented for the public and that produce results that can be explained and reproduced" and sufficient time to comment on them.[49]

[47] *See*, *e.g.*, Attachments C and F.
[48] Process Rule at § 7 (c).
[49] *See, e.g.,* Process Rule § 1(f); *see also*, *Grand Canyon Air Tour Coal. v. FAA*, 154 F.3d 455, 468 (D.C. Cir. 1998) (under the APA "an agency is required to provide a meaningful opportunity for comments."); *Am. Pub. Gas Ass'n v. DOE*, 22F4th 1018 (D.C. Cir. 2022) (DOE required to provide fulsome notice and explanation for its decisions).

2. DOE's Process is Inconsistent with the Statutory Requirements

The APA[50] requires that agencies provide a "meaningful" opportunity for comment,"[51] and "in order to satisfy this requirement, an agency must also remain sufficiently open-minded."[52] "That means enough time with enough information to comment and for the agency to consider and respond to the comments."[53] Among the purposes of the APA's notice and comment requirements are: (1) to ensure that agency regulations are tested via exposure to diverse public comment, (2) to ensure fairness to affected parties, and (3) to give affected parties an opportunity to develop evidence in the record to support their objections to the rule and thereby enhance the quality of judicial review.[54] Due to the issues with the Proposed Rule and the supporting analysis, discussed herein, stakeholders have been denied a meaningful opportunity to evaluate the NOPR.

As discussed herein, the Proposed Rule lacks essential elements needed to fully understand and evaluate it, depriving stakeholders of the opportunity for meaningful comment. For example, AGA cannot fully reproduce DOE's subgroup analysis for low-income consumers after extensive efforts and expending considerable resources. Moreover, the flawed model and reasoning offered in support of the NOPR prevent stakeholders from engaging with the Department on its rationale for the proposed action or offering contrary evidence or alternatives. Specifically, as discussed in Section E, numerous errors and defects in DOE's economic analysis, which presents scenarios that are neither reasonable nor representative of the real world, render its simulation of the economic impacts of the proposed standard meaningless. AGA has endeavored to respond to the NOPR in

[50] Pub. L. No. 79-404, 60 Stat. 237 (1946) (codified as amended at 5 U.S.C. §§ 551, *et seq.*).
[51] *See, e.g., Rural Cellular Ass'n v. Fed. Commc'ns Comm'n*, 588 F.3d 1095, 1101 (D.C. Cir. 2009), *Gerber v. Norton*, 294 F.3d 173, 179 (D.C. Cir. 2002).
[52] *Rural Cellular Ass'n,* 588 F.3d at 1101.
[53] *Prometheus Radio Project v. FCC*, 652 F.3d 431, 450 (2011).
[54] *Id.* citing *I'nt'l Union, United Mine Workers of Am. v. Mine Safety & Health Admin*., 407 F.3d 1250 (D.C. Cir. 2005).

these comments; however, interested parties cannot meaningfully comment upon DOE's proposal if stakeholders do not have an accurate picture of the reasoning that led the Department to the Proposed Rule. The Department's approval of the Proposed Rule (or some variation thereof) would contravene the APA's paramount directive to engage in meaningful public comment and reasoned decision-making.

Also problematic is the unnecessary speed that DOE is conducting this proceeding in light of the sweeping nature of its impact, potentially affecting millions of consumers with significant cost implications. With so many consumers facing negative consequences due to the Proposed Rule, DOE should not run afoul of the APA requirements that it be open-minded and for the Department to consider and respond to the comments.

3. DOE Should Follow the National Academies of Sciences, Engineering, and Medicine's Recommendations

DOE should follow, or at a minimum respond to, the National Academies of Sciences, Engineering, and Medicine's ("NASEM") Recommendations on its process. NASEM issued a report titled "Review of Methods Used by the U.S. Department of Energy in Setting Appliance and Equipment Standards" ("NASEM Report").[55] The NASEM Report evaluated the Department's appliance rulemaking process and identified several key areas of DOE's rulemaking process that need improvement. Several of these recommendations align with suggestions AGA and others have made over the years regarding DOE's economic modeling and data availability and would greatly help all stakeholders better understand the agency's process and ensure that

[55] *Review of Methods Used by the U.S. Department of Energy in Setting Appliance and Equipment Standards*, NASEM (2021), available at https://www.nap.edu/read/25992/chapter/1 (last visited on October 5, 2022).

DOE bases its decisions on the most appropriate data and models. Some of the most pertinent recommendations include:

- **Recommendation 2-2:** DOE should pay greater attention to the justification for the standards, as required by executive orders and the EPCA requirement that standards be economically justified. DOE should attempt to find significant failures of private markets or irrational behavior by consumers in the no-standards case and should consider such a finding as being necessary to conclude that standards are economically justified.

- **Recommendation 3-5:** DOE should expand the Cost Analysis segment of the Engineering Analysis to include ranges of costs, patterns of consumption, diversity factors, energy peak demand, and variance regarding environmental factors.

- **Recommendation 4-1:** DOE should put greater weight on ex post and market-based evidence of markups to project a more realistic range of likely effects of a standard on prices, including the possibility that prices may fall. This would improve future analyses.

- **Recommendation 4-13:** DOE should place greater emphasis on providing an argument for the plausibility and magnitude of any market failure related to the energy efficiency gap in its analyses. For some commercial goods in particular, there should be a presumption that the market actors behave rationally, unless DOE can provide evidence or argument to the contrary.

- **Recommendation 4-14:** DOE should give greater attention to a broader set of potential market failures on the supply side, including not just how standards might reduce the number of competing firms, but also how they might impact price discrimination, technological diffusion, and collusion.

Despite NASEM's clear indication that DOE's analytical methods need improvement, the NOPR takes no effort to do so, essentially ignoring NASEM's recommendations. In contravention of Recommendation 2-2, the NOPR does not identify significant failures of private markets or even provide qualitative estimates of their magnitude in distorting rational economic behavior. Concerning Recommendation 3-5, DOE inadequately considers the diversity of markets and associated energy use patterns of consumers. Regarding Recommendation 4-1, DOE has neither addressed this recommendation nor proposed appropriate follow-up measures to assess errors in

its rulemaking assumptions. As related to Recommendation 4-13, in a crucial shortcoming, the Proposed Rule does not provide plausible arguments for market failure or even qualitative estimates of their magnitude in distorting rational economic behavior. In contrast to Recommendation 4-14, the NOPR fails to adequately assess the competitive dynamics on manufacturers and suppliers meeting the definition of small businesses, which may be extraordinarily vulnerable when having to meet over-reaching minimum efficiency standards. NASEM sent a letter to DOE on the recommendations.[56] DOE should revisit the Proposed Rule to address NASEM's recommendations and allow stakeholders an opportunity to comment on the revisions.

4. DOE Has Not Properly Addressed Critical Flaws Previously Identified in Earlier Rulemakings

The NOPR fails to recognize or address comments that AGA and other stakeholders have previously raised pointing out that the flawed legal rationale and the underlying analytical methodologies used for the economic justification for the Proposed Rule are unsupported by substantial evidence and rely on arbitrary and capricious reasoning. Since 2010, AGA has repeatedly pointed out flaws in DOE's prior suggestions that a condensing-only furnace standard would be economically justified and technically feasible.

More specifically, in a series of comments submitted by AGA from 2010 through 2018, AGA has pointed out that (1) a proposed standard at or above AFUE 90% would unlawfully render atmospherically-vented consumer gas furnaces unavailable to millions of consumers; (2) the economic analyses that DOE has relied on to justify the costs of similar proposed standards were based on materially flawed methods that, among other things, ignore evidence demonstrating actual and rational consumer purchasing behavior, fail to rely on the best available data on costs,

[56] *See* https://regulatorystudies.columbian.gwu.edu/joint-letter-dept-energy (last visited on October 5, 2022).

overestimate natural gas prices, and assume equipment life that is unsupported by evidence; (3) the proposed standards grossly underestimate the costs of installing condensing furnaces in homes with atmospheric venting systems (and fail to rely on substantial evidence to support those estimates); (4) the proposed standards ignored building code and other legal requirements that would prevent installation of condensing furnaces (due to venting issues) in many locations; (5) the proposed standards would actually increase lifecycle costs to consumers on a national basis; (6) DOE unlawfully failed to propose a separate class for non-condensing furnaces; (7) the proposals failed to consider impacts on local distribution utilities; (8) the proposals were premature because the proposed standards were issued before DOE promulgated testing procedures that could be used to evaluate performance and comply with them; and (9) the proposed standards would present negative effects on the environment, including increased emissions of certain pollutants.[57] Those prior comments also included a detailed and substantive critique of the technical analyses underlying similar proposals, including flaws in DOE's modeling approach and LCC analysis.[58] Like the current rulemaking, those prior comments pointed out deficiencies in the technical information that DOE made available to the public, including DOE's failure to make public information critical to understanding and analyzing DOE's LCC analysis and hindering a meaningful opportunity to comment.

[57] *See* Letter Regarding Energy Conservation Standards for Residential Furnaces, Nov. 4, 2010 (Attachment G); AGA Comments on Energy Conservation Standards for Residential Furnaces, Oct. 14, 2011 (Attachment H); Request for Opportunity to Speak at March 27, Public Meeting, March 20, 2015 (Attachment I); Energy Analysis, May 28, 2015 (Attachment J); AGA Response to NOPR on Energy Conservation Standards for Residential Furnaces, July 10, 2015 (Attachment K); Supplemental Comments on September 2015 NODA, Nov. 6, 2015 (Attachment L); Petition for Rulemaking by Spire Inc., APGA, NGSA, AGA, and NPGA, October 18, 2018 (Attachment M); and Comments of AGA, NGSA, and U.S. Chamber on Proposed Interpretive Rule, Oct. 12, 2021(Attachment N).

[58] Gas Technology Institute, Technical Analysis of DOE Notice of Proposed Rulemaking on Residential Furnace Minimum Efficiencies, July 7, 2015 (Attachment O).

To this date, DOE has not meaningfully addressed the issues above and carries the same flaws over to the current proposal. Accordingly, AGA is resubmitting the prior comments and technical analyses as attachments to these comments and as additional comments on the current proposal.[59] AGA also presents in these comments a new analysis that utilizes DOE's LCC spreadsheet model that demonstrates the fundamental defects in the underlying methods related to DOE's economic justification.

Given the significant procedural, evidentiary, and legal flaws identified in these and past comments, DOE should rescind the proposal and address the substantive procedural and analytical defects before a new rulemaking on consumer furnace standards can be proposed and presented for public review and comment. Failure to do so would result in the issuance of unlawful energy efficiency standards that the courts would vacate. As DOE is aware, it must support energy conservation standards with substantial evidence, follow the Process Rule, and afford stakeholders a meaningful opportunity to comment and address the issues raised by commenters.[60] It is not possible for DOE to address the proposal's legal, technical and procedural flaws without making significant revisions that must themselves be subject to stakeholder input through notice and comment procedures.

5. The NOPR Fails to Meet DOE's Evidentiary Burden

Congress specified that energy conservation standards must be "supported by substantial evidence" on the record.[61] This requires DOE to support its conclusions with evidence that "a reasonable mind might accept as adequate to support a conclusion."[62] The substantial evidence

[59] *See* n.57-58.
[60] *See* 42 U.S.C. § 6306(b).
[61] 42 U.S.C. § 6306(b).
[62] *Consolo v. Fed. Maritime Comm'n*, 383 U.S. 607, 619-20 (1966); *NRDC v. Herrington*, 768 F.2d 1355, 1422 (D.C. Cir. 1985).

standard does not "allow an agency to close its eyes to on-point record evidence without any explanation at all."[63] Where DOE relies on assumptions and inputs to support projections or models it must provide a sufficient explanation of those inputs and assumptions and why they were selected to allow the courts to determine whether those inputs and assumptions are supported by the evidence.[64]

The NOPR suffers from many evidentiary shortcomings that fail to meet DOE's burden. As noted repeatedly in these comments and previous comments that AGA provided regarding earlier iterations of the proposal, the NOPR's conclusion that the proposed standards would be economically justified and technically feasible rely on unexplained assumptions and conclusions. For example, the LCC analysis relies on unexplained assumptions about market conditions and consumer behavior that conflict with actual evidence regarding those conditions and behavior.[65] As AGA has repeatedly explained, the NOPR vastly underestimates the costs of installing condensing units in homes with atmospheric venting, which permeates the NOPR's erroneous evaluation of the costs and benefits of the proposed standards as well as their technical feasibility.[66] AGA details many other significant flaws in the following sections of these comments. Unless and until DOE corrects these flaws and provides stakeholders a meaningful opportunity to comment on those corrections, any version of the proposal will be rendered arbitrary and capricious and unsupported by substantial evidence. Furthermore, the flaws in DOE's issuance render it impossible to propose or consider alternative proposals. Only after the model used for the proposed standards economic justification is fixed can stakeholders truly evaluate the proposal and suggest cost effective and technically feasible alternatives.

[63] *Fogo de Chao (Holdings) Inc. v. U.S. Dep't of Homeland Sec.*, 769 F.3d 1127, 1147 (D.C. Cir. 2014).
[64] *NRDC*, 768 F.2d at 1422.
[65] *See, e.g.,* Section E.
[66] *See, e.g.,* Sections E. 1., E. 6, E. 8, E. 9.

C. DOE Should Establish Separate Product Classes for Condensing and Non-Condensing Furnaces

The NOPR is fatally flawed by the Department's failure to recognize that it must treat condensing and non-condensing furnaces as separate product classes for the purposes of setting energy conservation standards. In the last year and a half, the Department has arbitrarily changed its mind on this topic, ignoring EPCA's plain instructions.[67]

On January 15, 2021, the Department issued a final interpretive rule correctly determining that "in the context of residential furnaces, commercial water heaters, and similarly situated products/equipment, use of non-condensing technology (and associated venting) constitute a performance-related "feature" under the EPCA that cannot be eliminated through adoption of an energy conservation standard."[68] The January 15, 2021 Interpretive Rule noted that "EPCA precludes adoption of energy conservation standards that would limit the market to natural gas, propane gas, and/or oil fired furnaces, water heaters, or similarly-situated covered products/equipment that use condensing combustion technology," (as the NOPR would do) because that would "result in the unavailability of a performance related feature. . . .," namely "non-condensing technology (and associated venting)."[69] Among the important implications of the January 15, 2021 Interpretive Rule was that the Department must establish separate classes of condensing and non-condensing residential furnaces and water heaters to enable the Department to establish separate energy conservation standards without eliminating important products and features from the market.

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[67] *See e.g.,* Attachments M and N.
[68] *Energy Conservation Program for Appliance Standards: Energy Conservation Standards for Residential Furnaces and Commercial Water Heaters*, 86 Fed. Reg. 4776 (Jan. 15, 2021) ("January 15, 2021 Interpretive Rule"). The Department Promulgated the January 15, 2021 final interpretive rule in response to a petition for rulemaking submitted by APGA, Spire, NGSA, AGA, and NPGA (collectively, " Petitioners").
[69] *See* 86 Fed. Reg. at 4816; 42 U.S.C. § 6295(o)(4).

Eleven months later, on December 29, 2021, the Department rescinded the January 21, 2021 Interpretive Rule, issuing a new interpretive rule. The new Proposed Rule wrongfully asserts that the differing constraints and functionality between condensing and non-condensing appliances do not constitute performance-related features.[70] The NOPR relies on the December 29, 2021 Interpretative Rule's flawed interpretation of EPCA to treat condensing and non-condensing products as the same class. Failure to correct this will render a final version of the NOPR arbitrary, capricious, and contrary to law.

The records for the January 21, 2021 Interpretive Rule and the December 29, 2021 Interpretive Rule include substantial comments, including the Petition, supporting comments, and the Petitioners' comments opposing the proposed version of the December 29, 2021 Interpretive Rule.[71] In the interest of expedience, AGA incorporates those materials by reference in these comments,[72] but highlights some of the key points below.

1. Non-Condensing Furnaces Provide Consumers with Unique Performance-Related Characteristics and Consumer Utility

The Proposed Rule would render natural gas heating products suitable to building design, climate, and consumer preferences unavailable to millions of consumers. It is undisputed that the proposed non-weatherized gas furnace and mobile home furnace energy conservation standards can only be met by natural gas furnaces if they use condensing technology. Replacing conventional natural gas furnaces that do not use condensing technology with those that do would require the renovation of millions of homes and would often be infeasible.

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[70] *Energy Conservation Program for Appliance Standards: Energy Conservation Standards for Residential Furnaces and Commercial Water Heaters*, 86 Fed. Reg. 73947 (Dec. 29, 2021) ("December 29, 2021 Interpretive Rule").

[71] The as noted above, AGA and others filed a petition for review of the December 29, 2021 Interpretive Rule in the D.C. Circuit, because it is unlawful. American Gas Association, *et al.* v. DOE, No. 22-1030 (D.C. Cir. filed Feb. 22, 2022). That petition has been held in abeyance.

[72] *See, e.g.,* Attachments M and N.

Many conventional natural gas heating products, such as furnaces, commercial water heaters, and boilers, in American homes and businesses are designed for use with atmospheric venting systems. Atmospheric venting systems allow the exhaust gases produced in combustion, which are under negative pressure, to exit a building through a vertical or nearly vertical chimney or conduit using the heat and buoyancy of the gases to carry them outside. Atmospheric venting has been used in the United States for generations and remains the primary exhaust gas venting system in millions of homes, apartments, and businesses.

Natural gas products that use condensing combustion technology can achieve higher measured efficiencies than conventional or "non-condensing" products, but they are not compatible with conventional atmospheric venting systems. Condensing products increase thermal efficiency by extracting additional heat from the combustion gases before they are vented. This increases the efficiency of the products but creates two conditions that are significantly different than conventional furnaces. First, the condensing process generates cooler exhaust gases that lack sufficient buoyancy to exit a building through an atmospheric venting system and cannot be "common vented" with other appliances connected to an atmospheric venting system.[73] Instead, condensing products require positive pressure venting—generally through a horizontal conduit powered by a fan or other additional electronic device—to generate sufficient pressure and flow to vent the gases. They also require plumbing drains to dispose of the condensate developed in the operation of the appliance (in contrast, non-condensing appliances do not create condensate).

As such, condensing products are a viable option for many consumers, but they are also incompatible with millions of homes and workplaces. As noted, American buildings have been

[73] There are literally millions of installations throughout the United States that have two or even three gas appliances common vented into a single chimney or vent. Second, the condensing process generates liquid condensate that must be disposed.

using atmospheric venting for generations.[74] Millions of homes, townhomes, apartment buildings, offices, and other commercial buildings were built with utility closets, chimneys, and conduits designed for this technology. Non-condensing furnaces have the unique ability to share a common atmospheric vent with other non-condensing products, like non-condensing water heaters. Many of these structures also lack existing plumbing systems to dispose of the condensate.

As a result, installing condensing products can be problematic, requiring major modifications to these buildings. The homeowner or business must install a new positive pressure venting system, that includes new electric equipment, *e.g.,* fans to create positive pressure, new conduits for the exhaust, new plumbing for the condensate, and additional modifications to accommodate exhaust from other existing appliances that use atmospheric venting. Homeowners and their contractors must also consider specific building and safety code requirements and physical constraints (such as adjoining walls in many townhome and urban settings) that may constrain the ability to perform the needed modifications. The homeowner or business must also install plumbing to deal with the condensate. In the event the homeowner or business also has other common vented appliances, *e.g.,* a gas water heater, the homeowner or business must either resize the vent for the other appliance to be compatible to the existing venting system or replace it with another unit. AGA addresses additional installation concerns below.[75]

The bottom line is that non-condensing atmospherically-vented consumer furnaces provide an important performance-related feature to millions of homes and businesses: they work with the homeowner or business's existing utility structure venting system. The NOPR would make them

[74] For example, Energy Information Agency data shows that "more than half of all commercial buildings were constructed before condensing commercial water heaters were introduced to the market." *Energy Conservation Program for Appliance Standards: Energy Conservation Standards for Residential Furnaces and Commercial Water Heaters: Proposed rule*, 84 Fed. Reg. 33011 (July 11, 2019).
[75] *See, e.g.,* Section D. 1, and E. 9.

unavailable and push millions of Americans to drop natural gas furnaces altogether to avoid the necessary remodeling.

2. EPCA Requires that DOE Adopt a Product Class Structure that Maintains the Availability of Non-Condensing Furnaces to Consumers

EPCA authorizes the Department to establish energy conservation standards for certain "covered products," including residential furnaces, boilers, and water heaters.[76] However, Congress was careful to ensure that energy conservation standards would not eliminate the availability of preferred types of appliances or product features that consumers desire and on which they depend. The Department may not promulgate standards that are "likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the finding."[77] To help avoid doing so, Congress instructed the Department to prescribe standards for a separate "class" of products if it determines that the products have a capacity or other "performance-related feature," "which other products within a product class do not have" and "such feature justifies a higher or lower standard."[78] This provision is directly applicable to this rulemaking proposal. Unless the Department recognizes that non-condensing products' ability to function with existing atmospheric venting systems in millions of homes provides a performance-related feature warranting treatment as a separate class, the proposed conservation standards will render furnaces, boilers, and water heaters with important performance characteristics unavailable.

