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September 26, 2023

Ms. Julia Hegarty
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Office, EE-5B
1000 Independence Avenue SW
Washington, DC 20585-0121

**Re: Notice of Proposed Rulemaking and Request for Comment:
*Energy Conservation Program: Energy Conservation Standards for
Consumer Water Heaters, EERE-2017-BT-STD-0019, RIN 1904-AD91,
88 Fed. Reg. 49058 (July 28, 2023)***

Dear Ms. Hegarty:

The American Gas Association (“AGA”), American Public Gas Association (“APGA”), National Propane Gas Association (“NPGA”), Spire Inc., Spire Missouri Inc., and Spire Alabama Inc. (collectively, “Joint Commenters”) respectfully submit these comments in response to the above-referenced proceeding regarding the notice of proposed rulemaking and request for comment (“NOPR”) pertaining to energy conservation standards for consumer water heaters issued by the U.S. Department of Energy (“DOE” or “Agency”).¹

I. 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 customers in the U.S., of which 96 percent — more than 74 million customers — receive their gas from AGA members. AGA is an advocate for natural gas utility companies and their customers 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.²

¹ *Energy Conservation Program: Energy Conservation Standards for Consumer Water Heaters*, EERE-2017-BT-STD-0019, RIN 1904-AD91, 88 Fed. Reg. 49058 (July 28, 2023).

² For more information, please visit www.aga.org.

APGA is the trade association for more than 730 communities across the U.S. that own and operate their retail natural gas distribution entities. They include not-for-profit gas distribution systems owned by municipalities and other local government entities, all locally accountable to the citizens they serve. Public gas systems focus on providing safe, reliable, and affordable energy to their customers and support their communities by delivering fuel to be used for cooking, clothes drying, and space and water heating, as well as for various commercial and industrial applications.³

NPGA is the national trade association of the propane industry with a membership of about 2,400 companies, and 36 state and regional associations that represent members in all 50 states. Membership in NPGA includes retail marketers of propane gas who deliver the fuel to the end user, propane producers, transporters and wholesalers, and manufacturers and distributors of equipment, containers, and appliances. Propane gas fuels millions of installations nationwide for home and commercial heating and cooking, in agriculture, industrial processing, and as a clean air alternative engine fuel for both over-the-road vehicles and industrial lift trucks. Roughly 75% of NPGA's members have fewer than 100 employees, and are considered small businesses. The proposal directly addresses products which currently, and in the future, may rely on propane for fuel, and as such, the proposal has the potential to have a direct and significant impact on NPGA's members.

Spire Inc., Spire Missouri Inc., and Spire Alabama Inc. (collectively, "Spire") are in the natural gas utility business. Spire Inc. owns and operates natural gas utilities that distribute natural gas to over 1.7 million residential, commercial, and institutional customers across Missouri and Alabama, and Spire Missouri Inc. and Spire Alabama Inc. are the largest natural gas utilities serving residential, commercial, and institutional customers in Missouri and Alabama, respectively.

Joint Commenters provide the energy needed to fuel consumer water heaters, thus making them critical stakeholders. Joint Commenters support and actively invest in energy efficiency.

II. Overview of the NOPR

The Energy Policy and Conservation Act, as amended ("EPCA"), prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including consumer water heaters. EPCA also requires DOE to periodically determine whether more-stringent standards would be technologically feasible and economically justified and would result in significant energy savings. In this NOPR, DOE proposes amended energy conservation standards for consumer water heaters. While the NOPR proposes new energy conservation standards for a number of different consumer water heaters, these comments focus on only those consumer water heaters that are gas-fired.

Of note, the NOPR proposes a uniform energy factor ("UEF") in the non-condensing range for all gas-fired storage water heaters ("GSWH") with effective storage volume less than or equal to 55 gallons or greater than 100 gallons. For gas-fired instantaneous water heaters ("GIWH"), the NOPR proposes a condensing level for those with less than 2 gallons of effective storage volume

³ For more information, please visit www.apga.org.

and an input rating greater than 50,000 British thermal units per hour (“Btu/hr”) (often referred to as “tankless water heaters”), but non-condensing for most other GIWHs.

III. Procedural History

According to the NOPR, DOE initiated the current rulemaking by publishing a Request for Information on May 21, 2020.⁴ DOE published its preliminary analysis and technical support document (“preliminary TSD”) on March 1, 2022.⁵ DOE also notes it deviated from its own procedural rules (Appendix A) by publishing a preliminary analysis without a framework document.⁶ DOE held a public meeting on April 12, 2022 on the preliminary TSD.⁷ Joint Commenters submitted materials in response to the preliminary TSD.⁸ After the close of the comment period for the preliminary TSD, DOE also received recommendations on amended energy conservation standards from what it terms “Joint Stakeholders,” which included, among other entities, a limited number of water heater manufactures, but not all.⁹ Joint Commenters responded to the recommendations by requesting that DOE proceed through the normal rulemaking process and not issue a direct final rule.

On July 21, 2023, DOE made available a prepublication version of the NOPR, along with associated data, including the Technical Support Document (“TSD”). DOE formally published the NOPR in the Federal Register on July 28, 2023. On September 13, 2023, DOE held a virtual public meeting to discuss the proposed rule. If finalized, the proposed standards in the NOPR are anticipated to become effective in 2030.

IV. Comments

A. Comments Pertaining to Gas-Fired Storage Water Heaters (“GSWHs”)

i. Maintaining a Non-Condensing Standard for GSWHs is Appropriate

Joint Commenters are encouraged by DOE’s proposed standards for 55 gallons or less storage volume for GSWHs maintains the availability of a non-condensing level standard. Non-condensing technology differs from condensing technology not only in how the appliance itself is manufactured and operates, but also in how the appliance must be installed (e.g., location, venting configuration, venting materials, condensate drainage, etc.) and whether it is compatible with a consumer’s home configuration. Maintaining a non-condensing standard for GSWH is especially important, as any energy conservation standard that effectively limits the market for GSWH (or any other gas-fired appliance) to products using only condensing combustion technology would

⁴ NOPR at 49067. *See also* 85 Fed. Reg. 35083 (May 21, 2020).

⁵ NOPR at 49067. *See also* 87 Fed. Reg. 11327 (Mar. 22, 2022).

⁶ *Id.* DOE’s procedural rules are codified in Appendix A to 10 C.F.R. Part 430, Subpart C.

⁷ *Id.* at 49068.

⁸ *See* Joint Commenter’s May 16, 2022, comments in this proceeding, identified in the docket as document No. EERE-2017-BT-STD-0019-0041.

⁹ *Id.*

result in the unavailability of “performance characteristics” within the meaning of the EPCA,¹⁰ and thus – as discussed in Section B.i. of these Comments – be precluded by statute.

Joint Commenters were also pleased to see DOE identify GSWHs that are both able to meet the proposed standards, as well as operate without any need for electricity or any electric connection, electric gauges, electric pumps, electric wires, or electric devices. The ability for a GSWH to operate with only a gas hook-up is a critical feature valued by many consumers, especially those communities that require hot water but do not utilize electricity some or all of the time.¹¹ However, based on the information presented in the TSD, it appears that only one, at most two, manufacturers currently utilize this technology. Before finalizing any new efficiency standards for gas-fired storage water heaters, DOE should ensure that there are no constraints surrounding the gas-actuated flue damper (referred to in the TSD as an inlet damper) that makes these efficiency gains possible, dependable, and safe over the lifetime of the product.

Before finalizing efficiency standards for GSWHs, DOE should also address some additional concerns to ensure minimal impact to homeowners who purchase a new GSWH in the future. For instance, the TSD suggests that the proposed standards can only be met with 2-2.5 inches of insulation for GSWHs, which may pose problems for the many consumers with GSWHs in tight closets and utility spaces,¹² which are especially typical in apartment homes,¹³ or for those in jurisdictions where the local building code requires a certain amount of space to be kept free surrounding a water heater to facilitate service, repairs, and replacements without the removal of permanent construction. DOE’s analysis also does not account for the breadth of existing multifamily building configurations. While DOE makes some reference to the differing installation and cost conditions (among other elements) between various housing types in the preliminary TSD and TSD, the analysis does not well-address distinctions within the multifamily landscape including high-rise versus low-rise buildings, historic structures and adaptive reuse projects (*i.e.*, commercial to residential conversions). Such features can significantly influence water heater installation, operations and consumer satisfaction, and DOE’s impact analysis would benefit from a broader consideration of the multifamily marketplace. This is simply just one reason why we are concerned that DOE underestimates the installation costs, and significant questions still remain regarding the quality of DOE’s data on installation costs.¹⁴

The proposed standards, if adopted, would result in GSWHs operating very close to the condensing/non-condensing efficiency line. Simply, this means that, in certain situations, condensate may unintentionally be created, which has the potential to cause both maintenance and safety issues. Before finalizing these standards, DOE should also confirm that the technology

¹⁰ Energy Policy and Conservation Act of 1975, as amended (“EPCA”), 42 U.S.C. § 6291, *et seq.*

¹¹ See, e.g., “Amish exemption” in DOE’s consumer boiler energy conservation starts. 10 CFR 430.32(e)(2)(v).

¹² DOE Public Meeting, Sept. 13, 2023, at 2:44 PM. See also NOPR at 49094.

¹³ The supporting analysis fails to understand that resizing a utility closet in an apartment home will typically involve substantial construction and quality of life impacts for apartment residents. DOE should also consider the consequences of utility closet changes given the common co-location of water heaters with laundry appliances in apartments.

¹⁴ DOE Public Meeting, Sept. 13, 2023, at 2:37 PM-2:47 PM. See also Comments of National Multifamily Housing Council and National Apartment Association in EERE-2017-BT-STD-0019 (hereinafter “NMHC/NAA Comments”).

available to meet these standards (especially those that do not require an electric connection) are able to do so safely in all anticipated conditions.