Congress did not specifically define "performance characteristics" or "performance-related features." However, EPCA's text, structure, and context show that the "performance

[76] 42 U.S.C. §§ 6295(a), (e), (f).
[77] *Id.* § 6294(o)(4).
[78] *Id.* § 6294(q)(1).

characteristics" and "performance related features" protected from elimination (or being rendered "unavailable") by energy conservation standards include the characteristic and/or feature of being able to work in one's home without requiring significant structural or aesthetic renovation.[79]

First, a "characteristic" is commonly understood to mean "a distinguishing trait, quality, or property."[80] "Performance" refers to a product's "ability to perform" or the "manner in which a mechanism performs."[81] So, a performance characteristic is a distinguishing trait, quality, or property relating to a product's ability to perform or the way it does so. Similarly, a "feature" is a "prominent part or characteristic" of a product or a "special attraction" such as "something offered to the public or advertised as particularly attractive."[82] Consistent with this understanding, Congress further directed the Department to consider, among other things, "the utility to the consumer of such a feature," *i.e.*, the characteristic's or feature's usefulness, when evaluating whether to develop separate classes. Through Sections 6294(o)(4) and 6295(q)(1), Congress, therefore, ensured that energy conservation standards would not eliminate traits, qualities, or characteristics of products that make them work for consumers or are otherwise attractive to them.

Second, Congress ensured that the energy conservation standards would be neutral as to which fuels that covered products use, protecting the standards from being used to favor one fuel source over another. Congress prescribed the initial energy conservation standards that it deemed appropriate for furnaces, boilers, and commercial water heaters.[83] It set separate standards for gas,

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[79] *See Davis v. Mich. Dep't of Treasury*, 489 U.S. 803, 809 (1989) ("It is a fundamental canon of statutory construction that the words of a statute must be read in their context and with a view to their place in the overall statutory scheme.").
[80] Characteristic, Merriam-Webster Online Dictionary 2022 https://www.merriam-webster.com/dictionary/characteristic (Aug. 17, 2022).
[81] Performance, Merriam-Webster Online Dictionary 2022, https://www.merriam-webster.com/dictionary/performance (Aug. 17, 2022).
[82] Feature, Merriam-Webster Online Dictionary 2022, https://www.merriam-webster.com/dictionary/feature (Aug. 17, 2022).
[83] 42 U.S.C. § 6294(a), (e), (f).

oil, and electric appliances and then directed the Department to update them in certain circumstances, but only at efficiency rates that "the Secretary determines [are] not likely to result in a significant shift from gas heating to electric resistance heating."[84] EPCA thus treats classes or categories of products differently, based on the type of fuel they used, demonstrating that separate standards are appropriate to prevent the elimination of fuel-type and other performance-related features from the market. That is true even when it results in the availability of less efficient products that serve the same overall purposes, *e.g.*, heating water/steam.[85]

Third, Congress ensured that the energy conservation standards would not eliminate a class of covered products or render them unworkable through infeasible or overly costly standards. Any amended conservation standards must be "technologically feasible and economically justified."[86] To be "technologically feasible," a standard must be capable of being carried out. That is, the entire class of covered products, *e.g.*, all gas furnaces, must be capable of complying with the standards.

Fourth, recognizing the desire to foster both the development and marketing of new efficient technologies and to ensure consumers do not lose the ability to purchase the types of products they desire or, in the case of atmospheric venting, that their homes were designed to use, Congress specifically contemplated sub-categorizing covered products. As stated above, Congress prohibited the Department from promulgating standards that are "likely to result in the unavailability in the United States of any covered product type (or class) of performance characteristics (including reliability) features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States."[87] Congress recognized that products

[84] 42 U.S.C § 6295(f)(1)(B)(iii).
[85] *See id*.
[86] 42 U.S.C § 6294(o)(2)(A).
[87] 42 U.S.C. § 6295(o)(4); § 6313(a)(6)(B)(iii)(II).

using different fuel types, *e.g.*, gas, oil, and electricity, create valuable options for consumers but operate differently and warrant separate efficiency standards. For example, as noted above, Congress itself set statutory energy conservation standard levels for water heaters and boilers based on fuel type.[88] EPCA also provides for establishing separate classes where appliances "consume a different kind of energy from that consumed by other covered products within such type (or class)." [89]

Congress further recognized that subcategorization would allow for higher and lower energy conservation standards among competing products in a category. "A rule prescribing an energy conservation standard for a type (or class) of covered products shall specify a level of energy use or efficiency higher or lower than that which applies (or would apply) for such type (or class) for any group of covered products which have the same function or intended use," if the Secretary determines that covered products within such group "have a capacity or other performance-related feature which other products within such type (or class) do not have" and "such feature justifies a higher or lower standard."[90]

As such, when read in context, performance characteristics and performance-related features are at least characteristics that render a product useful for its intended use and that allow the Department to differentiate the product from others in a category. Here, that intended purpose would be providing heat or hot water in a home designed with atmospheric venting. Consistent with Congress' plan, creating separate classes would allow the Department to set robust efficiency levels for both condensing and non-condensing appliances while promoting consistent innovation. The Department must create a separate class for those products.

[88] *Id*. § 6295(e)(1), (f)(3).
[89] *Id*. § 6295(q)(1)(A).
[90] *Id*. § 6295(q)(1).

D. DOE's Treatment of Venting Issues Raised by Condensing-Level Standards is Unreasonable and Contrary to Law

The NOPR would impose standards that only condensing products can achieve. Although condensing consumer furnaces are readily available and have already captured a significant percentage of consumer furnace sales, condensing products are not suitable for all installations. As explained below, the imposition of standards that non-condensing products cannot achieve would raise significant practical, economic, and legal issues. The economic analysis in the NOPR fails to properly account for the necessary engineering relative to venting consumer furnaces or common venting of multiple appliances, including consumer water heaters. Cumulatively, inaccurate assumptions undermine the NOPR's economic evaluation and its estimate of the market impacts the proposed standards would have.

1. A Condensing Only Standard Would Impose Significant Burdens on Consumers

Condensing products can be an attractive option for consumers but their feasibility depends on a building's design, cost, and other factors. The modifications required to alter existing buildings to accommodate the use of condensing products are far more complicated, extensive, and burdensome than the NOPR assumes.[91] Millions of homes were built with mechanical rooms, chimneys, venting, and associated infrastructure designed for atmospherically-vented appliances and equipment. Non-condensing consumer furnaces have the unique ability to share a common atmospheric vent with other non-condensing products, like non-condensing water heaters. The heat and volumes of gases combine to create the conditions necessary to carry the gases out of the building without powered positive pressure systems. Therefore, the installation of non-condensing

[91] *Energy Conservation Program for Appliance Standards: Energy Conservation Standards for Residential Furnaces and Commercial Water Heaters: Proposed Rule*, 84 Fed. Reg. 33011 (July 11, 2019).

furnaces must be coordinated with the design configuration and functioning of other appliances. Additionally, many homes designed with atmospheric venting lack accessible drainage, waste, and vent systems to dispose of the condensate. The burdens required to transition from a non-condensing furnace to a condensing furnace would be substantial in many cases.

Atmospheric venting systems allow the exhaust gases produced in combustion, which are under negative pressure, to exit a building through a vertical or nearly vertical chimney or conduit using the heat and buoyancy of the gases to carry them outside. Atmospheric venting has been used in the U.S. for generations and remains the primary exhaust gas venting system in millions of homes, apartments, and businesses. Many of these installations throughout the country have multiple vented gas appliances common vented into a single vent or chimney.

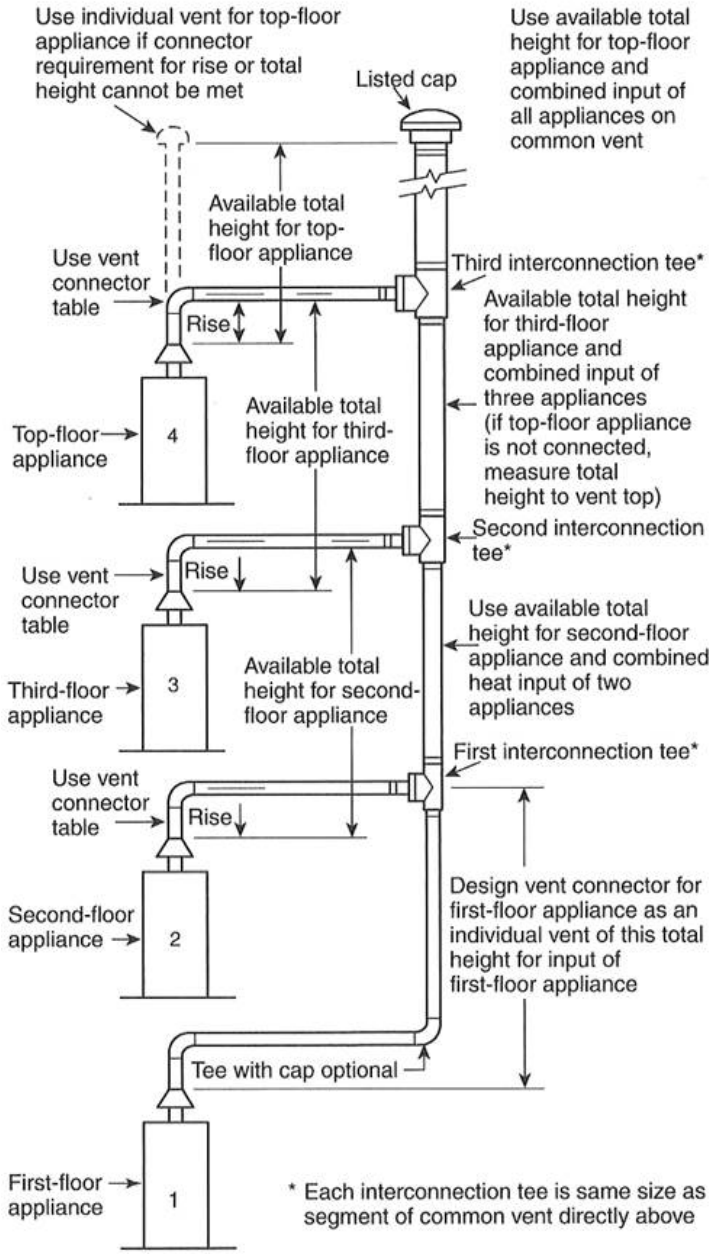
In condensing appliances, the condensing process generates cooler exhaust gases that the appliances discharge into the venting system under positive pressure. Additionally, the condensing process generates liquid condensate that must be disposed. Because of these conditions, condensing products require positive pressure venting—generally through a horizontal conduit powered by a fan or other additional electronic device—to generate sufficient pressure and flow to vent the gases. They also require plumbing drains to dispose of the condensate developed in the operation of the appliance. They lack sufficient buoyancy to exit a building through an atmospheric venting system and cannot be "common vented" with other appliances already connected to an atmospheric (non-positive) venting system.

Condensing furnaces are generally classified as either a power vent furnaces, either induced draft or forced draft. A power vent furnace is typically vented horizontally and vents exhaust through a horizontal pipe that leads out of a building or home. An added fan/blower pushes the exhaust gases through this pipe. Extra power is required to power the blower, and this power source

is separate from powering the furnace. A direct vent furnace uses special coaxial venting that has separate chambers for intake air and exhaust in a single assembled vent piece. The venting runs from the furnace through the side of a building or home. They pull and push air from outside to negate any back-drafting within the building or home.

Without non-condensing consumer gas-fired furnaces and their ability to utilize commonly vented Category 1 venting systems (described below), owners of a building designed with a common vent would often have no satisfactory options when it comes to replacing the furnace. As noted, atmospherically vented buildings are typically located in urban centers. Many homes in those areas have restricted exterior locations, *e.g.,* townhomes with adjoining walls, thus limiting a building owner's options for the side wall venting required for condensing products when an appliance needs to be replaced. Additionally, there are interior considerations a purchaser must consider when replacing a non-condensing appliance with a condensing appliance, including accessibility to condensate drain lines and often extensive renovations to accommodate new venting systems. Similarly, multistory buildings can not utilize horizontal venting for the same reasons traditional vented dryers can't, as it is impossible to install and service vent terminations. In many cases, wall penetrations would compromise the structural integrity of the building. Additionally, on lower floors, terminations would have to be seven feet above public sidewalks and streets, which is often impossible in an urban area. Finally, removing one or more consumer furnace would disrupt the venting systems of the other locations. Non-condensing furnaces can offer "unique utility." They are the only suitable gas replacement option in many existing applications that utilize common venting or masonry chimneys. Furthermore, they are the only gas space heating option that can be installed without the necessity of disposing of condensate and without electrical systems for the added load of electric furnaces.

Principles of Design of Multistory Vents Using Vent Connector and Common Vent Design Tables[92]



Replacing an existing non-condensing with a condensing furnace requires significant building renovations. At a minimum, a new horizontal venting system compatible with a condensing furnace is required as well as a means to dispose of condensate. The existing vertical

[92] Figure F.1(n), *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, 2021 edition.

venting system simply cannot be used. Additional complications exist when two or more non-condensing appliances are common vented through a single vertical venting system. When one (or more) non-condensing appliance is replaced with a condensing appliance, the existing venting system needs to be redesigned and configured to account for the lower number of appliances.

Failing to recognize the differences between condensing and non-condensing products is inconsistent with how building and safety code experts treat these products. For example, the safety standard, *Gas-fired Central Furnace*, CSA/ANSI Z21.47:2021 • CSA 2.3:2021, defines furnace categories as:

> **Furnace - Central** — a self-contained, gas-burning appliance for heating air by transfer of heat of combustion through metal to the air, and designed to supply heated air through ducts to spaces remote from or adjacent to the appliance location. Central furnaces are divided into four categories based on the static pressure produced in the vent and the flue loss.
>
> > **Category I** — a central furnace that operates with a non-positive vent static pressure and with a flue loss not less than 17%.
> >
> > **Category II** — a central furnace that operates with a non-positive vent static pressure and with a flue loss less than 17%.
> >
> > **Category III** — a central furnace that operates with a positive vent static pressure and with a flue loss not less than 17%.
> >
> > **Category IV** — a central furnace that operates with a positive vent static pressure and with a flue loss less than 17%.

A central furnace can be of the following types:

> **Down-flow furnace** — a furnace designed with air flow discharge vertically downward at or near the bottom of the furnace.
>
> **Forced air furnaces** — a furnace equipped with a fan or blower which provides the primary means for circulation of air.
>
> **Forced air furnace with cooling unit** — a single-package unit, consisting of a gas-fired forced air furnace of one of the types listed in forced air furnaces, above, combined with an electrically or gas-operated summer air conditioning system, contained in a common casing.

For installation in a manufactured (mobile) home — a forced air furnace for alcove or closet installation, or an enclosed furnace, which is intended for installation in a manufactured (mobile) home and designed to be readily convertible for use with natural gas and propane gas.

For recreational vehicle installation — a forced air direct vent furnace that is intended for installation in a recreational vehicle and designed to be readily convertible for use with natural gas and propane gas or for use with propane gas only.

Horizontal furnace — a furnace designed for low headroom installation with air flow across the heating element essentially in a horizontal path.

Up-flow furnace — a furnace designed with air flow discharge vertically upward at or near the top of the furnace. This classification includes "highboy" furnaces with the blower mounted below the heating element and "lowboy" furnaces with the blower mounted beside the heating element.

Regarding direct vent central systems, such systems consist of the following:

a. a central furnace for indoor installation;
b. combustion air connections between the central furnace and the vent-air intake terminal;
c. flue gas connections between the central furnace and the vent-air intake terminal; and
d. a vent-air intake terminal for installation outdoors, constructed so all air for combustion is obtained from the outdoor atmosphere and all flue gases are discharged to the outdoor atmosphere.

Direct vent central furnaces are divided into four categories based on the pressure produced in the vent and the difference between actual vent gas temperature and the dew point temperature. (See above definitions of Category I, II, III and IV.) Direct vent central furnaces can also be divided into the following two types:

Type FSP — a direct vent central furnace system in which the combustion air connections, the flue gas connections, and the vent-air intake terminal may be specified by the furnace manufacturer to be supplied by the installer.

Type MSP — a direct vent central furnace that has all elements of the system supplied by the manufacturer

The Method of Test in Clause 5.7 (*Category Determination*) of this standard determines the venting category required for the furnaces equipped with draft hoods or draft diverters. Table 12, *Determination of Category*,[93] and Figure 7, *Chart for Determination of Furnace Category*,[94] uses the test data produced to classify the necessary venting system as Category I, II, III or IV based on two specific results, the vent pressure and the net flue gas temperature.

Table 13

Determination of Category[95]

	Vent Pressure	**Net flue gas temperature °F (°C) (see Figure 7)**
Category I	Non-positive	On or above curve[1]
Category II	Non-positive	Below curve[1]
Category III	Positive	On or above curve1[1]
Category VI	Positive	Below curve[1]
[1] Reference American Gas Association Laboratories Report 1509 (Copyright © 1976) with curve based upon a 17 percent flue loss.		

Further, when installing a venting system for a furnace, the building owner must comply with existing fuel gas code provisions, which restrict the location of the vent terminations in relationship to:

[93] CSA/ANSI Z21.47:2021 • CSA 4.2.3:2021, *Standard for Gas-fired Central Furnaces.*
[94] CSA/ANSI Z21.47:2021 • CSA 4.2.3:2021, *Standard for Gas-fired Central Furnaces.*
[95] Table 7, Chart for the Determination of Vent Category, from CSA/ANSI Z21.47:2021 • CSA 4.2.3:2021, *Standard for Gas-fired Central Furnaces*, is applicable to both natural gas and propane-fired appliances.

- Clearance to operable windows and doors - 6 in (15 cm) for appliances ≤ 10,000 Btuh (3 kW), 9 in (23 cm) for appliances > 10,000 Btuh (3 kW) and ≤ 50,000 Btuh (15 kW), 12 in (30 cm) for appliances > 50,000 Btuh (15 kW).
- Clearance above grade – 6 inches.
- Clearance above a jurisdiction's expected snow line.
- Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance – 4 ft (1.2 m) below or to side of opening; 1 ft (300 mm) above opening.
- Clearance to a mechanical air supply inlet – 3 ft (91 cm) above if within 10 ft (3 m) horizontally.
- Clearance above paved sidewalk or paved driveway located on public property – 7 ft (2.13 m) for mechanical draft systems (Category I appliances). Vents for Category II and Category IV appliances cannot be located above public walkways or other areas where condensate or vapor cause a nuisance or hazard.

2. Failure to Adopt Separate Product Classes Would Be Inconsistent with DOE Precedent

Failing to adopt a separate class for non-condensing furnaces also is inconsistent with the Department's historical interpretation and application of EPCA. The Department has repeatedly recognized that performance-related features include those that affect a product's intended utility, conditions under which the products can be used, and design-specific factors that influence energy consumption. For example, when the Department reevaluated the standards for central air-conditioners and heat pumps and packaged terminal air conditioners, it recognized separate classes of "space constrained" and "non-standard sized" units from standard air conditioners because of their performance-related feature: accommodating the space constraints of many homes and apartments. The Department specifically noted that EPCA instructs it to avoid promulgating standards that would render a class of covered products, like window air-conditioning units, unavailable by failing to recognize the space constraints. It justified maintaining the separate classes of products, in part, on the need to avoid imposing standards that would require extensive building modifications. As the Department put it, "[t]he space-constrained product class acts as a

safe harbor for product types . . . [like window units] whose efficiency is limited by physical dimensions that are rigidly constrained by the intended application."

Similarly, the Department has recognized different product classes for electric residential clothes dryers to address differences in product features concerning installation space constraints—e.g., small laundry machine closets—and differences in electrical power supply. It adopted a product class for tabletop water heaters in 2001 to accommodate "strict size limitations" for the products. It similarly treats high-speed/small-diameter, highly decorative, and belt-driven ceiling fans as separate classes than standard ceiling fans to preserve "consumer options."

Perhaps most importantly, the Department previously recognized that condensing and non-condensing furnaces present significant design differences that warrant different product classes for the separately regulated furnace fans that work with them. The Department created nine different classes of residential furnace fans based on "application-specific design differences" that impact energy consumption and are, therefore, "performance-related features." The Department explained that "[t]he presence of a secondary heat exchanger [in condensing furnaces] increases static pressure," which causes furnace fans used with condensing furnaces to consume more electricity than furnace fans used with non-condensing furnaces. Similarly, the Department noted that "[s]pace and design constraints are different for products installed indoors compared to outdoors," and those constraints "will impact furnace fan performance differently because furnace fan energy consumption is dependent on clearances and airflow path." That is, the Department focused on the impact that non-consumer-facing, highly technical equipment factors had on the functionality and efficiency of the equipment when recognizing separate classes.

The Department has similarly proposed creating a separate class for "small" mobile home gas furnaces.[96] The Department correctly proposes to do so in recognition of the space constraints consumers face with these products and the increased costs uniform standards would impose on those consumers.[97]

The Department's assertion that it views a product's "utility" only "as an aspect of a product that is accessible to the layperson and is based on user operation and interaction with the product" is unreasonable and belied by these past rules. To justify this, the Department has argued that it recognizes user-facing features, such as having a window on an oven door or a front-loading washing machine door, as performance-related features because some consumers prefer those interfaces. That is true as far as it goes. But regardless of whether consumers regularly interface with the condensing equipment in their gas-fired appliances, a furnace serves a consumer limited or no utility if it can only be used after renovating a home or business. As the Department recognized in the furnace fan rule, the "application-specific design" differences between condensing and non-condensing appliances create performance-related features that must be differentiated.