Finally, the consumer benefits claimed to justify the proposed standards for GSWHs are remarkably small.¹⁵ Those benefits amount to an average life-cycle cost savings of only \$52 over an average product life of 14.5 years, based on operating cost savings of less than \$2.00 per month in the first year.¹⁶ According to DOE's analysis, purchasers affected by this proposed standard would face average payback periods of more than ten years¹⁷ and would experience net costs over 46% of the time.¹⁸ These are concerning figures for all impacted Americans needing to replace their appliance in the future.

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

The NOPR fails to address significant regional differences in costs and benefits that will disproportionately impact millions of Americans. The modeling done by DOE relies on national sales data only and results in impacts that do not capture the regional differences that could play a role in the installation or replacement of a water heater. Based on data taken from the proposed furnace and consumer boiler rule, the sale of higher efficiency condensing products tends to happen more in the north. In addition, regardless of venting type, the structure of a building and where the water heater may be placed will differ from region to region because of the ability to store it in the basement, ground level or attic.

While DOE's model does take into account some of these factors by utilizing the EIA Residential Energy Consumption Survey 2015 dataset, the use of national market shares treats every state the same and cannot pre-determine in the baseline where higher efficiency water heaters are more popular already. States with few sales would impact the Life Cycle Cost ("LCC") outcome more than others. In addition, the net higher installed costs for rule affected trials share the same average net cost of between \$122 and \$135 across the entire country.

¹⁵ NOPR at 49160.

¹⁶ 88 Fed. Reg. at 49137 at Tables V.1 and V.2.

¹⁷ The payback period reported at 88 Fed. Reg. 49137 Table V.1 is misleading. The payback period reported (7.9 years) is the product of abstract calculations based on average input parameters that only reflect the maximum potential efficiency improvement resulting from the standard (*i.e.*, an improvement from lowest efficiency product available to a standards-compliant product). As DOE's own figures show, the average of the payback periods for consumers affected by the proposed standards is 10.1 years. EERE-2017-BT-STD-0019-0060_content.xlsx, sheet: Summary, cell U9.

¹⁸ The percentage of consumers experiencing net costs as a result of the proposed standard – as reported at 88 Fed. Reg. 49137 Table V.2 – is also misleading. That figure (36%) presents the number of rule outcome trial cases with net cost outcomes as a percentage of all 10,000 of DOE's trial cases (including the cases representing consumers not affected by the standard). According to DOE's figures, 46.6% of the consumers affected by the standard would experience net costs. *See* Summary of Analysis of DOE's LCC Model, provided as Attachment A to these comments, at Table 2.

Based on the results of DOE's current model, most regions resemble one another with similar LCC savings, for low income and senior subgroups, there are a few regions with low or negatives LCC savings that could have played a different role in the modeled outcome if better market share data was incorporated in the results. The following tables summarize the national and subgroups for all households because DOE has elected to analyze only a subset of low-income households who are most likely to directly pay utility bills.¹⁹ This is an incomplete conclusion since utilities can also be a function of rent where higher utilities costs can still be passed on to the end user.

Table: Regional Impact of GSWH Rule

	Total Simulated		Total Negatively Affected		Average LCC Savings	Average First Year Savings	Higher Install Costs	Total Payback
	Trial Count	Affected	Affected					
New England	334	80%	17%	\$	193	\$ 29	\$ 128	5.2
Middle Atlantic	1466	80%	50%	\$	42	\$ 17	\$ 134	10.2
East North Central	1932	77%	59%	\$	10	\$ 13	\$ 133	12.4
West North Central	798	76%	52%	\$	34	\$ 15	\$ 128	10.5
South Atlantic	1030	77%	33%	\$	81	\$ 20	\$ 131	7.8
East South Central	350	77%	52%	\$	43	\$ 17	\$ 132	9.9
West South Central	1164	74%	57%	\$	26	\$ 14	\$ 133	12.8
Mountain	980	79%	45%	\$	52	\$ 16	\$ 127	10.1
Pacific	1946	78%	36%	\$	85	\$ 19	\$ 139	8.3
	10000	78%	47%	\$	52	\$ 17	\$ 133	10.1

Table: Regional Impact of GSWH Rule on Low-Income Households

				Percent of Low Income Affected that are		Average First			
	Total Simulated	Low Income Weighted	Percent Affected	Negatively Impacted	Average LCC Savings for Low Income	Year Savings for Low Income	Low Income Higher Install Costs	Low Income Payback	
	Trial Count	Trial Count							
New England	334	84	79%	17%	\$ 154	\$ 29	\$ 127	5.4	
Middle Atlantic	1466	224	85%	52%	\$ 40	\$ 17	\$ 135	9.9	
East North Central	1932	207	84%	61%	\$ 2	\$ 13	\$ 134	12.2	
West North Central	798	70	82%	55%	\$ 9	\$ 13	\$ 132	11.5	
South Atlantic	1030	138	78%	38%	\$ 66	\$ 19	\$ 133	8.2	
East South Central	350	71	83%	39%	\$ 92	\$ 19	\$ 127	8.0	
West South Central	1164	140	81%	58%	\$ 33	\$ 14	\$ 130	12.2	
Mountain	980	116	80%	44%	\$ 84	\$ 19	\$ 122	9.9	
Pacific	1946	272	83%	38%	\$ 67	\$ 17	\$ 133	8.9	
	10000	1322	82%	46%	\$ 53	\$ 17	\$ 132	9.9	

¹⁹ Tables showing the regional impacts of the GSWH rule generally, on low-income households, and on senior households are provided in Attachment B to these comments.