Just like dryers that can fit in consumer's apartment buildings without remodeling or losing living space serve a vital utility, natural-gas appliances that function with existing chimneys and plumbing designed around non-condensing appliances serve a vital utility. Just like air conditioners that can replace window units or other smaller units without requiring renovation provide an important feature and utility to consumers, natural-gas appliances that can replace existing non-condensing appliances without requiring renovation provide and important feature

[96] NOPR, 87 Fed. Reg. at 40614.
[97] *Id.* The Department's consideration of costs in relation to developing a separate class of mobile home gas furnaces directly controverts its assertion that it can only consider costs when evaluating whether standards are cost justified.

and utility to consumers. Just like the space constraints in mobile homes justify a separate class of mobile home gas furnaces, the physical constraints of homes designed for atmospheric venting justify a separate class for non-condensing furnaces that use atmospheric venting. Just as the design demands for condensing and non-condensing furnaces warranted separate classes for the furnace fans that work with them, those design demands warrant separate classes for the furnaces themselves. While features that consumers regularly interface with, like oven windows and dryer doors, are important performance-features too, it is absurd to suggest features that make the product work in a consumer's existing homes are not.

In addition to supporting the January 15, 2021 Interpretive Rule's reading of EPCA, the examples above show that the December 29, 2021 withdrawal of that reading was arbitrary and capricious and a breach of due process. The Department cannot consider the space and functional constraints a "performance-related feature" justifying separate standards for the covered products discussed above, but not for furnaces, commercial water heaters, and boilers with similar constraints. Nor can the Department consider costs when evaluating whether to develop a separate class for mobile home furnaces while ignoring cost for the same analysis with regard to standard furnaces. The Department should follow its past practice and continue to recognize non-condensing furnaces that work in homes constrained by existing exhaust and plumbing systems as a separate class from condensing products.

3. The Proposal Violates the "Unavailability" Provision of EPCA

The NOPR's failure to create a separate class for non-condensing furnaces also ensures that the proposed energy conservation standards would violate EPCA's "unavailability provision." As noted above, EPCA prohibits the Department from prescribing standards that are "likely to result in the unavailability in the United States in any covered product type (or class) of

performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States."[98] In 2018, the Gas Industry Petitioners submitted a rulemaking petition establishing that standards like these, which require condensing technology, would result in the unavailability of non-condensing natural gas furnaces needed to millions of consumers and would render all natural gas furnaces unavailable to consumers uninterested or unable to modify their homes to accommodate positive pressure venting. AGA incorporates the submission here as Attachment M. The evidence has not been controverted.[99] AGA also reincorporates the October 12, 2021 comments submitted by AGA, *et al.* (Attachment N), which demonstrate that the factual findings from the January 2021 Interpretive Rule remain uncontroverted.[100] Pursuant to 42 U.S.C. §§ 6295(o)(4), AGA requests that any final rule in this proceeding include a written finding that interested persons have established by a preponderance of the evidence that the proposed standards are likely to result in the unavailability in the U.S. of residential furnaces with "performance characteristics (including reliability, features, sizes, capacities, and volumes) that are substantially the same as those generally available in the United States" on the date any such rule issues.

4. The Proposal Unlawfully Imposes "Design Requirements" on Furnaces

The NOPR exceeds DOE's authority because it effectively imposes "design requirements" on furnaces. EPCA authorizes DOE to develop "energy conservation standards" for furnaces. "Energy conservation standards" are (i) "a performance standard which prescribes a minimum level of energy efficiency or a maximum quantity of energy use," or (ii) "a design requirement for

[98] 42 U.S.C. § 6295(o)(4).
[99] Indeed, the December 2021 Interpretive Rule did not disagree with the factual assertions in the petition. It just concluded that it would evaluate the complexities of trying to install a condensing appliance in a home designed for non-condensing appliances as part of its analysis of the costs of the new standards. *E.g.*, 86 Fed. Reg. at 73968; *see also id*. at 73952 ("DOE agrees with the commenters that little has changed in terms of the technology or operation of the products/equipment at issues since promulgation of the January 2021 Final Interpretive Rule.")
[100] Attachment N at p. 28-33.

the products specified in paragraphs (6), (7), (8), (10), (15), (16), (17), and (20) of section 6292(a) of this title . . . ."[101] The products specified in the enumerated paragraphs of Section 6292(a) are dishwashers, clothes washers, clothes dryers, kitchen ranges and ovens, showerheads, water closets, and metal halide lamp fixtures, *not* furnaces. Congress's decision to exclude furnaces from the list of products for which DOE can include design requirements demonstrates that DOE may not develop design requirements for furnaces. As stated by the D.C. Circuit in ruling against DOE that standing pilot lights were not an authorized design requirement for decorative fireplaces: "Whereas Congress authorized DOE to impose performance requirements on *all* covered products, it specifically limited its authority to impose design requirements to just a handful of product classes. *Id.* § 6291(6)."[102]

However, imposing design requirements is exactly what the proposal would do. It would require furnaces to have a condenser—a design element of a furnace. It carries other design requirements that the proposed standards would effectively impose on homeowners. As noted above, condensing furnaces require a positive-pressure exhaust system with horizontal piping made from different materials than those typically found in millions of American homes with vertical atmospheric (negative pressure) vents. Condensing furnaces also require additional equipment, including electric fans to push out the exhaust and drainage systems to dispose of the condensate. In short, by setting standards that require condensers, the proposal includes design requirements that will force compliant furnaces to be designed in a way that makes them

[101] 42 U.S.C. § 6291(6). The definition of "energy conservation standard" also "includes any other requirements which the Secretary [of Energy] may prescribe under section 6295(r) of this title." Section 6295(r), in turn, says that "[a]ny new or amended energy conservation standard prescribed under this section shall include, where applicable, test procedures prescribed in accordance with section 6293 of this title and may include any requirement which the Secretary determines is necessary to assure that each covered product to which such standard applies meets the required minimum level of energy efficiency or maximum quantity of energy use specified in such standard." It does not include design requirements.

[102] *Hearth, Patio & Barbecue Ass'n*, 706 F.3d., 499, 509 (2013).

incompatible with millions of homes, absent renovation. This is contrary to EPCA's exclusion of furnaces from DOE's ability to impose design requirements on certain products. While the furnace standard is phrased in numerical terms, the result is the same: the requirement of a condenser and other design elements. "DOE cannot now escape these limits [in EPCA] through its 'linguistic jujitsu.'"[103]

5. The Courts Will Not Defer to the Department's Proposed Interpretation of the "Unavailability" and "Performance-Related Features" Provisions

Any intent by the Department to rely on Chevron deference to defend the use of the December 2021 Interpretive Rule's position on developing separate classes is misplaced. The starting point for any inquiry into whether an agency has the authority to promulgate a rule is the words of the governing statute. An agency may not exercise its authority "in a manner that is inconsistent with the administrative structure that Congress enacted into law."[104] Rather the agency and the courts "must give effect to the unambiguously expressed intent of Congress."[105] Even where, as here, an agency relies on a purported ambiguity, the courts will not defer to an agency's interpretation until first "exhausting all the 'traditional tools'" of statutory interpretation and determining the statute is genuinely ambiguous.[106] Only after making such a determination will the courts evaluate whether the "agency's answer is based on a permissible construction of the statute" and therefore subject to deference.[107]

The courts will pay particular scrutiny to the Department's interpretation in this case because the Department asserts the authority to eliminate the availability of a class of natural gas

[103] *Id.* at 507 (quoting *Sherley v. Sebelius*, 644 F.3d 388, 399 (D.C.Cir.2011) (Henderson, J., dissenting)).
[104] *ETS Pipeline Project v. Missouri*, 484 U.S. 495, 517 (1988).
[105] *Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc.*, 467 U.S. 837, 842-843 (1984).
[106] *Kisor v. Wilkie*, 139 S. Ct. 2400, 204 L. Ed. 2d 841 (2019); *Chevron U.S.A. Inc.*, 467 U.S. at 843 n. 9.
[107] *Chevron U.S.A. Inc.*, 467 U.S. at 843.

appliances to millions of Americans.[108] Courts presume that "Congress intends to make major policy decisions itself,"[109] and "[e]xtraordinary grants of regulatory authority are rarely accomplished through 'modest words,' 'vague terms,' or subtle device[s]."[110]

As discussed above, Congress made its intentions quite clear in EPCA. The Department must consider characteristics or aspects of a class of covered products that make them useful to consumers, "a performance-related feature" that warrants separate standards and it must not set standards that would be "likely to result in the unavailability" of currently available "performance characteristics." The Department's interpretation to the contrary is not based on any ambiguity in the statute, but rather a desired policy outcome that fails to adhere to the structure Congress enacted into law. Even if there was ambiguity, the Proposal does not present a "permissible interpretation of the statute."

E. DOE's Assessment of the Maximum Technical Feasibility Levels and Cost Justification for the Proposal Overestimates the Benefits and Underestimates the Costs

DOE's modeling of consumer purchasing behavior in the absence of a revised standard – that is, its development of a baseline used to evaluate each of its proposed standard levels – is flawed. In particular, DOE's baseline assigns natural gas furnace technologies of varying efficiency to consumers without any regard to consumer costs and benefits. For instance, DOE randomly assigns non-condensing furnaces to consumers who have what DOE calls a "negative payback period" for a more-efficient furnace, *i.e.*, the purchase and installation cost and the first-year energy costs of the more efficient condensing furnace is lower than the purchase and

[108] Indeed, the rule implicates "major questions" of political and economic significance. *See West Virginia v. EPA*, 142 S. Ct. 2587 (2022).
[109] *United States Telecom v. FCC*, 855 F.3d 381, 319 (D.C. Cir. 2017).
[110] *West Virginia v. EPA*, 142 S. Ct. 2587, 2609.

installation cost and first-year energy costs of the non-condensing furnace. In addition, DOE's analysis underestimates the number of consumers likely to fuel switch and misidentifies which consumers are likely to fuel switch due to the Proposed Rule. These methodological defects have led DOE to overestimate the proposed standards' benefits and underestimate the costs.

AGA has submitted to DOE technical analysis that uncovered critical technical flaws in the modeling approach DOE uses as the basis of its life-cycle-cost analysis. The previously identified critical methodological issues persist in the modeling used for this rulemaking and continue to undermine the integrity of the results in the life-cycle-cost analysis used to justify the rule.

1. DOE's Energy Efficiency Distribution for Furnaces in the No-New-Standards Cases Suffers Critical Defects that Voids DOE's Economic Analysis

DOE's economic analysis suffers from a critical defect in the economic criteria of how gas furnace efficiencies are assigned to consumers in the No-New-Standards or "Base Case" referred to here. DOE uses so-called "random assignment" to determine which consumers in the Base Case would be assigned specific furnace efficiencies and whether they install condensing or non-condensing furnaces. At its core, random assignment is based on the assumption that gas furnace consumers do not consider economics when selecting the type of furnace to install in a home or business. In other words, DOE assumes that consumers act perfectly irrationally concerning furnace economics when DOE assigns furnace efficiencies within its base case scenario. Since the No-New-Standards or "Base Case" scenario forms the basis from which the energy and economic impacts of any proposed standard can be evaluated, a critical defect in the development of the Base Case renders void and unusable all subsequent analysis of any proposed trial standard level.

Stakeholders have raised with DOE concerns about this technical defect on multiple occasions, as well as a proposed alternative, and DOE has failed to address these concerns in this

NOPR adequately or logically. The Gas Technology Institute ("GTI"), in an analysis of the March 2015 proposed rulemaking,[111] uncovered the critical error in the base case furnace assignment methodology that continues to plague DOE's economic analysis in this NOPR. GTI describes the issue:[112]

> The DOE NOPR LCC model includes economic criteria and a distribution of allowable cost recovery times in its 92 trial standard level (TSL) furnace analysis and fuel switching decision algorithm. However, DOE's Base Case furnace assignment algorithm ignores economic decision making parameters. Instead, the Base Case AFUE, which is the efficiency of the furnace that is chosen by an individual consumer without the influence of DOE's rule, is assigned randomly to each of the 10,000 trial cases in the DOE LCC model. The economics of a particular efficiency level selection compared to other levels (e.g., 80% AFUE vs. 92% AFUE) are not considered in DOE's baseline furnace decision for any of the 10,000 Crystal Ball trial cases.

The GTI report continues:[113]

> DOE's decision to use a random assignment methodology to assign base case furnace efficiency to each of the trial cases in the Crystal Ball simulation is a significant technical flaw with meaningful impact on the DOE NOPR LCC results. A random assignment methodology misallocates a random fraction of consumers that use economic criteria for their decisions and results in higher LCC savings compared to rational economic decision-making criteria. DOE's Base Case furnaces in the 10,000 Crystal Ball trial case homes are intended to be representative of the RECS survey furnace distribution across various locations and categories. Random assignment of the Base Case furnace does not achieve this key objective and is not a technically defensible proxy for rational residential decision-making processes. Figure 7 shows GTI's Base Case furnace assignment algorithm that incorporates a CED framework into the trial case assignments to provide a reasonable, technically defensible Base Case furnace assignment algorithm for the LCC analysis.

To reiterate what this means in practice, *i.e.,* in the context of the analytical logic underlying this economic model, is that DOE completely ignores economic decision making by the consumer.

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[111] *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces*, 80 Fed. Reg. 13120 (March 12, 2015).
[112] Attachment O at p. 13.
[113] *Id*.

DOE does not assume that economics are partially ignored when consumers select furnace efficiencies; DOE is assuming that consumers *completely* disregard economics when selecting a gas furnace. What is worse is that this fundamental choice to ignore consumer economics does not adhere to the model logic related to consumer fuel switching to electricity. As discussed below, DOE assumes consumers *consider economics when choosing to* fuel switch. This inherent contradiction that forms the fundamental basis of the economic analytics at the heart of DOE's LCC modeling cannot be justified.

Furthermore, random assignment of individual household gas furnace efficiencies has a material impact on the actual economic outcomes determined by the life cycle cost model. As GTI wrote in its report, and which is still relevant to this NOPR, "DOE's random assignment puts non-condensing furnaces in buildings that would purchase condensing furnaces based on economic criteria" and "DOE's random assignment puts condensing furnaces in buildings that would not purchase condensing furnaces based on economic criteria."[114] Random assignment methodologies lead to an overstatement of benefits associated with the proposed rulemaking and an underestimation of the total costs.

In the NOPR, DOE acknowledges earlier stakeholder comments expressing concerns regarding DOE's use of random assignment.[115] DOE's defense of this methodology has been that some academic literature indicates that consumers do not consider economics, or at least do not consider economics accurately, when making purchasing decisions. Some of the literature is quite old and likely does not apply to purchases with the cost significance of furnaces. Again, DOE relies on an economically driven consumer choice model to determine fuel-switching decisions.

[114] Attachment O at p. 15.
[115] *See, e.g.,* NOPR, 87 Fed. Reg. at 40639.

Furthermore, some of the critical inputs in that model are derived from survey data which indicates that consumers do consider economics when making purchasing decisions.

DOE has failed to address the core issue at the heart of this critical defect in its model. Moreover, the NOPR preamble contradicts DOE's decision to continue to use random assignment in this manner. DOE states in the NOPR that, "[w]hile DOE acknowledges that economic factors may play a role when consumers, commercial building owners, or builders decide on what type of furnace to install, assignment of furnace efficiency for a given installation, based solely on economic measures such as life-cycle cost or simple payback period most likely would not fully and accurately reflect annual real-world installations."[116] Thus, DOE acknowledges that consumers consider economics when selecting furnace efficiencies but then proceeds to utilize random assignment in the context of its analysis, which assumes that consumers do not consider economics when choosing furnace efficiencies on a building level. In other words, DOE's says that "economic factors may play a role" but assumes consumers act without considering any economics when choosing furnaces.

To demonstrate the absurd results that arise from the use of random assignment of furnace efficiencies, one can look at the 10,000 trial cases presented in the LCC analysis. These trial cases represent the output of a model simulation of the economic impacts on individual consumers from potential energy efficiency standards for non-weatherized gas furnaces and mobile home furnaces. Of the 10,000 trials for non-weatherized gas furnaces, AGA can identify 607 trials, representing 6% of buildings with non-weatherized gas furnaces, that have favorable economics and lower upfront costs to install a condensing furnace relative to a non-condensing furnace, but, due to random assignment, these trials were randomly selected, *i.e.*, assumed, to have chosen a lower

[116] NOPR, 87 Fed. Reg. at 40640.

AFUE furnace. These consumers have every economic incentive to choose a lower-cost condensing furnace. Instead, DOE assumes those consumers will utilize a non-condensing 80% AFUE furnace in its base case. On average, these consumers would have saved $503 on lower installation costs and saved $45 in the first year on operating costs.

This failure to properly account for consumers who would have already invested in condensing technology in the No-New-Standards case is also shown for consumers assigned a 95% or 98% AFUE furnace in the base case by the model. There are 3,096 out of 4,328 trial cases unaffected by the rule (thus, those consumers have a 95% AFUE or higher efficiency furnace installed in the base case) who would have had a lower upfront installation cost with an 80% AFUE furnace. In this case, DOE's random assignment methodology assumes these consumers disregard economics once again and install more expensive first-cost equipment, regardless of payback. The average installation cost for these households was $867 higher because of the condensing furnace, with an average savings of $81 in the first year.

In both instances, where DOE is counting as rule-affected consumers that likely would have selected a condensing furnace anyway and consumers as non-rule-affected consumers that would never have selected a condensing furnace, DOE is simultaneously overestimating the proposed standards' benefits and overestimating the proposed standards' costs. Indeed, one would expect *some* level of market failure insofar that some consumers make economically irrational decisions, and therefore some of these cases may exist in the real world. However, DOE provides no evidence that they can justify an economic simulation that is based on the assumption that *consumers are perfectly irrational in all cases when selecting a condensing furnace.*

a. DOE's LCC Model Demonstrates that Consumers Consider Economics, and Therefore the Use of Random Assignment as Applied by DOE is Not Justified

If consumers do not consider economics, as suggested by DOE's use of random assignment of energy efficiency distributions, then there should *not* be a relationship between condensing furnace market share and LCC savings because consumers are not responsive to consumer furnace economics. If, however, there *is* a relationship between the LCC savings and condensing furnace market share, then it is also reasonable to assume that economics does affect the adoption of higher efficiency furnaces, and many of the outcomes for consumers that are mostly positive will already have been realized by consumers.

In the LCC spreadsheet model, DOE provides market share data of consumer furnaces of various efficiencies for new construction and replacements at a state level. It is possible to consider the relationship between consumer choice and economics that can be found in DOE's own LCC model. This can be accomplished by comparing the market share data to the life cycle cost savings calculated by the model for 80% AFUE and condensing furnaces at 90% AFUE and higher. Details of this analysis and results follow.

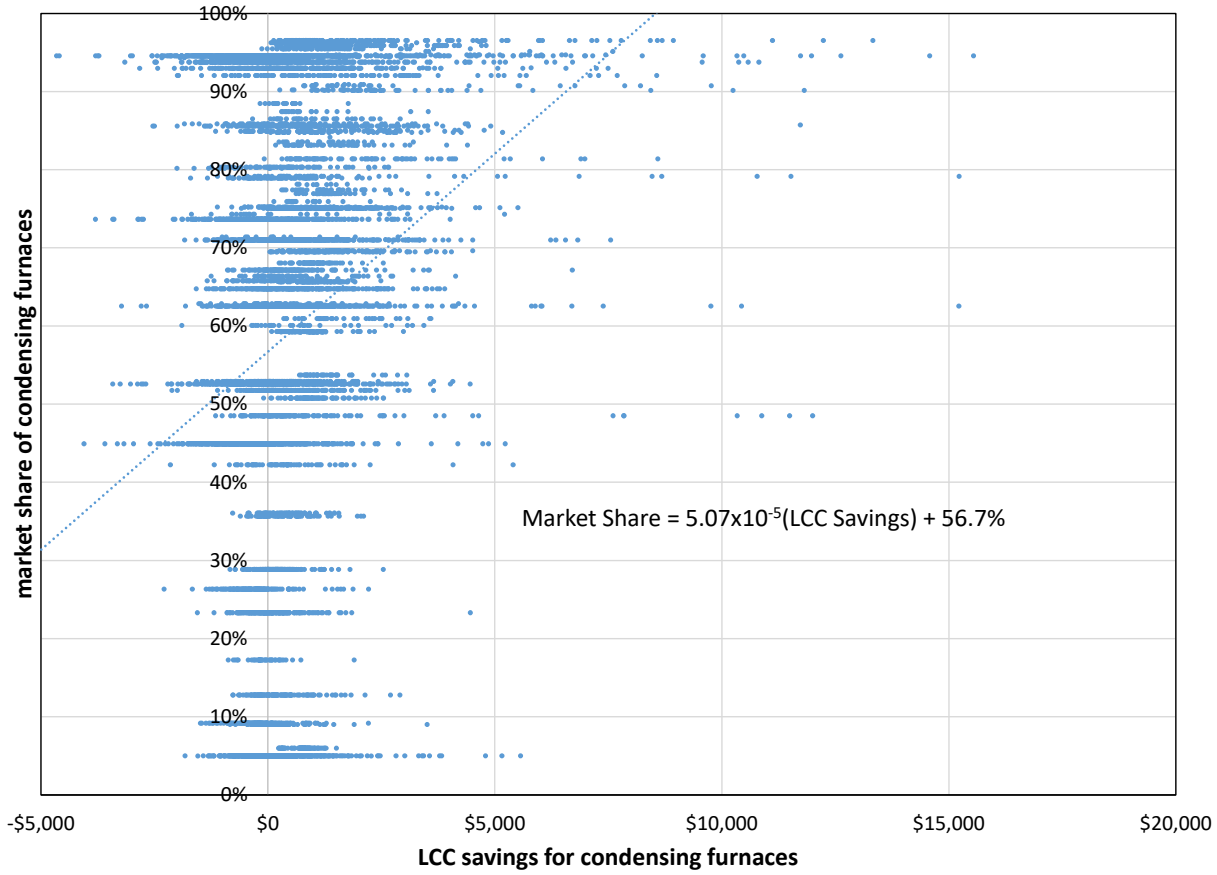
In the LCC model, DOE provides market share data of various efficiencies of furnaces for new construction and replacements at a state level. The as-received DOE LCC was modified to make all consumers affected by the rule and to prevent fuel switching. LCC savings was then analyzed as a function of market share. AGA modified the "Basecase AFUE" in the 'No New Standards AFUE' sheet in cell D18 to 80% to force all 10,000 trial cases in the model to be considered rule affected, as all consumers are "choosing" an 80% AFUE furnace in this case. Turning off the flag for fuel switching prevents any products other than gas furnaces from being considered. The LCC outputs of the model can then be compared to the market share data to

identify any relationships between the two. Note that if DOE's assertion that consumers do not consider economics in purchasing decisions is true, there should be no relationship between the market share of high-efficiency furnaces and the economics of those products.

The first indication that consumers are responding at some level to economics is that the market share of condensing furnaces ranges from 5% (Florida, Georgia, and Texas) to 95% (Colorado, Iowa, and New York) for replacements and 6% (Florida) to 97% (Colorado and Iowa) for new construction. Because the market share of condensing furnaces is generally high in cold weather states relative to warm weather states and the opportunity for savings is highest in the cold weather states, forcing all consumers to choose 80% AFUE furnaces in the base case for purposes of this analysis increases the LCC savings predicted by the model. LCC savings are $305, $430, $612, and $578 for 90, 92, 95, and 98% AFUE respectively.

Figure 1 shows the market share of condensing furnaces, 90% AFUE and higher, vs. the blended LCC savings for condensing furnaces. The blended LCC savings is the weighted average of LCC savings for each condensing furnace efficiency weighted by the relative market share of those efficiencies. Market shares are specific to each state and installation type (replacement or new).

Figure 1: Market share of condensing furnaces vs. LCC savings



While there is a scatter in the data, this should be expected (the 10,000 trials contain different buildings, new and replacement furnaces, different incomes, *etc*.). The least squares best-fit line indicates a relationship between market share and LCC savings and that increasing LCC savings correlates with increasing market share. Further, the Pearson correlation coefficient between these variables is 0.243, with a p-value of 0.000. It is, therefore, more than 99.9% certain that these variables are positively correlated. Note also that the use of blended LCC savings is not necessary for a positive correlation; the Pearson correlation coefficient for condensing furnace market share for 90, 92, 95, and 98% AFUE LCC savings relative to 80% AFUE is 0.215, 0.228, 0.239, and 0.233 respectively, all have a p-value of 0.000. While this analysis is sufficient to prove beyond a reasonable doubt that the opportunity consumers have to save money relative to an 80%

AFUE furnace is positively correlated with the market share of condensing furnaces, it may not be the easiest or most intuitive way to look at the data.

Another interesting feature of Figure 1 is that the intercept of the y-axis is above 50%, meaning that the expected market share of condensing furnaces is above 50%, even if there is no economic incentive to install them. This suggests that if there is a market failure, according to DOE's LCC model, the market failure is that consumers choose more efficient products slightly more often than they should be based on economics alone.

Figures 2 and 3 show the market share of condensing furnaces vs. average LCC savings with individual data points averaged by state. Again, there is a positive correlation between savings and market share in replacement and new construction applications. Unsurprisingly, in the case of new construction, LCC savings are higher, and there are no regions with a negative average LCC savings (because serious venting issues in new construction, designed for a condensing furnace, should never occur). Note that this portion of the analysis weights each region the same even though the number of data points between regions is not the same.

Figure 2: Average LCC savings vs. market share of condensing furnaces for replacement applications

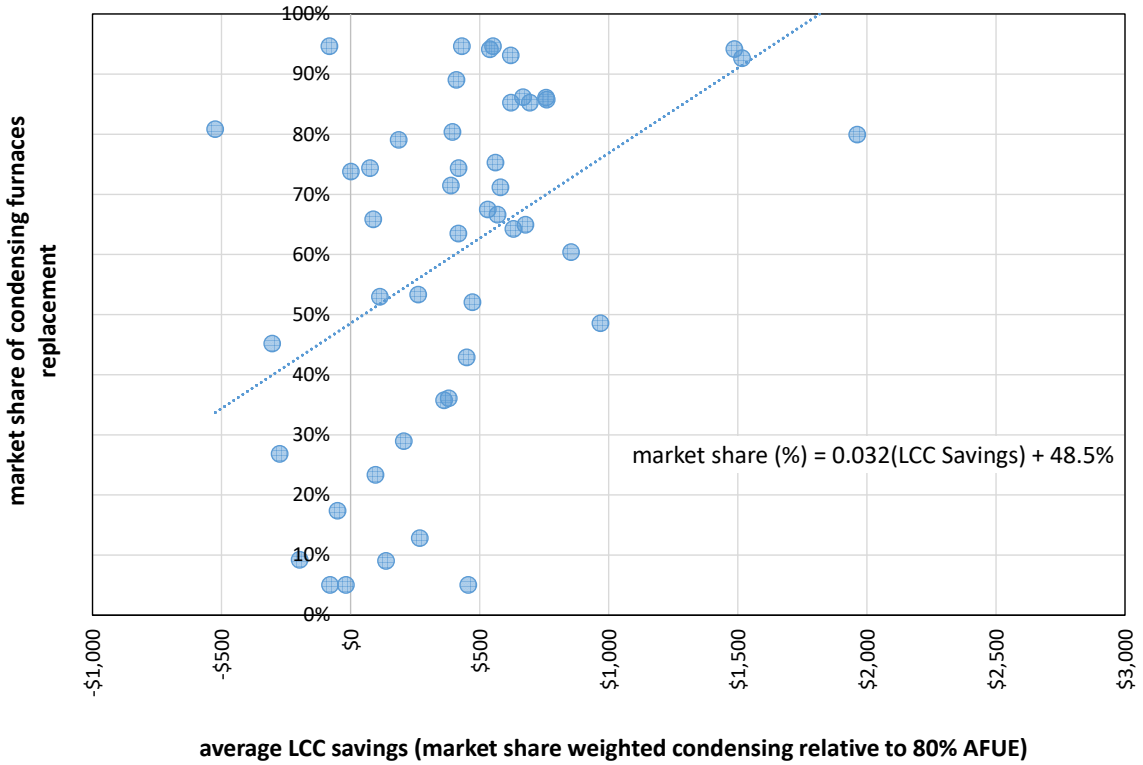
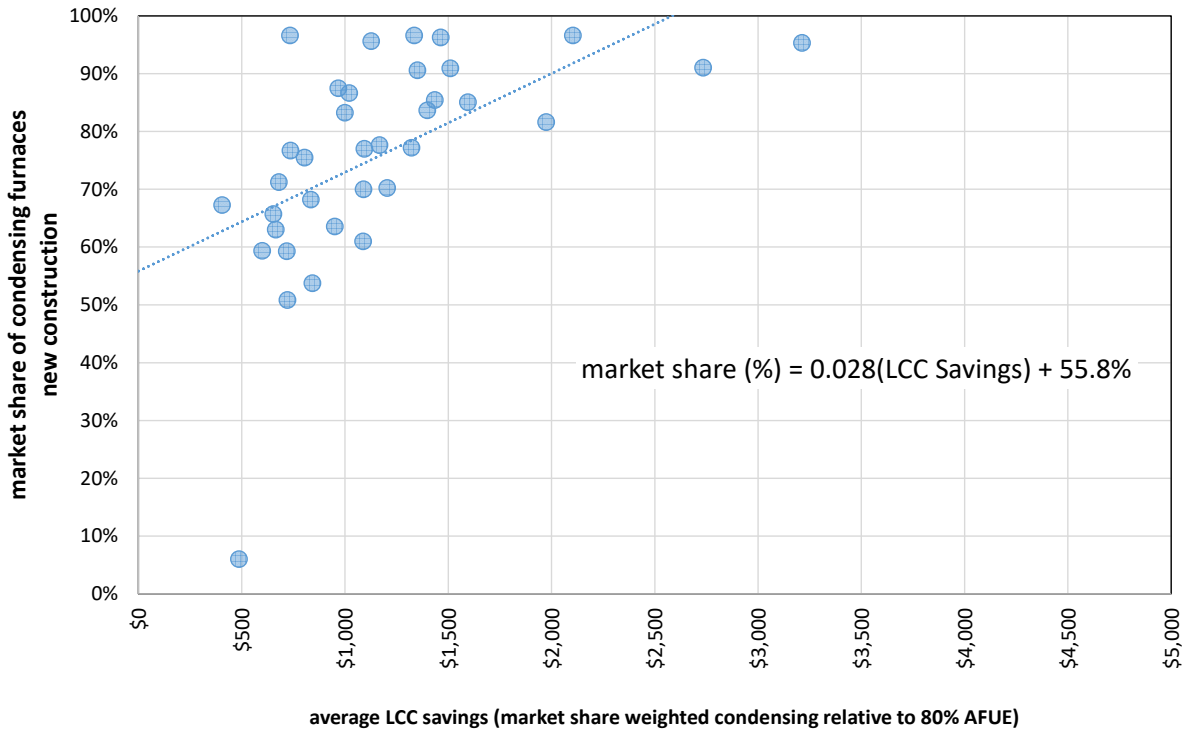
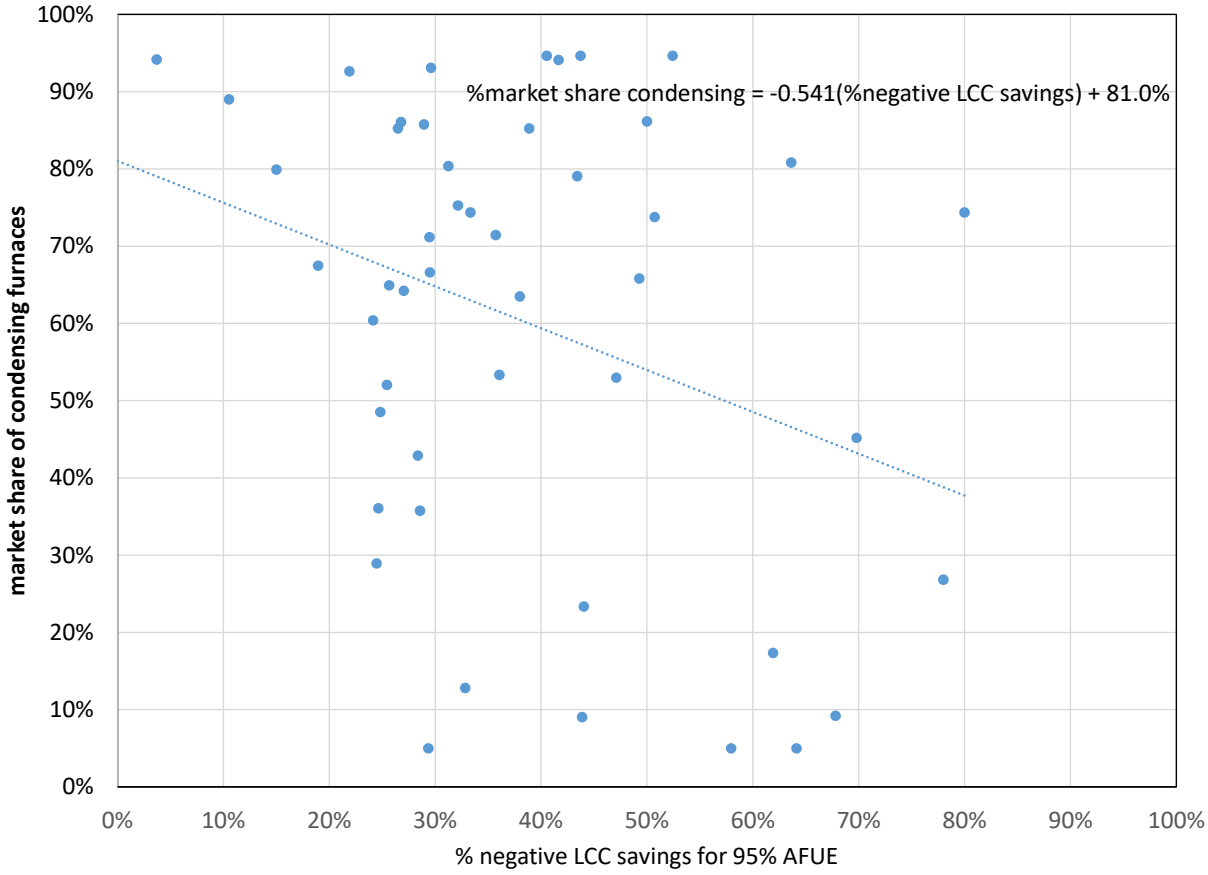


Figure 3: Average LCC savings vs. market share of condensing furnaces for new construction applications



Percent of negative outcomes is another way to look at the data produced by this analysis. One would expect that if consumers were paying attention to economics, however imperfectly, there would be a negative correlation between the percent of negative LCC outcomes in a region and the market share in that region. If a large fraction of consumers experienced negative financial consequences from adopting condensing furnaces, one would expect that the market share of condensing furnaces in that region would be low. In this case, the analysis was limited to replacement situations as there are few negative outcomes in new construction situations. The Pearson correlation coefficient for the data displayed in Figure 4 is -0.321 with a p-value of 0.026, meaning that these data are negatively correlated with 97.4% certainty.

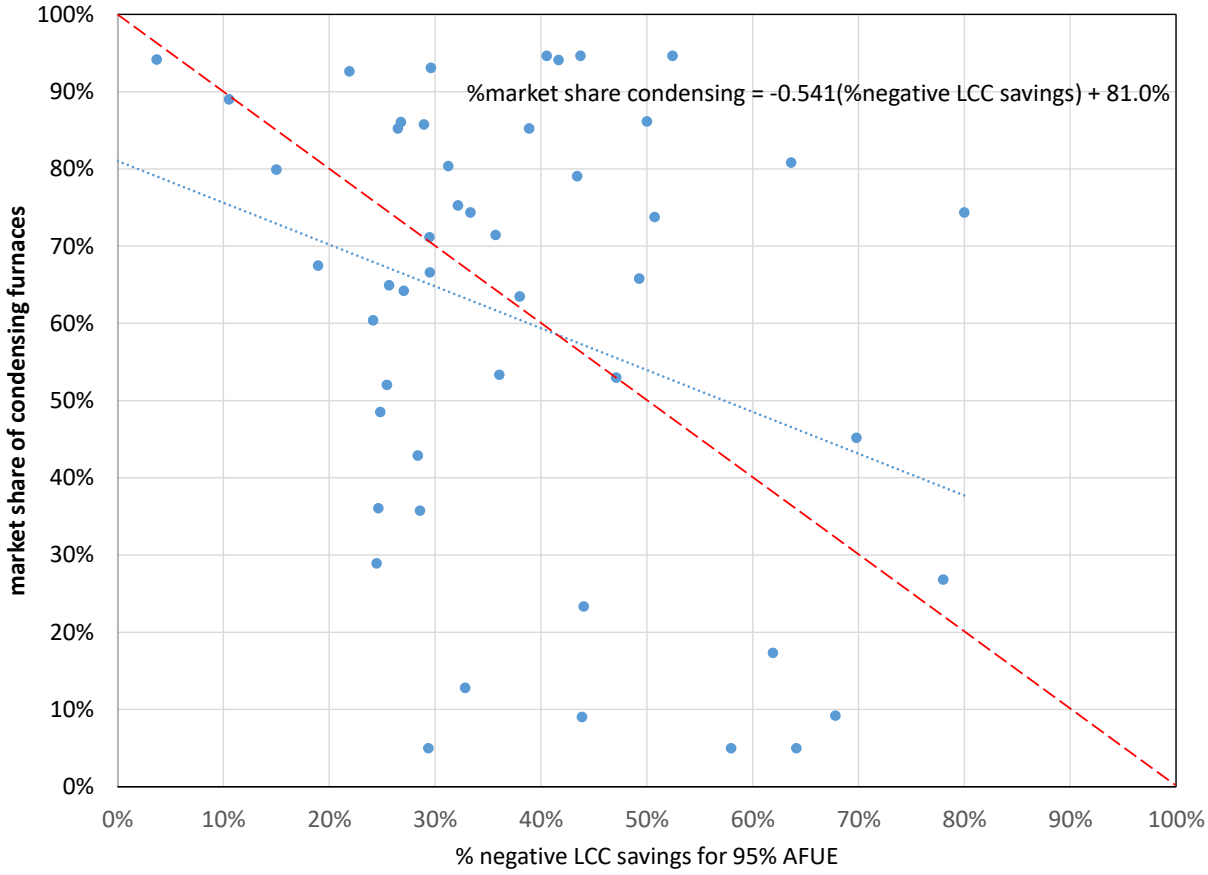
Figure 4: Percent of negative LCC outcomes for a 95% AFUE furnace relative to an 80% AFUE furnace vs. market share of condensing furnaces



If consumers were perfectly assessing economic impact, all of the data points would fall on a line with 100% market share at 0% negative LCC outcomes and 0% market share where there are 100% negative LCC outcomes. Outcomes above the line indicate that the market share of efficient products is higher than it should be, and outcomes below the line indicate that the market share of efficient products is lower than it should be in a given region. Figure 5 shows this red line added to the prior Figure 4. There are 48 total data points on the graph, and 25 of them are above the line. These 25 points represent 53.6% of the underlying replacement trial cases. This shows again that if there is a systematic market error, the error is more likely that consumers are choosing overly efficient products than are economically justified than the opposite. However, on

the whole, it appears that consumers, on average, are doing an excellent job of assessing economics and choosing products accordingly.

Figure 5: Percent of negative LCC outcomes for a 95% AFUE furnace relative to an 80% AFUE furnace vs. market share of condensing furnaces with "perfect" market line added.



This analysis, using DOE's LCC modeling spreadsheet, irrefutably and conclusively demonstrates that DOE's method of randomly assigning furnace efficiencies in its base case is improper. Moreover, it demonstrates that any market failure results in greater adoption of high-efficiency equipment than would be expected by economics alone

Therefore, DOE's use of random assignment of furnace efficiencies is a fatal defect in its methods of the economic justification of the proposed standards. As a result, DOE overstates the

benefits of the proposed standards for NWGF and MHGF in this rulemaking. This analysis is sufficient to show that DOE's LCC model is flawed; therefore, the economic justification for the proposed standards in this rulemaking proceeding is unsound. DOE should not issue a final rule based on this fatal analytical error—the defect being that consumers do not consider economics at all when selecting furnace efficiencies.

2. DOE's Economic Analysis is Highly Sensitive to Equipment Lifetime Assumptions, but the Assumed Consumer Furnace Lifetime Used in that Analysis is Neither Reasonable Nor Justified, Rendering the Economic Modeling Arbitrary and Capricious

DOE's Consumer Furnace Life-Cycle Cost and Payback Period Analysis Spreadsheet used to analyze the economic impacts of the proposed standards relies on unsupported assumptions regarding equipment lifetime that render its results unsupported, unreasonable, and arbitrary. More specifically, the LCC Spreadsheet incorrectly assumes that all consumer gas furnaces have the same lifetime regardless of energy efficiency. Since condensing furnaces are subject to condensing, acidic water vapor, contain more parts and are generally more complex, it is unreasonable to assume condensing furnaces would not have a shorter lifetime than non-condensing furnaces. Indeed, the shorter lifespan of condensing products is well documented by actual data and studies that the NOPR fails to confront. The most reliable source for residential furnace life expectancy is provided by the American Society of Heating, Refrigeration and Air-Conditioning Society ("ASHRAE"), which indicates that 18 years is the most accurate factor that DOE should use.[117] Additionally, the DOE model also arbitrarily assumes, contrary to experience and data, that the mean equipment lifetime is 22.5 years in the North, where heating equipment is subject to more strain and use, and 20.2 years in the rest of the country. These unsupported

[117] *See* HVACR Equipment Life Expectancy, available at https://hvac-eng.com/hvacr-equipment-life-expectancy (last visited October 5, 2022).

assumptions render the NOPR's economic analysis equally unreasonable and would render any final rule that relies on it arbitrary, capricious, and contrary to law.

To understand the impacts of different lifetimes on the life-cycle-cost savings of NWGF products, AGA conducted an analysis using DOE's LCC model spreadsheet. The effect of a shorter assumed lifetime is a reduced LCC because fewer years of operation and maintenance are included in the calculation. The subsequent analysis presented in these comments demonstrates that even modest changes in assumed equipment lifetime produce significant changes in the life-cycle cost savings.

The default DOE LCC model calculates the cost of non-weatherized gas furnaces over the lifetime of the furnace discounted back to the present. This approach is valid if, and only if, the different furnaces being compared are considered to have the same lifetime, which DOE assumes is the case in its analysis. However, the assumption that the lifetime of condensing and non-condensing furnaces is the same is not supported by any evidence.