Table: Regional Impact of GSWH Rule on Senior Households

	Total Simulated Trial Count	Senior Weighted Trial Count	Percent Affected	Percent Senior Affected that are Negatively Impacted	Average LCC Savings for Seniors	Average First Year Savings for Seniors	Higher Install Cost for Seniors	Payback for Seniors
New England	334	60	79%	14%	\$ 387	\$ 40	\$ 130	3.8
Middle Atlantic	1466	243	80%	43%	\$ 73	\$ 19	\$ 131	9.2
East North Central	1932	298	75%	61%	\$ (2)	\$ 12	\$ 137	13.0
West North Central	798	171	67%	58%	\$ 27	\$ 16	\$ 133	10.5
South Atlantic	1030	153	78%	33%	\$ 71	\$ 19	\$ 133	8.1
East South Central	350	64	80%	56%	\$ 47	\$ 17	\$ 128	10.0
West South Central	1164	245	71%	53%	\$ 59	\$ 16	\$ 134	12.3
Mountain	980	235	78%	46%	\$ 53	\$ 17	\$ 126	9.8
Pacific	1946	297	79%	36%	\$ 104	\$ 21	\$ 139	8.1
	10000	1767	76%	46%	\$ 67	\$ 18	\$ 133	10.0

While DOE's proposal for GSWHs appears to be a step in the right direction, the Agency should be diligent in addressing our concerns to ensure that its final standard is not only safe, but appropriately economically and technologically justified, while also ensuring consumers will continue to have access to the appliances that best fit their homes and budgets.

B. Comments Pertaining to Gas-Fired Instantaneous Water Heaters

i. If Finalized, the NOPR Would Result in the Unavailability of an Important Feature

As explained in detail in previous comment submissions and above, minimum efficiency standards that can only be achieved by condensing products would result in the unavailability of products with "performance characteristics" and "features" provided by non-condensing products and are thus precluded by 42 U.S.C. § 6295(o)(4) (the "unavailability" provision of the statute).²⁰ Previous comments indicated that this would unquestionably be true in the case of gas storage water heaters, but indicated that further evaluation would be necessary to determine whether the same is true with respect to gas instantaneous water heaters.²¹ Further evaluation indicates that it is true of gas instantaneous water heaters, as discussed in comments being submitted today by Rinnai America Corporation. In particular, non-condensing gas instantaneous water heaters can be installed (and thus used) in cases in which condensing gas instantaneous water heaters cannot, such as installations in high-rise buildings in which the venting required for condensing products would be precluded by any of a variety of factors including practical constraints, code restrictions, restrictive covenants, or historic preservation requirements. As explained in prior comments,²² DOE's insistence that such performance characteristics and features are not protected under 42 U.S.C. § 6295(o)(4) because they do not "provide any utility to the consumer that is accessible to

²⁰ See, e.g., Attachment C at 6-15, 17-23; Joint Commenter's May 16, 2022, comments in this proceeding, identified in the docket as document No. EERE-2017-BT-STD-0019-0041, at Attachment A pp. 7-11 and Attachment D pp. 3-10.

²¹ Joint Commenter's May 16, 2022, comments in this proceeding, identified in the docket as document No. EERE-2017-BT-STD-0019-0041, at 4.

²² See, e.g., Attachment C at 8-13; Joint Commenter's May 16, 2022, comments in this proceeding, identified in the docket as document No. EERE-2017-BT-STD-0019-0041, at Attachment A pp. 10-11.

the layperson”²³ is an *ipse dixit* that lacks any statutory basis and serves only to impermissibly nullify an express statutory constraint on DOE’s rulemaking authority.²⁴

Accordingly – pursuant to 42 U.S.C. § 6295(o)(4) – DOE should decline to adopt the proposed standard for gas instantaneous water heaters on the grounds that it would result in the unavailability of products with “performance characteristics” and “features” currently available to consumers in the United States.

ii. DOE has Not Justified the Proposed Standards for Instantaneous Gas Water Heaters.

EPCA requires that “[a]ny new or amended energy conservation standard” must be “technologically feasible and economically justified.”²⁵ Both the structure of the statute and its text make it clear that every individual standard must be economically justified and that benefits attributable to one standard cannot be used as a basis to justify a *different standard*.²⁶ DOE has not provided an economic justification for any of its proposed standards for GIWHs.

DOE has proposed new minimum efficiency standards for three separate categories of gas instantaneous water heaters.²⁷ However, DOE has provided only one life-cycle cost analysis to justify these three different standards.²⁸ At most, these results show that – if the economic impacts of this group of standards are combined – the net effect is positive. However, GIWHs with a rated storage volume under 2 gallons and an input capacity of up to 50,000 Btu/h are different than GIWHs with a rated storage volume of less than 2 gallons and an input capacity of over 50,000 Btu/h; these products presumably have different initial costs and different operating costs, and DOE concluded that they are *different enough* that they should be subject to two materially different minimum efficiency standards. However – as already indicated – DOE has not provided payback or life-cycle cost outcomes for either of these proposed standards. Would those results suggest that both standards are economically justified, that one is justified and the other is not, or that neither is economically justified? Having failed to address these questions, DOE has failed to justify any of its proposed standards for GIWHs. To the extent DOE believes that it does not need to justify these standards individually – an approach that presumes that benefits attributable to one standard can be used to justify a different standard – DOE is mistaken as a matter of law and should modify its regulatory approach. In any event, DOE has failed to justify its proposed standards for GIWHs as EPCA requires.

²³ 88 Fed. Reg. at 49079.

²⁴ See *Hearth Patio & Barbecue Association v. DOE*, 706 F.3d 499, 506 (D.C. Cir. 2013); *NRDC v. EPA*, 489 F.3d 1364, 1373 (D. C. Cir. 2007).

²⁵ 42 U.S.C. § 6295(o)(2)(A).

²⁶ See 42 U.S.C. § 6295(o)(2)(B).

²⁷ 88 Fed. Reg. at 49177.

²⁸ See 88 Fed. Reg. at 49139 Tables V.11 and V.12; 88 Fed. Reg. at 49149-51 (cumulative energy savings and net present value of consumer savings). It should be noted that DOE’s analysis of emissions reductions and claimed climate and health benefits does not even provide results specific to the groups of standards for gas instantaneous water heaters: instead, it provides a single set of results for the claimed combined impact of all of all of DOE’s proposed standards. 88 Fed. Reg. 49151-56.

iii. The Proposed Standards for Instantaneous Gas-Fired Water Heaters Are Not Economically Justified

The economic justification for the proposed standards for GIWHs is remarkably weak and based on an analysis that significantly overstates the potential for standards to provide economic benefits for consumers.

The consumer benefits claimed to justify the proposed standards amount to average life-cycle cost savings of \$135 over an average product life of 20 years, again based on operating cost savings of less than \$2.00 per month in the first year.²⁹ According to DOE's analysis, purchasers affected by this proposed standard would face average payback periods of more than *twelve years* and would experience net costs over 35% of the time.³⁰

These claimed economic benefits are not credible for a number of reasons. They appear to be based on overstated gas prices, understated product, installation, and maintenance costs, and – as explained below – an analytical approach that systematically overstates the potential for standards to provide economic benefits for consumers while understating their potential to impose net costs. For all of these reasons, the fact that DOE's analysis produced extremely modest claimed benefits is a strong indication that the proposed standards would actually do consumers more economic harm than good.

However, there is an additional and even more fundamental problem that undermines the credibility of the benefits claimed to justify the proposed standards: despite the artificial precision of DOE's analytical results, its analysis has neither the accuracy nor the precision required to produce meaningful results on the scale of the benefits DOE claims. This should be obvious, because DOE's entire analysis is based on precise data inputs that are developed on the basis of decidedly imprecise information and assumptions. For example – instead of gathering actual data on the prices consumers pay for products such as GIWHs – DOE employs an elaborate analysis to “build up” product price and installation cost estimates based on numerous parameter inputs for which credible information is frequently lacking.³¹ The results of this analytical approach have long been criticized for their lack of accuracy and precision, yet DOE's analysis is based on price inputs that are precise to the penny. In this case, DOE's analysis shows that the average difference in total installed cost between a non-condensing gas instantaneous water heater and an instantaneous water heater efficient enough to satisfy its proposed standard is only \$127. Direct pricing information submitted in the record suggests that the difference in average *product price alone* is on the order of \$450, suggesting that DOE's installed cost estimate is low by more than

²⁹ 88 Fed. Reg. at 49139 Tables V.11 and V.12.

³⁰ Again, the payback and net cost figures presented at 88 Fed. Reg. 49139 Tables V.11 and V.12 are misleading for the reasons already explained in footnote 17 and 18. As DOE's own figures show, the average of the payback periods for consumers affected by the proposed standards is 12.1 years (EERE-2017-BT-STD-0019-0060_content.xlsx, sheet: Summary, cell U28) and the percentage of consumers affected by the rule that would experience net costs is 35.3% (Attachment A at Table 3).

³¹ See Joint Commenter's May 16, 2022, comments in this proceeding, identified in the docket as document No. EERE-2017-BT-STD-0019-0041, at Attachment B pp. 71-73.