To examine the effect of different lifetimes on DOE's economic LCC analysis, AGA tested the sensitivity of DOE's LCC model to equipment life. Specifically, in the LCC model spreadsheet, and within the tab "LCC&PB Calcs," AGA changed cells AH6:AH10 and AH18:AH22 to 20 years. AGA then modified the LCC calculation to add a cost for a replacement furnace in the event the lifetime is lower than 20 years and discount it back to the present value. AGA chose twenty years because it is close to the mean lifetime specified in the DOE model, where the mean lifetime is 22.5 years in the north and 20.2 years in the rest of the country. Initially, both lifetime and discount rates were not modified relative to the baseline DOE LCC model-generated values. The added cost is the retail cost of the furnace at the indicated efficiency plus the minimum installation cost for each. The rationale for using the minimum is that even if there were an extra

cost associated with venting for the initial installation, this cost would not be incurred for a replacement.

Making this change to the lifetime assumption slightly changes the 20-year cost relative to the LCC in the DOE baseline model because the periods over which costs are calculated are different and because, in some cases, the cost of replacements is included in the 20-year cost (if the lifetime of the furnace is less than 20 years). The adjusted model shows savings in the range of $407 to $464 over 20 years:

	20 year cost/LCC cost (80% AFUE)	20 year cost/LCC cost (95% AFUE)	Cost Savings (95% AFUE)
DOE baseline model	$13,864	$13,217	$464
20 year cost model	$14,023	$13,468	$407

The overall intent of this work is to look at the effect that a difference in furnace lifetime would produce in expected savings. Because different lifetimes are used for some of the electric fuel switching options, and the effects of fuel switching are not relevant to the test explored in this particular analysis, the remainder of this analysis was conducted with fuel switching turned off. Turning off fuel switching in the DOE model and using a 20-year cost assumption produces the following results.

	20 year cost/LCC cost (80% AFUE)	20 year cost/LCC cost (95% AFUE)	Cost Savings (95% AFUE)
DOE baseline model	$13,864	$13,250	$246
20 year cost model	$14,040	$13,513	$200

As discussed earlier, it's reasonable to assume that condensing furnaces may have shorter lifetimes relative to non-condensing furnaces. To simulate this impact of a shorter condensing furnace lifetime relative to non-condensing furnaces, the lifetime given by the DOE model was discounted by small amounts to look at the effect on savings. This was done by multiplying the

DOE-generated equipment lifetime by a constant factor (0.95 for a 5% reduction in equipment lifetime, 0.93 for a 7% reduction in equipment lifetime, and so on). This analysis, using a reasonable modification of DOE's LCC model, demonstrates that if the lifetime of condensing equipment is less than non-condensing equipment by even 11%, LCC savings are negative, and the proposed standard for NWGFs cannot be economically justified. Notably, the 11% reduction from 20 years would make the life 17.8 years, which is below the 18 years life assumed by ASHRAE.

Reduction in condensing equipment lifetime	**20 year cost/LCC cost (80% AFUE)**	**20 year cost/LCC cost (95% AFUE)**	**Cost Savings (95% AFUE)**
20 year cost model (no reduction)	$14,040	$13,513	$200
5% reduction	$14,040	$13,633	$114
6% reduction	$14,040	$13,661	$94
7% reduction	$14,040	$13,688	$77
8% reduction	$14,040	$13,722	$57
9% reduction	$14,040	$13,754	$35
10% reduction	$14,040	$13,790	$13
11% reduction	$14,040	$13,822	-$8
12% reduction	$14,040	$13,855	-$32

Note the sensitivity to lifetime equipment assumptions alone is enough to erode any purposed economic savings of banning non-condensing equipment and requiring condensing equipment to meet a 95% AFUE or higher efficiency standard. This analysis examines the impacts on LCC savings and the demonstrated sensitivity of DOE's simulated approach by adjusting in a reasonable manner just one variable in DOE's LCC modeling spreadsheet. Numerous other obvious flaws in the modeling spreadsheet and methodology, such as random furnace assignment errors that create absurd outcomes such as trial cases where the first cost of condensing equipment is lower than non-condensing equipment. These flaws are detailed in other areas of these comments.

3. DOE's Economic Analysis Depends on Completely Random Factors that are Not Supported by Evidence, Logic or Reason

On top of the LCC model's numerous flaws, its results, which the NOPR relies on for justification, depend on wholly random factors that are not supported by evidence, reason, or logic. As previously noted, DOE first presented for public review an LCC modeling spreadsheet dated June 15, 2022. When operated as presented and instructed, the LCC model spreadsheet produced summary results inconsistent with DOE's TSD provided in support of this rulemaking. That is, stakeholders could not reproduce or test DOE's results.

AGA and several other groups expressed concerns regarding the inconsistency of the TSD and DOE's LCC model.[118] DOE must have recognized its error because it released a new version of the LCC model spreadsheet on August 24, 2022. This updated version did produce summary results consistent with the TSD. The core difference between the two LCC model spreadsheets was that the August 24, 2022 version used a random "seed" number to drive a random number generator utilized within the LCC model's Monte Carlo analysis. Using a seed number like this ensures that future simulations run the exact same random (or in this case pseudo-random) simulations.

Use of a seed number generator in a Monte Carlo analysis is not by itself concerning. Monte Carlo analyses model various outcomes based on different scenarios. When those scenarios are randomly generated, a seed number allows others to run the same scenarios to see the same results. However, even when different random scenarios are used, *i.e.,* without the same "seed," one would expect any reasonably accurate model to generate at least similar results under a similar range of random but similar scenarios. In other words, the determining factor of whether a Monte

[118] *See e.g.,* Attachments E and F and transcripts of the August 3 and September 6, 2022 webinars.

Carlo analysis shows that a regulatory choice is cost-justified should not be based on one random scenario, but rather outcomes that are most likely. That is not the case here.

This is exemplified by comparing the results from using DOE's June 15, 2022 LCC spreadsheet to its August 24, 2022 spreadsheet. First, by modifying the June 2022 LCC model so that the cost comparisons are made assuming a 20-year lifetime (as before) results in the following:

	20 year cost/LCC cost (80% AFUE)	20 year cost/LCC cost (95% AFUE)	Cost Savings (95% AFUE)
DOE baseline model	$12,533	$11,918	$507
20 year cost model	$12,710	$12,181	$456

Performing the exact same test in the August 24, 2022 spreadsheet generates the following:

	20 year cost/LCC cost (80% AFUE)	20 year cost/LCC cost (95% AFUE)	Cost Savings (95% AFUE)
DOE baseline model	$13,864	$13,217	$464
20 year cost model	$14,023	$13,468	$407

Next, turning off fuel switching and making the same modifications to the model to produce a 20-year cost comparison results in the following with the June 15, 2022 LCC Spreadsheet.

	20 year cost/LCC cost (80% AFUE)	20 year cost/LCC cost (95% AFUE)	Cost Savings (95% AFUE)
DOE baseline model	$12,533	$12,115	$153
20 year cost model	$12,722	$12,387	$105

But the following with the August 24, 2022 spreadsheet:

	20 year cost/LCC cost (80% AFUE)	20 year cost/LCC cost (95% AFUE)	Cost Savings (95% AFUE)
DOE baseline model	$13,864	$13,250	$246
20 year cost model	$14,040	$13,513	$200

Finally, to simulate the sensitivity of shorter equipment lifetime, the lifetime given in the DOE model was discounted by small amounts to look at the effect on savings.

Reduction in condensing equipment lifetime	20 year cost/LCC cost (80% AFUE)	20 year cost/LCC cost (95% AFUE)	Cost Savings (95% AFUE)
20 year cost model (no reduction)	$12,722	$12,387	$105
5% reduction	$12,722	$12,507	$27
6% reduction	$12,722	$12,534	$6
7% reduction	$12,722	$12,561	-$16
8% reduction	$12,722	$12,592	-$37
9% reduction	$12,722	$12,620	-$53
10% reduction	$12,722	$12,655	-$80

Note in this case, using the earlier as-released LCC model, if the lifetime of condensing equipment is less than non-condensing equipment by only 7%, the resulting LCC savings of the proposed standard are negative. Again, this is without removing or modifying the other identified flaws in DOE's analysis. However, the following table uses the August 24, 2022 spreadsheet, indicating that an 11% reduction in the lifetime of condensing equipment results in negative LCC savings.

Reduction in condensing equipment lifetime	20 year cost/LCC cost (80% AFUE)	20 year cost/LCC cost (95% AFUE)	Cost Savings (95% AFUE)
20 year cost model (no reduction)	$14,040	$13,513	$200
5% reduction	$14,040	$13,633	$114
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10% reduction	$14,040	$13,790	$13
11% reduction	$14,040	$13,822	-$8
12% reduction	$14,040	$13,855	-$32

By analyzing in this manner the two different as-presented DOE LCC model spreadsheets released as part of this rulemaking, it is clear that the modification of an arbitrary random number in the LCC model spreadsheet alters in a fundamental and meaningful manner not only the results

of a LCC analysis but the conditions within which assumptions may be tested and understood. A random number should not be the critical factor that alters the experimental result of a test conducted to test various assumptions within the LCC model spreadsheet.

DOE's modeling approach is fundamentally flawed, being shaped by random numbers producing inconsistent results and, in some cases, profoundly different economic analyses. The only conclusion that can be reached is that DOE's LCC model is fundamentally flawed in its basic analytical structure. Any conclusions that DOE draws from the LCC model, including using numbers from the LCC Spreadsheet to calculate payback periods and other elements of whether the standards would be economically justified, are therefore equally flawed.

4. DOE's Analysis of Projected Energy Savings is Flawed

DOE's analysis of energy savings is flawed. As an initial matter, it is improper for DOE to include fuel switching in the energy saving and economic justification of a consumer natural gas furnace standard. In the NOPR, DOE erroneously claims that it does not need to limit its analysis to the consideration of the covered product or covered products likely to result from the Proposed Rule to the covered product type (or class) that would be subject to the Proposed Rule.[119] EPCA, however, requires that DOE consider "the savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered products which are likely to result from the imposition of the standard."[120] In short, this provision directs DOE to compare savings in operating costs throughout the estimated average life of a category of products, *i.e.*, a natural gas furnace.

[119] NOPR, 87 Fed. Reg. at 40628.
[120] 42 U.S.C. § 6295(o)(2)(B)(II).

Furthermore, EPCA states that the comparison includes any increase in the price of, or in the initial charges for, or maintenance expenses of a category of products, *i.e.*, a natural gas furnace. EPCA does not direct or permit the comparison of savings or expenses for a particular category of products with the savings or expenses of a different category of products. In other words, the same category of products must be compared, *i.e.*, natural gas appliances are compared to natural gas appliances. EPCA does not envision DOE comparing an electric furnace versus an oil furnace versus a natural gas furnace. Such an analysis contradicts EPCA and what must be considered in determining whether standards are economically justified.[121]

Moreover, DOE's own analysis, which includes fuel switching, concludes that the Proposed Rule will increase energy use, which contradicts the purpose of EPCA. DOE's LCC Model is DOE's method for analyzing the economic and energy usage impacts on individual consumers from potential energy efficiency standards for non-weatherized gas furnaces and mobile home gas furnaces. DOE is required to demonstrate that the proposed standards would save energy. However, an analysis of the projected energy savings demonstrates that consumers that fuel switch due to the proposed standards for non-weatherized gas furnaces result in higher overall energy consumption. DOE does not correctly report the aggregate energy increases resulting from the Proposed Standard.

AGA analyzed the results of the 10,000 simulation trials provided by DOE. AGA compared the consumption for each building simulated and the average consumption over the 2025-2050 timeframe developed in the technical support document, Appendix 10B, and Full Fuel Cycle Analysis. AGA conducted an additional sensitivity analysis by setting all of DOE's 10,000 trials to an 80% AFUE baseline to evaluate the maximum savings potential, *i.e.,* a baseline that

[121] *See* 42 U.S.C. § 6295(o)(2)(B)(i)(I).

incorrectly assumes all installed furnaces have an 80% AFUE and no consumers have installed more efficient furnaces, which demonstrated a positive savings of 8.1 MMBtu per year, based on assuming replacement with 95% AFUE furnaces. However, based on the randomly assigned distribution of 5,672 rule-affected trials, the average savings is much lower and only reduce consumption by 4.1 MMBtu per year. This equates to a 9% reduction in consumption based on an average usage of 46.2 MMBtu. For consumers who had fuel switched, the overall impact was negative, *i.e.*, it resulted in *more* energy being used than the baseline gas or propane furnace. Of the 887 trials that fuel switched, the average usage grew by 0.9 MMBtu because of fuel switching.

Even still, the rule would negatively impact energy efficiency for far more consumers in multiple regions of the country than DOE's national or regional comparison summaries suggest. For NWGF only, which represents more than 90% of all gas and propane furnaces in use today, DOE has concluded that the overall positive net benefit of $464 is a reasonable representation of the rule's impact on the average U.S. consumer. The technical support document states that 56.7% of buildings in the U.S. will be affected by the rule and that only 16.6% of all buildings will have a negative outcome. This means that nearly one in three residential and small commercial buildings that see an impact from this rule will pay more to heat than otherwise over the life of the equipment. The 16.8% of buildings with lower efficiency condensing furnaces (90% and 92%) see far fewer negative outcomes because of the rule. Under the NOPR, 95% of all negative outcomes affected buildings, with an 80% efficiency NWGF accounts for 70% of all rule-affected cases. The analysis done by DOE misses the disproportionate impact on a specific product class by combining condensing and non-condensing furnaces into a single modeled output.

DOE also fails to acknowledge that with a condensing furnace, consumers will use more electricity in addition to fuel savings. This exchange in site energy usage, which results in higher

electricity usage, is not reflected in the marketed AFUE of 95%. DOE's model may also be underestimating the impact from a higher fan load while using a condensing furnace because the overall difference between the two for all rule-affected trials that were assigned an 80% efficiency unit in the baseline is 31 kWh (344 kWh vs. 375 kWh).

In short, DOE should not incentivize fuel switching in the Proposed Rule, and DOE should recognize that fuel switching, under the Proposed Rule, would increase overall energy consumption, which runs counter to the objectives of an energy conservation standard. DOE cannot economically justify efficiency improvements when its analysis is based on fuel switching, as such an action is not authorized by EPCA. Moreover, the Department should not issue a final rule claiming that such an action will save energy when it increases energy consumption.

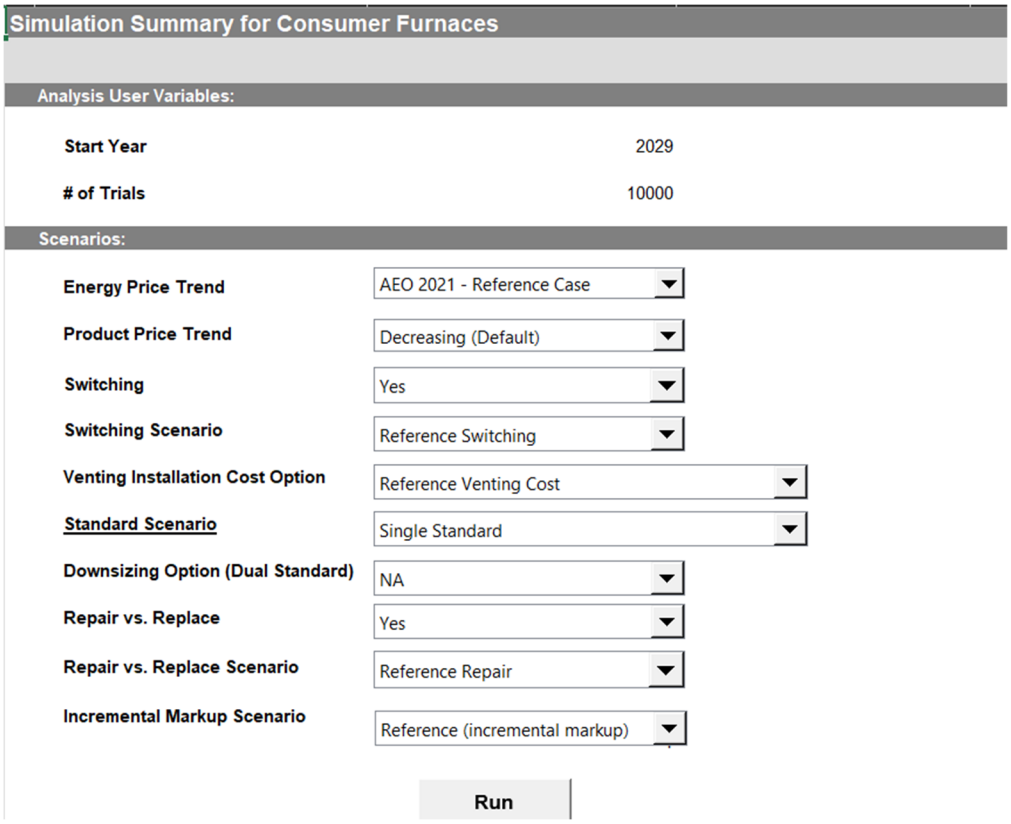
a. DOE's Economic Justification is Flawed and Fuel Switching Should Not be Used to Justify the Proposed Rule

DOE's economic justification suffers a critical defect as it relies on cost savings associated with fuel switching to justify its proposed standards for covered consumer gas furnaces. The use of any savings in operating costs resulting from the elimination of a covered product and the substitution for a different energy source and appliance cannot be used to justify the standard for that product.

DOE reports an average life cycle savings of $464 to justify its proposed non-weatherize gas furnace standard. However, most of the purported cost savings that comprise this average result from consumers switching from natural gas to electricity, which is highly regionally sensitive, *i.e.*, more significant amounts of fuel switching in southern states. DOE's model determined that 8.9% of all buildings would switch from natural gas to electric heating or 15.7% of all buildings affected by the rule. In addition, while the average LCC savings is $464, the median LCC savings is $160. This would suggest that half of all rule-affected buildings would save $160 or less from this rule.

The LCC model spreadsheet utilized for this rulemaking allows DOE and the public to independently assess the rule's economic costs and benefits, including the direct impacts of fuel switching. More specifically, the model projects the degree of fuel switching and its impacts through an input that can be switched off. This option within the LCC model spreadsheet is shown in the following exhibit:

LCC Model Spreadsheet Summary Tab Scenarios Selection – Indicates that Fuel Switching May Be Toggled "Yes or No" (i.e., On or Off)



When the "Switching" tab is changed to "No"— that is, fuel switching is "turned off" and excluded from the analysis— the model produces an average savings of $246, a 47% decrease in average savings. Turning off fuel switching in the model also increases the average payback for a 95% AFUE non-weatherized gas furnace to 25.2 years, which is three years beyond the average 21.6-year lifespan of the new furnace assumed in the model and 7.2 years beyond the 18-years

lifespan for furnaces estimated by ASHRAE. In other words, nearly half of the LCC savings that DOE claims will result from the Proposed Rule are the direct result of fuel switching to electricity, which is presented as evidence that the rule is economically justified. When fuel switching is not an option within the model, the total payback period for a 95% AFUE non-weatherized gas furnace is longer than the lifetime of the equipment itself.

Summary Table from DOE's Furnace Rule LCC Model – Fuel Switching Turned Off

Simulation Results NATIONAL - 10000 samples — *Note: Fractions refer to Large furnaces* — AEO 2021 - Reference Case

			Average LCC Results									Payback Results		
	Level	Description	Installed Price	First Year Oper. Cost	Lifetime Oper. Cost*	LCC	LCC Savings	Simple LCC Savings	Net Cost	No Impact	Net Benefit	Simple PBP	Average	Median
NWGF	0	NWGF 80%	$3,310	$664	$10,554	$13,864	NA	NA	NA	100%	NA			
NWGF	1	NWGF 90%	$3,767	$622	$9,791	$13,558	$57	$306	22%	60%	18%	10.9	47.6	19.8
NWGF	2	NWGF 92%	$3,778	$613	$9,655	$13,433	$143	$431	20%	60%	20%	9.2	39.9	16.6
NWGF	3	NWGF 95%	$3,786	$601	$9,464	$13,250	$246	$614	18%	43%	39%	7.5	25.2	7.7
NWGF	4	NWGF 98%	$3,963	$592	$9,326	$13,289	$104	$575	56%	2%	42%	9.0	34.6	16.3
MHGF	0	MHGF 80%	$2,084	$521	$8,447	$10,531	NA	NA	NA	100%	NA			
MHGF	1	MHGF 90%	$2,409	$488	$7,961	$10,370	$144	$161	28%	30%	42%	9.8	23.7	8.7
MHGF	2	MHGF 92%	$2,423	$481	$7,844	$10,267	$243	$264	24%	30%	46%	8.3	16.5	7.8
MHGF	3	MHGF 95%	$2,434	$474	$7,737	$10,172	$308	$360	23%	21%	55%	7.4	13.2	5.9
MHGF	4	MHGF 96%	$2,440	$475	$7,747	$10,187	$230	$344	40%	1%	59%	7.7	12.7	6.0

To further illustrate the impacts of fuel switching on the reported average LCC savings DOE is using to justify its Proposed Rule, AGA developed an alternative review of DOE's as-presented LCC model spreadsheet and trial runs. This alternative approach was developed by examining all 10,000 trial cases and identifying the trials that resulted in fuel switching. To be clear, AGA was examining the as-presented LCC spreadsheet model DOE uses to justify the proposed standard. In this case, "Switching" is toggled "Yes"—that is, fuel switching is turned on and allowed in the model simulation.