350%.³² The problem is not just that DOE's critical installed cost numbers appear to be grossly underestimated. It is that the uncertainties in DOE's numbers are far too great to support the claim that the small benefits it claims to justify its proposed standards can be reliably distinguished from net costs of a similar magnitude. To illustrate this point, Joint Commenters prepared a sensitivity analysis to determine the impact of incremental increases in DOE's installed cost estimates. If DOE's installed cost estimates for gas water heaters are low by even 3%, over half the consumers affected by the rule would experience net costs; if DOE's estimates are low by 6%, the average life-cycle cost savings would be negative.³³ And this is just the impact that an error in one key parameter would have. A sensitivity analysis combining errors in installed product and maintenance costs shows that – if DOE underestimated installed costs by just 2% and maintenance costs by 5% – over half the consumers affected by its proposed gas water heater standards would experience net cost results.³⁴

DOE would need far better data to achieve anything like the level of precision and accuracy required to make credible claims that its standards would produce consumer benefits on the scale of the benefits it claims for gas water heaters.

iv. DOE's "Random Assignment" Methodology is Unreasonable

Gas water heaters efficient enough to satisfy the proposed standards (*i.e.*, "Standards-Compliant" water heaters) are already well-established in the market and have captured a significant and ever-increasing share of the gas water heater market. DOE's own numbers demonstrate that the economic consequences of investments in such products vary considerably based on individual circumstances, producing significant economic benefits in some cases and imposing significant costs in others. In these circumstances, a perfectly-functioning market would not result in a 100% market share for Standards-Compliant products and a standard designed to achieve a 100% market share for such products would, at best, be an over-correction for any "market failures" alleged to exist. Moreover – where some investments in Standards-Compliant products would be economically beneficial and others would impose net costs – the economic impact of a standard necessarily depends on the extent to which purchasers acting in the absence of the standard have any significant tendency to make investments in Standards-Compliant products when it would be economically beneficial to do so or to decline such investments when they are economically unattractive. To the extent purchasers have such tendencies, the distribution of economic outcomes for investments in Standards-Compliant products would be different for the investments purchasers would choose to make on their own (*i.e.*, "base case" investments) than for those they would make only if a new standard left them no choice (*i.e.*, "rule outcome" investments). Specifically:

- The base case investments in Standards-Compliant products would disproportionately include investments with *attractive* economic outcomes;

³² August 28, 2023, Letter from Rinnai America Corp. to the U.S. Department of Justice, identified in the docket as document No. EERE-2017-BT-STD-0019-0612, at Table 1.

³³ Attachment A at 5-7 & Figure 1.

³⁴ Attachment A at 8, 10 & Figure 4.

- The rule outcome investments in Standards-Compliant products would disproportionately include investments with *unattractive* economic outcomes; and
- The average economic outcome for base case investments in Standards-Compliant products would be better – and *that for rule outcome investments would be worse* – than the average economic outcome for all potential investments in Standards-Compliant products.

It is absurd to suggest that the purchases of gas water heaters consumers are making in the absence of standards do not reflect *any* significant consumer preference for economically beneficial investments in Standards-Compliant water heaters or aversion to economically unattractive investments in such products. Nevertheless, DOE employs a “random assignment” methodology that assumes that such purchasing decisions are *never* influenced by the economic consequences of potential investments in Standards-Compliant water heaters *regardless of the economic stakes involved*. DOE has never even claimed that assumption is factually valid. As discussed in numerous previous comment submissions, that assumption provides a basis for analysis that significantly overstates the potential for standards to produce good economic outcomes, significantly understates their potential to impose bad economic outcomes, and thus systematically skews the results of the economic analyses DOE relies upon to justify new standards.³⁵

a. The Mechanics of Random Assignment

DOE's analysis is based on 10,000 “trial cases” that ostensibly represent the full range of scenarios in which Standards-Compliant products may be installed. The economic consequences of potential investments in Standards-Compliant products – as compared to investments in lower efficiency products – can be determined for each of these 10,000 trial cases. These consequences vary depending on the case-specific circumstances represented by each individual trial case and – as already indicated – typically include some cases with very favorable economic outcomes and others with very unfavorable outcomes. For example, DOE's analysis indicates that individual investments in Standards-Compliant GIWHs can provide economic benefits of up to \$5,078 or impose net costs of up to \$1,886.³⁶

DOE accounts for the fact that a significant percentage of consumers already choose Standards-Compliant products by creating a base case in which that same percentage of trial cases are “assigned” Standards-Compliant products to start with. Having accounted for these “base case” investments in Standards-Compliant products, the remaining trial cases are “assigned” lower efficiency products and used to simulate the investments in Standards-Compliant products that would occur only if a new standard is imposed. DOE's analysis of the economic impact of a standard is based on the economic consequences of replacing lower-efficiency products with Standards-Compliant products in the latter cases.