As indicated previously, DOE's model shows that the Proposed Rule would result in 8.9% of households with non-weatherized gas furnaces to fuel switch. Those fuel-switching consumers correspond to 887 trial cases out of the 5,672 rule-affected trials. If the LCC savings associated with those 887 trials correspond to simulated households that switched to electricity due to the proposed standard, the average LCC savings drop by 52% to $226. Again, this alternative approach demonstrates that half of the LCC savings DOE claims will result from the proposed standard and

are the direct result of fuel switching to electric appliances. The significantly lower savings reflects the actual cost savings associated with the proposed standard on consumer furnace consumers and is not influenced by the impacts of fuel switching. The NOPR relies inappropriately on the purported economic savings of fuel switching to justify the proposed standard for consumer gas furnaces. Note that these average LCC savings of $226 are close to the $246 average LCC savings achieved when the "fuel switching" option in the LCC model spreadsheet is togged off. However, it is unclear why there is any difference, which further calls into question the modeling logic related to fuel switching.

DOE should not include LCC savings associated with fuel switching in its economic justification of consumer gas furnace standards. DOE must consider the cost savings from efficiency improvements without fuel switching. Furthermore, fuel switching, which takes place in 8.9% of trial cases, has a disproportionate impact (half) on the final LCC savings submitted as evidence for the economic justification of this rule.

To be sure, DOE has provided in the TSD an LCC savings analysis that appears to analyze costs under a no-switching scenario (Table 8J.6.1 in the TSD, page 887, copied in part below). However, the results of Table 8J.6.1 presented in the TSD do not entirely match the summary page within the LCC spreadsheet model. While the first year operation costs of $601 appear to be the same, AGA has not been able to validate the DOE-reported $291 savings under a no-switching scenario (Table 8J.6.1 in the TSD) within the model or in the output file provided in the docket. Stakeholders cannot assess how DOE came up with this number or meaningfully comment on it.

LCC, PBP, and Switching Results and Comparisons Presented in the Technical Support Document Table 8J.6.1

Table 8J.6.1 Results for No Switching Scenario for Non-Weatherized Gas Furnaces with Input Capacity Cutoffs

Input Cutoff	AFUE (%)	All Consumers*					Impacted Consumers**	
		Installed Cost	First Year Oper. Cost	Lifetime Oper. Cost*	LCC	Simple PBP	LCC Savings	Net Cost
0	80	3,310	664	10,554	13,864	NA	NA	0.0%
0	90	3,767	622	9,941	13,708	10.9	57	25.3%
0	92	3,778	613	9,805	13,583	9.2	145	23.5%
0	95	3,786	601	9,614	13,400	7.5	291	21.7%
0	98	3,963	592	9,476	13,439	9.0	193	58.4%

Summary Table from DOE's Furnace Rule LCC Model – No Switching Scenario

Simulation Results NATIONAL - 10000 samples — *Note: Fractions refer to Large furnaces* — AEO 2021 - Reference Case

			Average LCC Results									Payback Results		
	Level	Description	Installed Price	First Year Oper. Cost	Lifetime Oper. Cost*	LCC	LCC Savings	Simple LCC Savings	Net Cost	No Impact	Net Benefit	Simple PBP	Average	Median
NWGF	0	NWGF 80%	$3,310	$664	$10,554	$13,864	NA	NA	NA	100%	NA			
NWGF	1	NWGF 90%	$3,767	$622	$9,791	$13,558	$57	$306	22%	60%	18%	10.9	47.6	19.8
NWGF	2	NWGF 92%	$3,778	$613	$9,655	$13,433	$143	$431	20%	60%	20%	9.2	39.9	16.6
NWGF	3	NWGF 95%	$3,786	$601	$9,464	$13,250	$246	$614	18%	43%	39%	7.5	25.2	7.7
NWGF	4	NWGF 98%	$3,963	$592	$9,326	$13,289	$104	$575	56%	2%	42%	9.0	34.6	16.3
MHGF	0	MHGF 80%	$2,084	$521	$8,447	$10,531	NA	NA	NA	100%	NA			
MHGF	1	MHGF 90%	$2,409	$488	$7,961	$10,370	$144	$161	28%	30%	42%	9.8	23.7	8.7
MHGF	2	MHGF 92%	$2,423	$481	$7,844	$10,267	$243	$264	24%	30%	46%	8.3	16.5	7.8
MHGF	3	MHGF 95%	$2,434	$474	$7,737	$10,172	$308	$360	23%	21%	55%	7.4	13.2	5.9
MHGF	4	MHGF 96%	$2,440	$475	$7,747	$10,187	$230	$344	40%	1%	59%	7.7	12.7	6.0

5. The NOPR Fails to Address Significant Regional Differences in Costs and Benefits

The NOPR also fails to address significant regional differences in costs and benefits that will disproportionately impact millions of Americans. Regionally, the share of all buildings with condensing furnace equipment installed is higher in the north, where space heating requirements are higher and where DOE's model shows a greater share of high-efficiency condensing furnaces shipped and installed. Within the north, minimal fuel switching takes place in the model, but the average LCC savings and payback periods are still less or take longer than the national averages.

AGA developed the following tables based on the 10,000 simulated trial cases that DOE presented as evidence supporting the proposed rule for non-weatherized gas furnaces. For each analysis, tables marked in yellow correspond to DOE's No Switching Scenario and tables labeled in white correspond to DOE's unedited model.

Table 5.1: Regional Impact of 95% AFUE NWGF Rule

Region	Total Simulated Trial Count	Percent Affected	Percent of Total Negatively Impacted	Percent that Fuel Switched	Percent of Affected that are Negatively Impacted	Average Affected LCC Savings	Average First Year Savings (95% vs 80% Only)	Higher Residential Install Costs (95% vs 80% Only)	Total Affected Payback	Total Simple Payback
New England	276	42%	7%	1%	17%	$ 417.44	$ 125.54	$ 550.24	6.8	4.4
Middle Atlantic	1,579	37%	5%	1%	12%	$ 261.51	$ 77.55	$ 669.92	8.1	8.6
East North Central	2,376	43%	12%	1%	29%	$ 388.65	$ 65.76	$ 554.92	15.8	8.4
West North Central	750	41%	9%	3%	23%	$ 577.01	$ 58.93	$ 381.90	8.7	6.5
South Atlantic	1,326	79%	18%	23%	23%	$ 950.39	$ 79.63	$ 179.02	8.4	2.2
East South Central	672	77%	23%	14%	30%	$ 528.26	$ 40.44	$ 295.40	8.8	7.3
West South Central	1,040	79%	29%	21%	37%	$ 497.04	$ 36.12	$ 176.31	16.0	4.9
Mountain	987	66%	21%	13%	32%	$ 385.01	$ 42.80	$ 316.92	16.0	7.4
Pacific	994	61%	31%	8%	50%	$ (115.62)	$ 9.55	$ 426.49	31.0	44.7
Total	10,000	57%	17%	9%	29%	$ 463.96	$ 57.96	$ 417.06	14.1	7.2
North	5,697	41%	9%	1%	22%	$ 350.17	$ 68.06	$ 543.40	12.1	8.0
South	4,303	78%	27%	19%	34%	$ 543.18	$ 44.60	$ 249.78	15.5	5.6

There are many aspects of this table to note. While slightly smaller in terms of total market share, the south is where most consumers will see an impact from this rule and where 2/3rds of all negatively impacted trials are located. The Pacific region has the highest negative impact overall, with a negative LCC of $116 and 31% of all trials in Pacific states resulting in negative LCC savings (higher costs). The South Atlantic, East, and West South-Central regions present findings where nearly a quarter of all buildings, regardless of base case AFUE, will be negatively affected and between 10% and 20% are assumed to fuel switch. DOE's current rule must not ignore these negatively impacted sub-regions and consider alternatives to justify savings for all US consumers.

Table 5.2: Regional Impact of 95% AFUE NWGF Rule – No Switching Scenario

Region	Total Simulated Trial Count	Percent Affected	Percent of Total Negatively Impacted	Percent of Affected that are Negatively Impacted	Average LCC Savings	Average First Year Savings (95% vs 80% Only)	Higher Residential Install Costs (95% vs 80% Only)	Total Payback	Total Simple Payback
New England	276	42%	6%	14%	$ 457.09	$ 137.76	$ 551.42	7.3	4.0
Middle Atlantic	1,579	37%	5%	12%	$ 252.06	$ 88.19	$ 675.06	10.2	7.7
East North Central	2,376	43%	11%	25%	$ 417.16	$ 74.00	$ 562.88	18.7	7.6
West North Central	750	41%	9%	22%	$ 398.98	$ 68.01	$ 399.70	13.3	5.9
South Atlantic	1,326	79%	24%	31%	$ 368.14	$ 68.60	$ 330.73	25.3	4.8
East South Central	672	77%	21%	28%	$ 318.97	$ 52.58	$ 387.05	13.6	7.4
West South Central	1,040	79%	35%	44%	$ 157.02	$ 38.53	$ 305.17	27.8	7.9
Mountain	987	66%	28%	42%	$ 28.26	$ 33.70	$ 387.82	33.4	11.5
Pacific	994	61%	31%	50%	$ (78.21)	$ 28.79	$ 500.41	49.6	17.4
Total	10,000	57%	18%	32%	$ 246.13	$ 63.24	$ 475.15	24.4	7.5
North	5,697	41%	8%	20%	$ 341.25	$ 77.04	$ 552.29	15.8	7.2
South	4,303	78%	31%	40%	$ 179.91	$ 44.96	$ 373.01	30.4	8.3

Fuel switching has a disproportionate impact on projected LCC savings for consumers in the south. DOE reports savings of $543 when fuel switching is allowed. However, in the "No Switching" scenario, LCC savings in the South dropped to $181, a dramatic drop of 66%. Savings of $181 represent only 1.5% of the total LCC of the 95% AFUE non-weatherized gas furnace. Consumers in the south also have higher payback periods, with the average payback nearly exceeding the average lifespan of the furnace or 30.4 years, which far exceeds the expected lifetime of the furnace equipment of 18 years according to ASHRAE and 21.6 according to DOE's modeled averages. Because 92% of all trial cases where fuel switching occurs in the south, DOE has done a disservice to stakeholders by reporting LCC as national averages and for Northern states failing to illustrate (and possibly masking) the full breadth of regional impacts related to its proposed rule.

6. DOE's Analysis of Energy and Emissions Factors is Flawed

As previously discussed, DOE claims average LCC savings of $464 for 95% AFUE non-weatherized gas furnace standard. DOE's model is based on 10,000 simulated trials, with each simulated LCC worth a fraction of the total number of furnaces shipped yearly. DOE assumed that

approximately 3.3 million furnaces would be shipped in 2029 based on the current number of units shipped at the end of the 2010s. Therefore, the rule will impact millions of consumers annually and as many as 56 million natural gas and propane furnaces in use today.

To further examine the aggregate impacts of this rulemaking, AGA examined the individual LCC savings, installation costs, and first-year savings. To scale individual average impacts to a national scale, these individual values were multiplied by 323.9409, which is the average weighted worth of an individual trial AGA derived based on DOE's use of NWGF furnace shipment data.

In the first year the proposed rule would go into effect, DOE's model estimated it could cost all 3.3 million NWGF consumers $712.4 million in net increased installation costs, save $76.1 million in net first year operating costs, and save a net $852.5 million over the lifetime of the equipment with an average payback of 15.7 years. While the overall net savings are positive, the initial investment by consumers nearly matches the total net savings and takes over a decade to make a return on it.

The use of fuel switching as an alternative, which impacts 8.9% of all NWGF trials or 15.7% of all rule-affected outcomes, significantly impacts DOE's estimates of total savings from the proposed rule. Consumers that fuel switched in the model accounted for 59% of all lifetime savings or net savings of $502.3 million. Low assumed installation costs primarily drive these savings, which may not be a reasonable assumption. For example, the DOE assumes that if a building already has a heat pump for cooling or partial heating, it will not need to replace or upgrade the unit and will operate the unit just like a new one with a full lifespan (*See* Section 12, Worksheet Errors, below). Based on DOE's model, net installation costs for fuel-switched trials were negative $1.52 million, and net energy savings was $21.6 million.

Without using the fuel switching feature and only accounting for the potential savings from upgrading gas appliances to a 95% AFUE standard, the total net LCC savings is cut by 47% to $452.2 million. Total net installation costs are higher as well. Consumers pay during the first year of the new rule $901.8 million and provide $93.1 million in net first-year operating cost savings.

Not all consumers would experience a net positive impact from the rule. DOE's analysis shows that 16.6% of all trials or 29.3% of rule-affected trials face negative LCC savings. Isolating the trials with net negative LCC savings resulted in a total consumer cost of $305.9 million more over the life of the equipment. By contrast, the net positive LCC trials could save consumers $1,158.4 million, which includes fuel switching. The sum of these values equals the $852.5 million reported earlier. Under the no-switching scenario, the net loss to consumers is reduced to $258.2 million, while net positive trials were cut to $710.5 million in LCC savings, resulting in net savings of $452.2 million.

Annual energy cost savings are proportionally low compared to the total cost to heat all homes in the U.S. every winter. Based on the latest winter fuels outlook from the Energy Information Administration, the average natural gas customer spent $746 for the 2021-2022 winter season on space heating and $573 on the previous winter. Propane consumers spent more with the average reported winter heating cost of $1,789 for the 2021-2022 season and $1,157 the winter season before. During the winter of 2021-2022, 60.5 million homes were heated with natural gas, and 6.2 million were heated with propane.

Total expenditures for space heating using either fuel amounted to $56,191 million during the 2021-2022 winter heating season and $41,817 million the year prior. Comparing these actual annual costs to DOE's purported cost savings, the total savings from the proposed rule in the first year would reduce total expenditures on gas and propane space heating relative to recent

winters by 0.135% and 0.187%. Twenty years later, assuming most furnaces with an AFUE below 95% would have been replaced, this could amount to savings of 2.7% to 3.6% based on DOE's modeled results and historically low assumed adoption rate of condensing furnaces in their baseline.

7. Most of DOE's Negative Outcomes Are Associated with Buildings Utilizing Non-Condensing Furnaces; However, These Impacts are Masked by Including Benefits from Consumers that Have Homes Designed for Condensing Furnaces

Most of DOE's negative outcomes on the NOPR are related to building that utilize non-condensing furnaces. These impacts, however, are masked by the inclusion of consumers that have buildings designed for condensing furnaces. Specifically, ninety-five percent of the negative outcome trials are associated with buildings assumed to install 80% efficiency NWGF, which accounts for 70% of all rule-affected cases. For NWGF only, which represents more than 90% of all gas and propane furnaces in use today, DOE has concluded that the overall positive net benefit of $464 is a reasonable representation of the Proposed Rule's impact on the average U.S. consumer. The TSD states that 56.7% of buildings will be affected by the rule but that only 16.6% of all buildings will have a negative outcome. However, DOE's analysis shows that nearly one in three residential and small commercial buildings that are impacted by the rule will pay more to heat the structure than otherwise over the life of the equipment. The 56.7% rule affected market share also includes buildings with lower efficiency condensing furnaces (90% and 92%) that see fewer adverse outcomes because of the rule since these homes are already designed to accommodate condensing furnace equipment. In other words, DOE is masking the impacts of the Proposed Rule on consumers with non-condensing gas furnace equipment, which face significantly higher purchase and installation costs, by including the energy savings and lower installation costs of consumers that already have condensing furnace equipment installed.

This failure to properly account for consumers who would have already invested in condensing technology is also shown for consumers assigned a 95% or 98% AFUE furnace in the base case by the model. 3,096 out of 4,328 not affected trials would have had cheaper installation costs with an 80% AFUE furnace. The average installation cost for these households was $867 higher because of the condensing furnace, with an average savings of $81 in the first year. Many of these buildings are in regions with high penetration of condensing furnaces, which means many consider energy efficiency a priority over cost. DOE should revise its analysis to ensure that impacts are not inappropriately included by the inclusion of buildings that are designed for condensing equipment and consumer that already have condensing furnaces.

8. DOE's Cost Analysis is Flawed

A review of the assumptions in the DOE cost analysis calls into question the basis that the Department used in its cost determination of non-weatherized residential and manufactured home gas furnace, installation, and maintenance costs from what occurs in the marketplace. These assumptions are critical elements in determining the cost impacts of DOE's proposed minimum efficiency requirement of 95% AFUE for furnaces will have on consumers. AGA recommends that DOE undertake additional evaluation of cost installation and annual maintenance costs of non-weatherized residential and manufactured home gas furnaces to ensure a complete LCC and payback period analysis. A comprehensive analysis of the average installed replacement cost of an 80,000 BTU/hour, 80% AFUE non-condensing residential non-weatherized natural gas furnace is needed. The installed cost can be from approximately $3,100 to $7,200. For an 80,000 BTU/hour, 90%-Plus AFUE non-weatherized condensing natural gas furnace, the installed cost can be from approximately $5,300 to $9,100. It is understood that the wide differences between the 80% AFUE non-condensing residential non-weatherized natural gas furnace and the 90%+ AFUE models can be attributed to the region that it is installed and operating features such as 2-

stage or variable capacity models. The result is that DOE must assess the wide range of consumer costs of furnaces across the country to determine the basis of the LCC and payback period and the economic impacts on individual consumers of the proposed 95% AFUE minimum efficiency requirement for these products. Even with some sensitivity analysis, establishing averages on furnace cost, installation costs, annual maintenance cost, energy consumption, *etc.*, is not appropriate for this type of DOE consumer-covered product. As stated above, an extensive reevaluation of residential gas furnaces, both non-weatherized and manufactured home types, non-condensing, and condensing types, with their wide range of annual energy consumption depending on the climate and structure they serve and the variations of installation, particularly in the replacement market is not only warranted but vital in assessing the LCC and payback period for consumers.

a. DOE has Potentially Overestimated the Cost of Venting for Non-Condensing Furnaces

DOE has potentially overestimated the cost of venting for non-condensing furnaces. Looking at only new construction, where builders would ideally have better control over the design and installation of a new vent, the cost of a new vent is, on average, $1,520 based on what is presented in the TSD Table 8.2.12. This value includes several parts, labor, and markups. Compared to relining retrofits, this is double the cost presented in the replacement market.

The cost of a new construction vent is defined as being the parts of a new 4" vent type B, a 4" connector, and a 3" connector for the water heater. Each of these costs are based on a combination of material and labor costs with most of the expense going to labor. Other pieces of equipment also are comprised of several separate calculations. However, many of the same individual calculations used to build the vent are reused to determine other pieces of the installation.

One area where DOE may have overestimated is the length of pipe, which makes up half the cost of a new 4" vent. For buildings where the furnace was installed in the basement, the calculations appear to fit a typical 2-story home where the average vent length is 26 feet. However, for buildings where the furnace is in the attic the average length is 10 feet, which means up to 15 feet would more than extends beyond the roof. This impact is particularly sensitive to the South, where 5 out of 6 new homes have a furnace installed in the attic. This extra-long vent is also found with existing units as well.

DOE's method for calculating labor overestimates time spent on tasks because it includes an average unit of type for each individual part. In many cases, completing any given task takes the same 0.4-0.5 hours. For example, it takes 0.21-0.27 hours to install each foot of straight pipe, with the average attic pipe taking 2.1 hours to install. This total does not include each elbow or adjustment piece to fit the installation, which typically takes 0.4-0.5 hours each. This method of calculating labor oversimplifies the totals and results in higher estimates. Many tasks may have been completed concurrently with other pieces, such as the installation of an elbow or short 12" extension piece.

Actual Commerical Historical Prices vs Annual Energy Outlook Forecast

	Historical Data	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
		$ 11.34	$ 12.23	$ 10.06	$ 9.47	$ 8.91	$ 8.10	$ 8.08	$ 8.90	$ 7.91	$ 7.28	$ 7.88	$ 7.79	$ 7.61	$ 7.49	$ 8.78
Forecast Release Year Data	2010	$ 11.53	$ 12.29	$ 9.31	$ 8.92	$ 10.01	$ 10.36	$ 10.20	$ 10.14	$ 10.28	$ 10.38	$ 10.40	$ 10.46	$ 10.53	$ 10.65	$ 10.76
	2011		$ 12.32	$ 9.94	$ 9.15	$ 9.30	$ 9.03	$ 8.80	$ 8.52	$ 8.60	$ 8.68	$ 8.74	$ 8.84	$ 8.96	$ 9.19	$ 9.37
	2012			$ 10.06	$ 9.32	$ 8.82	$ 8.90	$ 8.86	$ 8.67	$ 8.82	$ 8.82	$ 8.85	$ 8.94	$ 9.06	$ 9.21	$ 9.49
	2013				$ 9.61	$ 9.04	$ 8.26	$ 8.66	$ 8.42	$ 8.29	$ 8.76	$ 9.03	$ 9.38	$ 9.57	$ 9.69	$ 9.83
	2014					$ 9.16	$ 8.29	$ 8.49	$ 9.29	$ 9.11	$ 8.91	$ 9.21	$ 9.62	$ 9.76	$ 9.70	$ 9.90
	2015						$ 8.36	$ 8.35	$ 8.82	$ 8.73	$ 8.76	$ 8.77	$ 8.81	$ 9.32	$ 9.82	$ 10.15
	2016								$ 9.24	$ 7.92	$ 7.46	$ 7.93	$ 8.54	$ 9.19	$ 9.58	$ 9.67
	2017									$ 8.28	$ 7.42	$ 8.14	$ 8.69	$ 9.33	$ 9.96	$ 10.07
	2018										$ 7.50	$ 8.11	$ 7.96	$ 8.33	$ 8.69	$ 8.88
	2019											$ 8.12	$ 8.01	$ 7.94	$ 8.14	$ 8.26
	2020													$ 7.80	$ 7.43	$ 7.58
	2021														$ 7.51	$ 7.95
	2022															$ 8.76

*Red highlighted cells note forecasted prices that were higher than what was reported historically by EIA.

9. DOE Continues to Utilize Energy Price Projections with an Upward Bias, Consistently Overestimates Future Natural Gas Costs, and Should Utilize Price Distributions Instead of a Mean

In the NOPR, DOE uses an energy price forecast based on the AEO that has consistently overestimated future natural gas energy costs. AGA conducted a review of forecasted prices versus actual prices using historical AEOs back to 2010. The AEO reported higher prices for residential consumers actually faced 70% of the period analyzed and 86% for commercial consumers nationally. The only year with higher actual versus forecasted prices is the most recent year or 2021 ("2022 AEO"), which is heavily impacted by the COVID-19 pandemic and widespread supply chain issues. The commercial water heater and boiler rule use the 2021 release year AEO.

While uncertainty is a significant factor in any projection or forecast, the statistically biased outcome towards higher prices in the AEO compared to what is actually reported historically presents a need for DOE's analysis to utilize a distribution of prices in its model simulations and not a forecasted mean. The figures below compare what EIA reports as actual prices versus what was projected in each AEO.

DOE uses EIA historical price data to generate an estimate of what the first year of usage should be for any given appliance and customer. In the Monte Carlo simulation, with the exception of fuel prices, all costs are reported in $2020 dollars and rely on 2020 or 2021 data. DOE did not update fuel or marginal pricing to match other base year costs despite the data being available before the last update on March 25, 2022. DOE noted but did not explain why it cannot update prices with the following comment "2020 prices incomplete within NG Navigator," even though the data is accessible on the EIA website.

Actual Residential Historical Prices vs Annual Energy Outlook Forecast

Forecast Release Year Data	Historical Data	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
		$ 13.08	$ 13.89	$ 12.14	$ 11.39	$ 11.03	$ 10.65	$ 10.32	$ 10.97	$ 10.38	$ 10.05	$ 10.91	$ 10.50	$ 10.51	$ 10.78	$ 12.24
	2010	$ 13.32	$ 13.87	$ 11.72	$ 11.21	$ 12.12	$ 12.21	$ 11.81	$ 11.74	$ 11.89	$ 11.99	$ 12.03	$ 12.10	$ 12.18	$ 12.30	$ 12.42
	2011		$ 13.99	$ 12.20	$ 11.31	$ 10.56	$ 10.44	$ 10.39	$ 10.28	$ 10.39	$ 10.50	$ 10.61	$ 10.74	$ 10.90	$ 11.16	$ 11.38
	2012			$ 12.25	$ 11.36	$ 10.65	$ 10.78	$ 10.69	$ 10.38	$ 10.56	$ 10.61	$ 10.67	$ 10.80	$ 10.94	$ 11.11	$ 11.42
	2013				$ 11.62	$ 11.05	$ 10.71	$ 10.72	$ 10.49	$ 10.39	$ 10.91	$ 11.24	$ 11.66	$ 11.89	$ 12.05	$ 12.24
	2014					$ 11.22	$ 10.69	$ 10.62	$ 11.44	$ 11.24	$ 10.92	$ 11.25	$ 11.71	$ 11.88	$ 11.85	$ 12.06
	2015						$ 10.86	$ 10.29	$ 10.80	$ 10.62	$ 10.48	$ 10.65	$ 10.84	$ 11.38	$ 11.92	$ 12.29
	2016								$ 11.08	$ 10.40	$ 9.70	$ 9.87	$ 10.28	$ 10.67	$ 11.08	$ 11.19
	2017									$ 10.58	$ 10.22	$ 10.91	$ 10.92	$ 11.06	$ 11.20	$ 11.31
	2018										$ 10.30	$ 11.17	$ 10.77	$ 11.19	$ 11.47	$ 11.59
	2019											$ 11.18	$ 10.75	$ 10.71	$ 11.00	$ 11.08
	2020													$ 10.80	$ 10.39	$ 10.53
	2021														$ 10.54	$ 10.81
	2022															$ 12.15

*Red highlighted cells note forecasted prices that were higher than what was reported historically by EIA.

10. DOE's LCC Model Makes Unreasonable Assumptions About Future Market Share of Condensing Furnace Equipment Shipments

The LCC model's cost savings relies on unreasonable and unsupported assumptions about what share of the market non-condensing furnaces would hold without the Proposed Rule's requirements. The model relies on data from the Air-Conditioning, Heating, and Refrigeration Institute ("AHRI") that shows the percentile of the market with furnaces that meet various AFUE levels from 1997 through 2015.[122] In 2015, non-condensing furnaces held 41% of the market for AFUE 80 furnaces. But that rate has trended down over time and continues to do so. For example, non-condensing natural gas furnaces held 54% of the market for AFUE 80 furnaces in 2006, 45% in 2009, and 41% in 2015. Despite this clear trend, the LCC model assumes non-condensing natural gas furnaces will retain 41% of the market through 2029.

[122] *See* DOE's model, excel tab labeled "AFUE Existing".

U.S. Consumer Furnace Shipment Market share by AFUE Reported in DOE Excel Model

AFUE Percentiles by Year (NWGF)																		
AFUE	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997
65	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
65	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
66	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
67	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
68	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
69	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
70	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
71	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
72	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
73	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
74	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
75	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
76	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
77	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
78	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
79	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
80	41%	41%	48%	49%	48%	42%	45%	51%	56%	54%	56%	58%	59%	68%	72%	76%	73%	75%	77%
90	41%	41%	48%	51%	51%	46%	50%	57%	62%	62%	64%	67%	69%	76%	79%	83%	80%	81%	83%
91	41%	41%	48%	51%	52%	47%	52%	59%	64%	64%	67%	70%	72%	79%	82%	85%	83%	84%	85%
92	60%	60%	65%	69%	71%	70%	74%	80%	84%	86%	89%	92%	94%	97%	97%	98%	97%	98%	98%
93	61%	60%	65%	69%	71%	71%	75%	81%	85%	87%	90%	93%	96%	98%	99%	99%	99%	99%	99%
94	61%	61%	66%	69%	71%	71%	76%	81%	85%	87%	90%	93%	96%	98%	99%	99%	99%	99%	99%
95	76%	76%	79%	81%	82%	82%	85%	88%	91%	92%	94%	95%	97%	98%	99%	99%	99%	99%	99%
96	97%	97%	97%	98%	98%	98%	98%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
97	98%	98%	98%	99%	99%	99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
98	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

This is not only contrary to clear trends but also to DOE's assessment of the market in other parts of its Proposed Rule. DOE claims in the NOPR that "[f]or each considered efficiency level in each product class, DOE calculated the LCC and PBP for a nationally representative set of housing units and, for NWGFs, commercial buildings."[123] For example, DOE's TSD provided a forecast for each AFUE level through 2058. That forecast projected that non-condensing furnaces would lose 10% of the market (from 40% to 30%) for AFUE 80 furnaces between 2029 and 2058. Found in DOE's TSD, Section 10 Figure 10.2.1. But even that assumption is unreasonable. As noted above, AHRI's data showed that non-condensing furnaces lost 10% of the AFUE 80 market between 2006 and 2015. DOE does not explain why that trend would not continue over the next 10 years (i.e., 2015-2025) or why it is reasonable to expect a slowdown in the trend that would reflect a loss in market share of only 10% over 43 years (2015-2058).

[123] NOPR, 87 Fed. Reg. at 40627.

DOE's Projection of NWGF Shipments by AFUE:

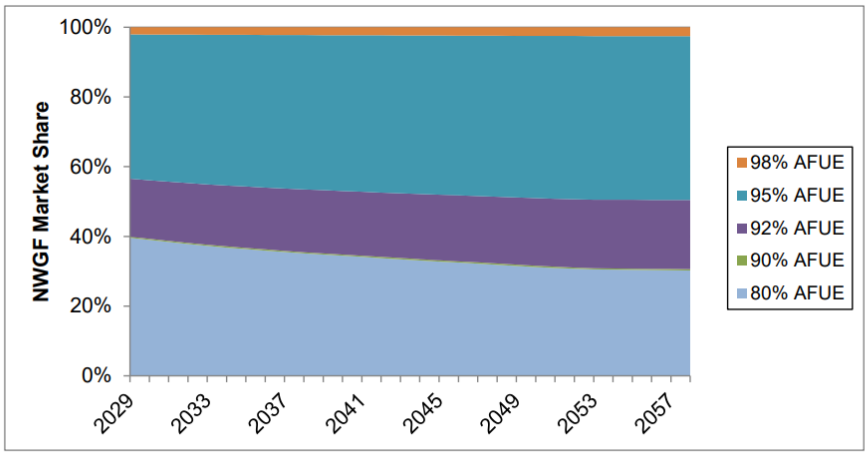


Figure 10.2.1 Projection of No-New-Standards Case Efficiency Distribution for Non-Weatherized Gas Furnaces, 2029-2058

In short, it is arbitrary and capricious for DOE to assume no change to the market for AFUE 80 furnaces in its LCC analysis. Even the Department's TSD suggests at least a 10% decrease in non-condensing furnace sales, and that number is unreasonably low because it fails to account for market trends. As with other aspects of the LCC analysis, DOE must revisit its unsupported assumptions about market share and replace them with data, assumptions, or estimates that are actually supported by evidence.

11. Shipment Data Relied on By DOE Could Not Be Verified

The model developed by DOE relies on data from the Residential Energy Consumption Survey ("RECS") 2015 database to randomly select buildings to model and determine if the rule would theoretically save money and lower consumption for the average U.S. consumer. The model randomly picks buildings based on probability weights created by DOE specifically for this rule, despite having weights used in the RECS database that can be verified by other governmental organizations. During the September 6, 2022 webinar, DOE said that the weights are representative of furnace shipment data, not RECS data. Unfortunately, the model only provides

the market share percentages and not the total number of shipments per state needed to verify this fact. Because of this lack of data, no one outside DOE can verify how they developed their probability weights and if they correctly represent the U.S. consumer. Put another way, this data is not supported by substantial evidence and appears to be an arbitrary and capricious selection by DOE.

Some cross-analysis has revealed that these weights do very closely resemble the RECS database in terms of North vs Rest of Country, but never match what the total market shares are for specific states or regions in the RECS survey. This suggests that DOE wants the numbers to resemble some of what is in the RECS database but failed to sync up individual states and possibly other characteristics like income. It is possible, though impossible to verify, that the furnace shipment data is for a single year and that state would not be 100% the same. However, many regions show such high margins of change that the model under-reports entire states by as much as 33%. Because the model depends on state-level price, cost multiplier, demographics, and climate to generate the final national average LCC, the model should represent the longer-term trend of customer growth and not a lagging indicator of shipments in the past year. If DOE uses weights based on shipment data, that data should reflect a multiyear average that fits the long-term trend of consumers as reported in the RECS, U.S. Census, and other Energy Information Administration surveys such as EIA 176.

Using furnace shipment data along with the RECS database may also present a problem not discussed by DOE. The model only simulates a single furnace for a given building. Single-family, multifamily, and commercial units can have multiple furnaces, even within a single residence, as shown in the RECS data. The use of 3.3 million units shipped per year can never properly be linked to the number of buildings being serviced per year or in total existence. Units

may have been shipped but not installed or returned to the manufacturer before installation. This is simply one example of how the use of furnace shipment data rather than the RECS market share data could distort the value of a given trial simulation by misrepresenting the probability that that building represents the average U.S. consumer.

Table M.1.1: Regional Differences Between Furnace Rule Market Shares and the 2020 Residential Energy Consumption Survey

Region	Total Trial Count	Residential Natural Gas Trials	Residential Natural Gas Retrofits	2020 RECS Natural Gas Count	Modeled Residential Retrofit % Market	2020 RECS Gas Residential % Market
New England	276	198	179	2,380,743	2.5%	4.3%
Middle Atlantic	1,579	1,433	1,185	9,130,573	16.4%	16.7%
East North Central	2,376	2,190	1,824	12,224,900	25.2%	22.3%
West North Central	751	652	493	4,898,790	6.8%	8.9%
South Atlantic	1,326	1,178	934	5,802,284	12.9%	10.6%
East South Central	671	564	486	2,059,091	6.7%	3.8%
West South Central	1,042	940	738	4,861,069	10.2%	8.9%
Mountain	985	923	680	4,776,645	9.4%	8.7%
Pacific	994	930	719	8,669,799	9.9%	15.8%
	10,000	9,008	7,238	54,803,892	100.0%	100.0%

Region	Total Trial Count	Total Propane Trials	Residential Propane Retrofits	2020 RECS Propane Count	Modeled Residential Retrofit % Market	2020 RECS Propane Residential % Market
New England	276	71	30	303,196	16.6%	6.9%
Middle Atlantic	1,579	118	29	519,192	16.0%	11.8%
East North Central	2,376	127	24	1,186,960	13.3%	27.1%
West North Central	751	55	12	755,772	6.6%	17.2%
South Atlantic	1,326	114	16	481,499	8.8%	11.0%
East South Central	671	81	28	213,617	15.5%	4.9%
West South Central	1,042	48	25	276,616	13.8%	6.3%
Mountain	985	37	15	264,213	8.3%	6.0%
Pacific	994	28	2	383,552	1.1%	8.7%
	10,000	679	181	4,384,618	100.0%	100.0%

The mismatches between modeled residential retrofit percentages and the 2020 RECS data for the residential natural gas and propane market lead to unrepresentative samples of households that undermine the validity of the model simulation used to justify the Proposed Rule.

12. Worksheet Errors

The worksheet suffers from several errors that must be corrected. For example, the Tab "Bldg Sample" includes weather data used to calculate the efficiency of a heat pump. From the EIA Residential Energy Consumption Survey "RECS" 2015 data, columns BP-BQ or DBT1 and DBT99 use data from one specific year and not the 10-year average provided on the Tab "Weather Data." However, the CBECS table under column GA-GB or Heating ODT and Cooling ODT does use the 10-year averages found in the Tab "Weather Data." The 10-year data provided in the "Weather Data" tab is colder than the single-year data used in the RECS 2015. This discrepancy has a noticeably negative impact on the overall LCC results in the model and does not reflect the data, evidence, or sound judgment.

Additionally, the worksheet's calculation of building energy use includes the waste heat from the blower motor used in the existing home. This waste heat is being doubled counted in the model because it is included in the intermediate calculations for space heating load. On the tab "Energy Use within cell E69," the model includes a 100% conversion of the rated wattage of the fan motor into thermal energy. This increased load is added to the estimated load taken from the RECS and CBECS database for all furnaces. This load should not be added as it is contrary to physics to consider the waste heat as both a load and a draw.

Moreover, the thermal load should already be included as part of the total load for gas furnaces using a similarly sized motor. It should not be added to the heating load for condensing furnaces unless those furnaces use a smaller or more efficient motor than originally present in the building. Where that is the case, only the difference in thermal waste heat between the original unit and the condensing or heat pump unit would need to be added to the new space heating or cooling demand load. Additionally, the thermal load assumed a 100% conversion based on the motor wattage. Fan motors have an electrical efficiency of at least 70%, which would cut the

thermal waste conversion to 30% or below the annual wattage of the unit. These inputs and related calculations in the model must be changed to reflect facts, data, and physics.

Importantly, there is a critical error identified in a subset of the 730 trials where an electric heat pump was selected for fuel switching. Of those trials, 151 have a $0 rule-affected retail cost to convert to electric heating because the baseline home was assumed to have already had an electric heat pump installed for air cooling with a gas furnace. The model assumes that the original heat pump can handle the entire heating load of the home without a gas furnace or electric backup system after the removal of the gas furnace. It's not reasonable to assume that the original heat pump was always sized or installed with auxiliary backup space heating because the initial gas load was high for many of these buildings, and the electric load was low before the projected conversion. The model does not consider additional costs from missing auxiliary backup heat or mix-matched sizing of the unit because the system was sized with an NWGF for space heating before the rule change. The existing heat pump is also not necessarily an 8.8 HSPF unit (which will be the new minimum efficiency requirement for air source heat pumps) and would either need to be replaced or have lower performance than modeled. For these reasons, the model's assumption that the retail cost of using the existing heat pump is zero is not supported by facts and evidence. The model must be reworked to account for the actual anticipated costs.

The worksheet also fails to reflect rational consumer behavior. Based on the outputs from all 10,000 trials, 887 trials resulted in fuel switching, with 334 or 38% of the trials resulting in fuel switching, demonstrating positive LCC savings prior to fuel switching. However, because of DOE's model logic in the fuel switching module, consumers make perfectly informed decisions, resulting in fuel switching rather than upgrading to a condensing furnace. Of the 334 with positive LCC savings from gas or propane, 37 had negative LCC savings because of the fuel switching.

These 37 trials should never have been counted as fuel switched because it would be irrational for those consumers to make that switch. The other 297 trials with positive LCC savings from natural gas or propane should also have installed a condensing unit because of the same market failures that DOE implemented using random assignment. Because DOE believes the gas furnace market is perfectly irrational, consumers that would see a benefit from a condensing furnace would likely not seek out other alternatives.

F. The Proposed Rule Would Disproportionately Impact Certain Communities

DOE claims to have provided a complete analysis of low-income and senior households impacted by the rule. A careful analysis of DOE's TSD reveals that the reported percentage impacts for low-income consumers only include the results of low-income renters that pay their gas bills. The remainder of low-income households is substantial and includes owner-occupied units and renters that do not pay their bills. It is unreasonable to assume that the low-income subgroup DOE reports represent most consumers. Nearly 38% of low-income households own and pay for natural gas (Table 11.2.4 of TSD), and some renters may still pay utility bills via membership fees like HOAs. Even if low-income consumers aren't responsible for paying utility bills, the negative impacts of this rule should not be ignored in the low-income subgroup analysis. One primary concern is that owners will have lower savings due to additional investments than renters and that the landlords of rental units may not always have the best long-term interest of their tenants (the principal-agent problem). DOE states in the TSD 11.2.3 that the model considers the potential for landlords to install equipment and or fuel switch to the lowest installation cost option but provides no explanation of how this was done or its impact. The technical support document also assumes different final installation costs for low-income households than what is represented in the 10,000 trials, where the average installation cost for low-income consumers is

about one-third of what all other buildings pay. For low-income households, the average installation cost for a 95% AFUE furnace was $1,326 vs. $3,727 for all households.

Table 11.3.3 Average LCC and PBP Results by Efficiency Level for Non-Weatherized Gas Furnaces for Low-Income Households for AFUE Standards

EL	Input Capacity Cutoff *kBtu/h*	AFUE (%)	Average Costs *2020$*				Simple Payback *years*	Average Lifetime *years*
			Installed Cost	First Year's Operating Cost	Lifetime Operating Costs	LCC		
0	0	80	1,142	411	6,414	7,556	NA	21.6
1	0	90	1,319	386	5,969	7,288	3.1	21.6
2	0	92	1,322	381	5,885	7,207	2.6	21.6
3	0	95	1,326	373	5,767	7,093	2.1	21.6
4	0	98	1,379	375	5,741	7,120	2.8	21.6
0	0 (North)	80	381	411	6,414	6,795	NA	21.6
1	0 (North)	90	415	392	6,132	6,546	1.8	21.6
2	0 (North)	92	415	388	6,071	6,486	1.5	21.6
3	0 (North)	95	416	383	5,989	6,405	1.2	21.6
4	0 (North)	98	425	382	5,957	6,382	1.5	21.6

DOE claims in section 11 of the TSD that the savings to low-income and seniors are significant, with an average LCC savings of $292 and $327. DOE also states that the impact on consumers will only negatively affect 13.7% of low-income and 15.1% of seniors. AGA found that after using the weights (developed by DOE in section 11.2 of the TSD) provided by the model on all rule-affected low-income and senior trials, low-income would only save $222, and seniors would save $548. Twenty-five percent of all low-income consumers would be negatively impacted, and 16.6% of all seniors. By leaving out the full low-income and senior market, DOE has misrepresented the full impact in the subgroup analysis.

Like the national average LCC savings, the inclusion of fuel switching in the overall LCC savings significantly impacts the total and average LCC savings for low-income and senior households. Fuel switching occurs in 12% of all low-income households and 9% of all senior households. The LCC savings under the no-switching scenario as an option for low-income households is only $40; for senior households, it decreases to $272. The payback period for low-

income also exceeds the lifespan of the equipment leaving many households with equipment with no potential savings from the investment.

AGA developed the following tables based on the 10,000 simulated trial cases that DOE presented as evidence supporting the proposed rule for non-weatherized gas furnaces. For each analysis, tables marked in yellow correspond to DOE's No Switching Scenario and tables labeled in white correspond to DOE's unedited model.