³⁵ See e.g., Joint Commenter's May 16, 2022, comments in this proceeding, identified in the docket as document No. EERE-2017-BT-STD-0019-0041, at Attachment A at 13-14 and Attachment B at 58-62; see also Attachment C to these comments, at 15-17.

³⁶ These are DOE's outcomes for trial cases 7633 and 1685, respectively.

For purposes of this analysis, the percentage of trial cases “assigned” to represent base case investments in Standards-Compliant products (*i.e.*, those investments that consumers are already making on their own) is based on the market share DOE expects Standards-Compliant products to capture if no new standard is imposed. However – whatever that percentage is – the *individual trial cases* assigned to the base case are selected randomly (*i.e.*, without regard to their economic outcomes), as though base case purchasers have no statistically significant preference for economically beneficial investments in Standards-Compliant products or aversion to economically unfavorable investments in such products regardless of the economic stakes involved.

b. Random Assignment Simulates Extreme and Unreasonable Purchasing Behavior.

DOE offers a tepid acknowledgement that “economic factors may play a role” in purchasing decisions but claims that random assignment reasonably “simulates behavior in the water heater market, where market failures and other consumer preferences result in purchasing decisions not being *perfectly aligned* with economic interests.”³⁷ DOE then “emphasizes that its approach does not assume that all purchasers of water heater make economically irrational decisions,” pointing out that “[a]s part of the random assignment, some homes or buildings with large hot water use will be assigned higher efficiency water heaters, and some homes or buildings with particularly low hot water use will be assigned baseline water heaters.”³⁸ However, as DOE is well aware:

- Economic considerations play a significant role in consumer purchasing decisions; and
- The fact that random assignment produces some apparently reasonable assignments by chance does not provide a basis to assert that it simulates a market in which *any* purchasing decisions are influenced by economic considerations.

1. *Economic Considerations Do Influence Purchasing Behavior*

DOE knows that economic considerations have a significant influence on consumer purchasing decisions. In the NOPR, it identifies “significant additional installation costs” as a basis to conclude that “very few consumers” would make a particular kind of purchasing decision, a conclusion that follows only if economic considerations influence purchasing behavior.³⁹ Similarly, DOE’s analysis supporting its proposed standards for non-weatherized gas furnaces included a “consumer choice” model that used economic criteria such as initial costs and payback periods to simulate purchasing behavior. While DOE used that model to address fuel switching decisions rather than to replace its random assignment methodology for base case efficiency assignment, its model was based on survey-based data that “identified consumers’ willingness to purchase more-efficient space-conditioning systems.”⁴⁰ DOE acknowledged that this data addressed decisions to pay more up-front for more efficient products – not decisions to engage in fuel switching – but argued that “because the data reflect a trade-off between first cost and ongoing savings, it is reasonable to expect that the payback criterion is broadly reflective of the potential

³⁷ 88 Fed. Reg. at 49115 (emphasis added).

³⁸ *Id.*

³⁹ 88 Fed. Reg. at 49119.

⁴⁰ 87 Fed. Reg. 40590 at 40647 (July 7, 2022).

consumer behavior regarding switching.”⁴¹ In short, DOE indicated that it was employing data demonstrating that economic considerations have a significant impact on purchasing behavior and – specifically – *on decisions to make or decline investments in more efficient products*. The source of that data was an earlier vintage of the same data source DOE is relying on for other purposes in this rulemaking: the American Home Comfort Studies.⁴² DOE’s insistence that it can reasonably ignore the impact that economic considerations have on consumer purchasing decisions flies in the face of such evidence.

Moreover, the fact that economic considerations have an impact on consumer purchasing decisions has been confirmed by analysis of DOE’s own numbers in its rulemaking concerning standards for non-weatherized gas furnaces. As documented in comments submitted in that proceeding, DOE’s numbers show that there is a significant correlation between the regional market shares for condensing furnaces and regional differences in the economic outcomes of investments in such products. In particular:

- There was a correlation showing that the market share for condensing furnaces increased as the life-cycle cost savings for investments in such products increased;⁴³ and
- There was correlation showing the market share for condensing furnaces decreased as the percentage of investments with net cost outcomes increased.⁴⁴

While DOE has not provided the regional data needed to show similar correlations in DOE’s results for consumer water heaters, there is no basis to suggest that economic considerations have a significant impact on decisions to invest in more efficient furnaces but not on similar decisions to invest in more efficient water heaters.

2. Random Assignment Assumes that Economic Considerations Never Matter

Random assignment simulates a market in which some base case purchasers make economically advantageous efficiency investments purely by chance, not a market in which some purchasing decisions are made *on the basis of economic considerations*. This is obvious, because – if DOE assumed that *any* percentage of purchasing decisions are made on the basis of economic considerations – that percentage of trial cases would be assigned accordingly: *i.e.*, in those cases, the trial cases in which investments in Standards-Compliant products would be economically *favorable* would at least generally be assigned to represent base case investments in such products and those in which investments in Standards-Compliant products would be economically *unfavorable* would at least generally be assigned to represent rule outcome investments in such products. **DOE does not assign any trial cases in that way.**

⁴¹ 87 Fed. Reg. at 40647 (July 7, 2022).