Table J.1: Regional Impact of 95% AFUE NWGF Rule on Low-Income Consumers

Region	Total Simulated Trial Count	Low-Income Weighted Trial Count	Percent Affected	Percent Low-Income Negatively Impacted	Percent Low-Income that Fuel Switched	Percent of Low-income Affected that are Negatively Impacted	Average LCC Savings for Low-Income	Average First Year Savings for Low-Income (95% vs 80% Only)	Low-Income Higher Install Costs (95% vs 80% Only)	Low-Income Payback	Low-Income Simple Payback
New England	276	42	43%	14%	2%	31.8%	$ 28.15	$ 30.42	$ 818.41	11.9	26.9
Middle Atlantic	1,579	212	40%	5%	1%	11.6%	$ 275.29	$ 59.09	$ 611.02	6.3	10.3
East North Central	2,376	206	54%	21%	2%	39.3%	$ 101.81	$ 50.75	$ 667.58	20.3	13.2
West North Central	750	52	39%	12%	2%	31.9%	$ 368.51	$ 56.87	$ 655.88	13.2	11.5
South Atlantic	1,326	145	85%	37%	32%	43.8%	$ 342.17	$ 36.46	$ 438.13	19.1	12.0
East South Central	672	124	79%	24%	14%	30.0%	$ 538.57	$ 32.06	$ 264.36	10.4	8.2
West South Central	1,040	75	92%	50%	36%	54.2%	$ 199.54	$ 16.66	$ 229.45	26.4	13.8
Mountain	987	88	79%	44%	25%	55.8%	$ 155.65	$ 24.19	$ 444.13	40.6	18.4
Pacific	994	89	66%	41%	7%	62.8%	$ (291.37)	$ 13.92	$ 617.94	29.0	44.4
Total	10,000	1,034	63%	25%	12%	40.1%	$ 221.74	$ 62.93	$ 525.80	19.9	8.4
North	5,697	572	46%	14%	2%	30.6%	$ 148.08	$ 50.68	$ 644.80	17.5	12.7
South	4,303	462	85%	39%	25%	46.5%	$ 271.27	$ 26.27	$ 378.54	21.6	14.4

Table J.2: Regional Impact of 95% AFUE NWGF Rule on Senior Consumers

Region	Total Simulated Trial Count	Senior Weighted Trial Count	Percent Affected	Percent Senior Negatively Impacted	Percent Senior that Fuel Switched	Percent of Senior Affected that are Negatively Impacted	Average LCC Savings for Seniors	Average First Year Savings for Low-Income (95% vs 80% Only)	Senior Higher Install Costs (95% vs 80% Only)	Senior Payback	Senior Simple Payback
New England	276	58	37%	3%	1%	9%	$ 635.69	$ 186.09	$ 165.21	3.3	0.9
Middle Atlantic	1,579	304	38%	4%	1%	10%	$ 339.44	$ 103.73	$ 570.20	4.2	5.5
East North Central	2,376	362	47%	12%	1%	25%	$ 347.95	$ 63.77	$ 650.25	8.1	10.2
West North Central	750	129	46%	12%	3%	26%	$ 606.83	$ 57.08	$ 455.40	8.2	8.0
South Atlantic	1,326	175	79%	23%	28%	28%	$ 1,553.32	$ 98.12	$ 360.31	16.7	3.7
East South Central	672	117	79%	19%	19%	24%	$ 569.10	$ 10.10	$ 316.27	5.9	31.3
West South Central	1,040	153	86%	40%	25%	46%	$ 365.89	$ 2.76	$ 355.29	13.8	128.6
Mountain	987	193	74%	25%	10%	34%	$ 326.08	$ 47.13	$ 302.31	15.3	6.4
Pacific	994	168	53%	20%	5%	37%	$ 171.34	$ 35.88	$ 467.48	18.8	13.0
Total	10,000	1659	58%	17%	9%	29%	$ 547.59	$ 64.27	$ 463.25	11.4	7.2
North	5,697	994	43%	8%	1%	19%	$ 384.46	$ 81.35	$ 547.57	6.7	6.7
South	4,303	665	80%	29%	20%	37%	$ 678.06	$ 38.74	$ 337.18	15.1	8.7

Regionally, the impacts are not centered on just the South, though after factoring in fuel switching, the impacts are greater where more households assumed fuel switching as an option. Average LCC savings are the highest in the East South-Central region and lowest in the New England or Pacific regions. All but one region has an average payback longer than ten years, and five have payback near or longer than the lifespan of the equipment of 21.6 years. These results are all without turning off fuel switching.

Table J.3: Regional Impact of 95% AFUE NWGF Rule on Low-Income Consumers No Switching Scenario

Region	Total Simulated Trial Count	Low-Income Weighted Trial Count	Percent Affected	Percent Low-Income Negatively Impacted	Percent Low-Income that Fuel Switched	Percent of Low-Income Affected that are Negatively Impacted	Average LCC Savings for Low-Income	Average First Year Savings for Low-Income (95% vs 80% Only)	Low-Income Higher Install Costs (95% vs 80% Only)	Low-Income Payback	Low-Income Simple Payback
New England	276	42	43%	11%	2%	26.4%	$ 39.81	$ 82.40	$ 819.58	13.6	9.9
Middle Atlantic	1,579	212	40%	5%	1%	12.7%	$ 270.01	$ 59.25	$ 625.65	8.6	10.6
East North Central	2,376	206	54%	19%	2%	34.8%	$ 208.05	$ 52.78	$ 682.01	22.7	12.9
West North Central	750	52	39%	14%	2%	36.0%	$ 274.39	$ 57.36	$ 684.48	17.3	11.9
South Atlantic	1,326	145	85%	50%	32%	59.0%	$ (113.26)	$ 30.97	$ 616.98	63.9	19.9
East South Central	672	124	79%	26%	14%	33.0%	$ 278.82	$ 44.28	$ 352.50	18.3	8.0
West South Central	1,040	75	92%	61%	36%	66.7%	$ (103.10)	$ 19.87	$ 459.10	52.8	23.1
Mountain	987	88	79%	57%	25%	71.9%	$ (269.50)	$ 13.84	$ 575.20	48.6	41.6
Pacific	994	89	66%	38%	7%	58.4%	$ (232.00)	$ 21.22	$ 673.96	51.7	31.8
Total	10,000	1,034	63%	29%	12%	45.5%	$ 40.26	$ 43.04	$ 601.54	36.1	14.0
North	5,697	572	46%	13%	2%	28.9%	$ 189.84	$ 55.82	$ 661.31	20.4	11.8
South	4,303	462	85%	48%	25%	56.6%	$ (60.33)	$ 27.24	$ 527.58	46.6	19.4

Table J.4: Regional Impact of 95% AFUE NWGF Rule on Senior Consumers No Switching Scenario

Region	Total Simulated Trial Count	Senior Weighted Trial Count	Percent Affected	Percent Senior Negatively Impacted	Percent Senior that Fuel Switched	Percent of Senior Affected that are Negatively Impacted	Average LCC Savings for Senior	Average First Year Savings for Low-Income (95% vs 80% Only)	Senior Higher Install Costs (95% vs 80% Only)	Senior Payback	Senior Simple Payback
New England	276	58	37%	3%	1%	9%	$ 686.81	$ 186.05	$ 168.27	3.4	0.9
Middle Atlantic	1,579	304	38%	3%	1%	9%	$ 353.28	$ 104.09	$ 579.15	5.9	5.6
East North Central	2,376	362	47%	9%	1%	20%	$ 440.49	$ 79.05	$ 659.03	9.8	8.3
West North Central	750	129	46%	12%	3%	25%	$ 487.96	$ 86.74	$ 479.19	12.8	5.5
South Atlantic	1,326	175	79%	35%	28%	44%	$ 369.96	$ 62.15	$ 485.14	29.2	7.8
East South Central	672	117	79%	19%	19%	24%	$ 294.15	$ 55.22	$ 453.32	10.7	8.2
West South Central	1,040	153	86%	45%	25%	52%	$ 11.07	$ 31.99	$ 488.53	23.7	15.3
Mountain	987	193	74%	29%	10%	39%	$ 66.05	$ 37.74	$ 362.29	24.2	9.6
Pacific	994	168	53%	22%	5%	41%	$ 144.45	$ 41.90	$ 512.14	24.4	12.2
Total	10,000	1,659	58%	18%	9%	32%	$ 272.36	$ 71.58	$ 515.39	17.6	7.2
North	5,697	994	43%	7%	1%	16%	$ 411.95	$ 91.04	$ 558.15	8.8	6.1
South	4,303	665	80%	35%	20%	44%	$ 160.71	$ 42.49	$ 451.45	24.7	10.6

Low-income consumers in four separate regions have negative LCC savings under a no-switching scenario. The south, on average, presented an average of negative $60 with an extreme payback period of 46.6 years. Fuel switching has such a high impact on low-income consumers in the south that the rule will negatively impact a third of low-income consumers, and half will be negatively affected if fuel switching is disallowed in the model. Senior households also present similar challenges concerning fuel switching. The model shows significant positive savings in both the north and the south. However, without using DOE's fuel-switching model, senior households only save $161 and have an average payback period of 24.7 years.

While DOE reviews the impact of the Proposed Rule on a regional basis, appended as Attachment P, are the impacts on low-income and senior consumers state-by-state.[124]

G. DOE's Propose Rule Would Compel Fuel Switching, Contrary to EPCA

The Proposed Rule would unlawfully compel many consumers to switch from gas to electric appliances. Indeed, the NOPR expects that millions of consumers will switch from natural gas furnaces to electric heat pumps because of its requirements.[125] This intended outcome, however, is contrary to EPCA.

Congress made it clear that the energy conservation standards must not force fuel switching in several ways. First, when Congress gave the Department authority to establish new standards for furnaces, it specified that those standards must not be "likely to result in a significant shift from gas heating to electric resistance heating with respect to either residential construction or furnace

[124] *See* State Impact Summary of DOE's Rule, Attachment P at pages. 3-6.
[125] 87 Fed. Reg. at 40666-67, 40647; TSD Figure 9.5.8 (projected heat pump shipments due to switching); TSD Table 10.3.5; and *see* Attachment N at pages 20-22. AGA believes that the NOPR vastly underestimates the degree of fuel switching that proposed standards would force, particularly in light of the incentives for heat pumps under various state and federal programs and the enormous costs involved with modifying a home to accommodate positive pressure venting. *See*, *e.g.*, 87 Fed. Reg. at 40654. Moreover, the NOPR presents its estimate of the number pushed to electric furnaces as a national average. This ignores regional differences that will cause a far higher percentage of fuel switching in certain markets.

replacement."[126] Indeed, Congress itself set separate standards for gas and electric products.[127] Second, as noted in Sections C and D. 3., above, Congress prohibited the standards from rendering performance characteristics unavailable.[128] Third, Congress ensured that the standards would be technologically and economically feasible for the entire product class.[129] Fourth, Congress authorized the Department to create separate classes specifically to allow the Department to increase efficiency standards for some products within a class without eliminating "performance related features" important to consumers.

If there were any confusion about the intention behind these provisions, the legislative history demonstrates that Congress did not intend for the energy conservation standards to allow DOE to favor one fuel over another or limit consumer choice. The original conference report on the energy conservation standards program explicitly stated that, "[i]n providing the Secretary the authority to establish different standards based upon the type of energy consumed, the conferees intend to provide the Secretary flexibility *so that energy efficiency standards will not result in the elimination of any type of covered product using a particular form of energy."*[130] As the Chairmen of the Senate Committee on Energy and Natural Resources later clarified when presenting legislation that would revise the program, "[w]e don't want this bill to have the effect of creating a significant biase against any fuel—be it oil, gas, or electricity—so as to favor one over the other."[131] The Committee Report further noted that EPCA includes "several safeguards against a standard for small gas furnaces being set at a level that results in a buying preference or significant

[126] 42 U.S.C. § 6295(f)(1)(B)(iii).
[127] *Id*. § 6295(f)(3).
[128] *Id*. § 6295(o)(4).
[129] *Id*. § 6294(o)(2)(A).
[130] 124 Cong. Rec. 35050 (1978) (conference report and statement submitted by Rep. Dingell) (emphasis added).
[131] 133 Cong. Rec. 545 (1987).

switching from gas heating to electric resistance heating."[132] It would be an anathema to the drafters to interpret EPCA in a way that would allow the energy conservation standards to force fuel switching or electrification.

The NOPR's approach to its evaluation of fuel-switching concerns also is arbitrary and capricious. To evaluate the degree of fuel switching that the proposed standards would cause, the Department created a consumer choice model.[133] The model relied, in part, on the NOPR's evaluation of the installation costs to accommodate a new product.[134] As noted in Section E, however, the NOPR vastly underestimates the installation costs associated with installing condensing appliances in homes with atmospheric venting. These same problems permeate the NOPR's evaluation of the payback period for new condensing furnaces, which also heavily influences the fuel switching analysis.[135] Until the Department corrects its flawed analysis of the installation costs and payback period estimates, its fuel-switching analysis will remain arbitrary and unsupported by substantial evidence.

Moreover, in deciding not to create a separate class for non-condensing appliances, the Department completely ignored the impacts of fuel switching. In its December 29, 2021 Interpretive Rule, the Department brushed aside the impacts of fuel switching arguing that only "[i]n a limited number of cases, a consumer facing a difficult installation situation may decide it to be impracticable . . . to replace a product with another that relies on the same fuel source."[136] It similarly asserted "the mere potential for fuel switching does not serve as a basis for establishment of a performance-related feature under EPCA."[137] In contrast, the NOPR's own underestimate of

[132] S. Rep. No. 99-497, at 5 (1986); *see also* Report of the Senate Commerce Committee on Energy and Natural Resources, S. Rep. No. 100-6, at 5–6 (noting safeguards against fuel switching).
[133] *See* 87 Fed. Reg. at 40646.
[134] *Id.*
[135] *See id*.
[136] December 29, 2021, Interpretive Rule, 86 Fed. Reg. at 73962.
[137] *Id*.

fuel switching shows that over 7% of consumers will do so.[138] Another several percent of consumers will make major repairs to their existing furnaces, rather than replace them, undermining the NOPR's purported efficiency benefits. The NOPR and the Department's decision to reject creating separate classes are rendered arbitrary and unsupported by substantial evidence of their failure to grapple with the impacts of fuel switching meaningfully.

For similar reasons, it is improper for DOE to rely on the impacts of fuel switching to support its economic justification for the rule. As noted above, Congress designed the energy conservation standard program to be fuel neutral and prevent fuel switching. It is, therefore, improper for DOE to consider fuel switching as one of the benefits of the proposed standards. Nevertheless, at least half of the purported nationwide LCC savings that the proposal asserts would result from the rule are due to fuel switching. In some regions of the country, that number increased to nearly three-quarters of the purported savings. To be consistent with EPCA's text, purpose, structure, and intent, those purported savings must be subtracted from EPCA's analysis of whether the standards would be economically justified.

H. DOE Should Fully Examine the Impacts of Fuel Switching on the Entire Energy System

While it is improper to consider fuel switching one of the benefits of the proposed standard, it is essential to understand the consequences of fuel switching impacts on the overall energy system. Therefore, DOE should fully examine, and not ignore, the impacts fuel switching would have on the entire energy system, including utilities and end-use residential consumers. Fuel switching can impact existing and future natural gas utility consumers and existing and future electricity consumers. For example, electrifying buildings can lead to additional infrastructure

[138] NOPR, 87 Fed. Reg. at 40666-67, 40647; TSD Figure 9.5.8 (projected heat pump shipments due to switching); TSD Table 10.3.5.

costs if it's necessary to add additional generation capacity and electric transmission and distribution infrastructure to meet new peaks in electricity demand. As pertinent to the topics raised in this proceeding and the questions raised above, in 2018, AGA engaged a cross-functional team of experts to evaluate policy-driven electrification of the U.S. residential sector. The study, "Implications of Policy-Driven Residential Electrification," appended as Attachment Q,[139] identified numerous challenges to electrification including:

- Cost-effectiveness
- Consumer impacts
- Transmission capacity constraints on the existing electrical system
- Current and projected electric grid emissions levels
- Requirements for new investments in the power grid to meet new growth in peak generation demand during winter periods

Furthermore, the impacts of fuel switching on the reliability and resilience of the energy system must be fully examined. The Department should consider the performance of electric end-use equipment on the coldest and hottest days of the year. Concerning the infrastructure requirements of fuel switching, the Department should thoroughly examine how fuel switching would impact the determination of future electric generation, transmission, or distribution infrastructure requirements. The natural gas pipeline, distribution, and storage systems can deliver large capacity to meet variable demand. The U.S. natural gas system delivers three times more energy on the coldest day of the year than the electricity grid provides on the hottest.[140] In some regions, "on a peak demand day, the natural gas network delivers up to four times as much energy as the electric network on a peak day."[141] To that end, the Department should determine if electric

[139] AGA, Implications of Policy-Driven Residential Electrification, July 2018 (Attachment Q).
[140] Based on Energy Information Administration and market data.
[141] *See* Columbia SIPA, Center on Global Energy Policy, "Investing in the US Natural Gas Pipeline System to Support Net-Zero Targets," April 22, 2021, at p. 25, available at https://www.energypolicy.columbia.edu/research/report/investing-us-natural-gas-pipeline-system-support-net-zero-targets (last visited Oct. 5, 2022).

system planning adequately anticipates the peak requirements based on design-day and better understand if there will be a shift from summer to winter peak due to the NOPR.

I. DOE Should Fully Assess the Impacts of the Proposed Rule on Natural Gas Distribution Utilities

The Process Rule requires DOE to conduct a utility impact analysis in its standards rulemakings.[142] Specifically, the Process Rule requires DOE's utility impact analysis to "include estimated marginal impacts on electric and gas utility costs and revenues."[143] In the NOPR, DOE states that the "utility impact analysis estimates several effects on the electric power generation industry that would result from the adoption of new or amended energy conservation standards." While DOE defines the analysis as only relating to electric power generation, it discusses DOE's utility impact analysis related to gas utilities.[144] Regarding gas utilities, DOE asserts that energy efficiency can reduce utility revenues through lower volumetric sales.[145] DOE notes that it is difficult to ascertain the precise financial impacts on specific gas utilities. Despite the difficulty noted by DOE, the NOPR nevertheless concludes that negative impacts on gas utilities in certain states would be minimal and for several other States there would be a potential for negative financial impacts on gas utilities.[146] DOE claims that revenue decoupling is the reason for the minimal impact. However, based on a single state, it also asserts that the impact of the standard would be minimal even where revenue decoupling is not in place.[147] In short, the Department states it did not ascertain the precise financial impacts on utilities, but in the few cases it looked

[142] *See* 10 C.F.R. part 430, subpart C, App. A § 6(e)(4)(iv) (Factors to be considered in selecting a proposed standard include an "analysis of utility impacts will include estimated marginal impacts on electric and gas utility costs and revenues.").
[143] *Id.*
[144] NOPR, 87 Fed. Reg. at 40663.
[145] *Id.*
[146] NOPR, 87 Fed. Reg. at 40664.
[147] *Id.*

at, the impact was minimal despite certain sample jurisdictions having very different rate and revenue mechanisms.

This is insufficient. DOE should adhere to the Process Rule and conduct a complete impact analysis that quantifies and evaluates the marginal impacts to gas utility costs and revenues of a reduction in gas deliveries due to fuel switching driven by the Proposed Rule. In addition to its analysis of impacts to gas distribution utilities, DOE should analyze whether the imposition of furnace standards could have adverse impacts on retail natural gas ratepayers. As referenced by DOE, decoupling will not fully protect consumers from increased rates if a utility's fixed costs are allocated across lower volumes that may result from the removal of non-condensing furnaces from the market and fuel switching caused by the Proposed Rule. Furthermore, decoupling takes on different forms: 1) full revenue decoupling, 2) partial revenue decoupling, where only a portion of losses are recovered, and 3) revenue decoupling with certain restrictions. If the Department plans to rely on decoupling as the basis for claiming minimal impacts, it must fully examine the Proposed Rule's impact on utilities subject to differing regulatory mechanisms and different forms of decoupling. Because DOE acknowledges that its proposed efficiency standards threaten to drive many consumers to shift from natural gas heat to electric heating, the Department should evaluate whether the loss of demand for natural gas local distribution companies could lead to higher rates on remaining consumers to cover fixed distribution costs. DOE should consider and understand the nature and magnitude of these effects before it finalizes any revised furnace efficiency standards. To the extent it believes it does not have to follow the Process Rule's requirements with regard to utility impacts, it must explain why deviation from the Process Rule is necessary (or at least appropriate) and allow stakeholders to comment on that explanation.

DOE also failed to analyze the impact of the Proposed Rule on natural gas utility efficiency programs. As noted above, in Section III. B., AGA member companies invested $1.6 billion to support energy efficiency programs in 2019 and budgeted $1.7 billion for 2020. These programs reach nearly 7 million consumers, more than 380,000 low-income consumers, nearly 140,000 multi-family consumers, more than 130,000 commercial consumers, and 41,000 separate industrial program consumers. DOE should fully analyze the impact of the Proposed Rule on utility efficiency programs. For the Department to fully consider the impact of the Proposed Rule, it should understand if programs that assist utility consumers will be negatively impacted.

J. DOE has a Duty to Respond to these Comments

In these comments, AGA has raised a number of issues regarding faulty assumptions, unsupported data and assumptions, legal errors, and other critical flaws with the Proposed Rule. As noted above, EPCA requires DOE to support the Proposed Rule with substantial evidence. Where, like here, AGA has raised concerns about crucial parts of DOE's analysis, the Department must respond to those concerns with "a cogent and reasoned response" that itself is supported by substantial evidence. Several of the concerns raised herein have permeated multiple efforts by DOE to address efficiency standards for furnaces, including the Department's modeling assumptions, approach to consumer choice and economics, assumptions regarding installation costs, and others. Failure to provide a reasoned, evidence-based response to these comments will render any final version of the Proposed Rule vulnerable to challenge.

VI. CONCLUSION

The American Gas Association respectfully requests that the Department of Energy consider these comments in this proceeding and rescind the Proposed Rule for the reasons stated herein. If you have any questions regarding this submission, please do not hesitate to contact the undersigned.

Respectfully submitted,

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