⁴² See 87 Fed. Reg. 40590 at 40647 (July 7, 2022); 88 Fed. Reg. at 49114 n. 84.

⁴³ See Comments of the American Gas Association for Docket No. EERE-2014-BT-STD-0031, (Oct. 6, 2022) 60-64, provided as Attachment D to these comments.

⁴⁴ *Id.* at 64-67.

The difference between random assignment and an approach that simulates *any* economic decision-making is substantial. For purposes of illustration, consider a very simplified example in which half of all potential investments in Standards-Compliant products – represented by 10,000 individual trial cases – would have “good” economic outcomes and the other half would have “bad” outcomes. Further assume that 50% of purchasers are already choosing Standards-Compliant boilers, in which case 5,000 trial cases would be assigned to represent base-case investments in Standards-Compliant products and the other 5,000 would represent rule-outcome investments in such products. The question is how the individual trial cases should be “assigned” to these two categories.

With random assignment, the 5,000 trial cases representing base case investments in Standards-Compliant products are selected randomly, with the result that – statistically – they should include about 2,500 trial cases with “good” outcomes and 2,500 cases with “bad” outcomes. This would leave about 2,500 trial cases in which investments in Standards-Compliant products would have “good” outcomes and 2,500 cases in which such investments would have “bad” outcomes to represent the investments in Standards-Compliant products that would occur as a result of the standard.

If it is assumed that *half* of all purchasing decisions are the product of sound economic decision-making, 5,000 trial cases should be “assigned” accordingly: those in which investments in Standards-Compliant products would have “good” economic outcomes (about 2,500 cases) should be assigned to represent base case investments in such products, and those with “bad” outcomes (again, about 2,500 cases) should be assigned to represent investments that would occur as a result of the standard. The remaining 5,000 trial cases would then be assigned randomly (to simulate the 50% of cases in which economic considerations are completely ignored) with the result that the additional 2,500 trial cases representing base case investments in Standards-Compliant products should include about 1,250 cases with “good” outcomes and 1,250 cases with “bad” outcomes (leaving about 1,250 case with “good” outcomes and 1,250 cases with “bad” outcomes to represent the investments that would occur as result of the standard).

The resulting difference in the distribution of economic outcomes is striking:

- Random assignment simulates a market in which economic considerations *never* matter, with the result that about half of the 5,000 trial cases representing rule-outcome investments in Standards-Compliant products would have “good” economic outcomes and the other half would have “bad” outcomes. As a result, the average LCC result for the standard would be squarely between “good” and “bad.”
- By contrast, simulation of a market in which half of all purchasing decisions are based on sound economic decision-making produces a result in which about 1,250 (25%) of the 5,000 trial cases representing rule outcome investments in standards-compliant products would have “good” economic outcomes and the other 3,750 (75%) would have “bad” economic outcomes. As a result, the average LCC result for the standard would be “bad.”

This difference in outcome is not attributable any difference in the base case market share for standards-compliant boilers or in the range or distribution of economic outcomes for potential investments in standards-compliant products: it is solely a product of the difference between random assignment and a methodology that really does assume that some purchasing decisions are made on the basis of sound economic decision making and others are not.

c. Random Assignment Unreasonably Skews the Results of DOE's Analysis.

Because it simulates a world in which decisions to make (or decline) efficiency investments are *never* influenced by the economic consequences of such investments, random assignment treats too many good investments in Standards-Compliant products as rule outcomes and too many bad investments in such products as the self-inflicted injuries of consumers acting on their own. As a result, DOE's analysis significantly understates the percentage of consumers that would experience net costs as a result of the standard and overstates the economic benefits the standard would provide. The practical impact of the latter problem is significantly exacerbated by the fact that the average LCC outcome for DOE's purported rule outcome investments (a figure on which DOE principally relies to justify standards) tends to be disproportionately influenced by a small percentage of trial cases with relatively extreme economic outcomes: precisely the kinds of cases in which economic considerations are *most likely* to drive purchasing decisions. Accordingly – while random assignment is unreasonable – it is *most unreasonable* as applied to the individual trial cases that matter most: those that have the most substantial economic consequences (good or bad) and thus the greatest impact on the results of DOE's analysis.

To illustrate, DOE's analysis for GIWHs claims regulatory benefits in the form of life-cycle cost savings that barely exceed zero. These claimed benefits are the product of analysis based on 3,751 randomly selected trial cases, of which over 35% (1,324 cases) have net cost economic outcomes: *i.e.*, outcomes *so bad* that consumers would still be left in the red even after the average 20-year life of the product. Statistically, DOE's 3,751 randomly selected trial cases should be representative of all 10,000 trial cases, and analysis of DOE's numbers confirms that they are.⁴⁵ Consequently, roughly one third of *all potential investments* in Standards-Compliant products (represented by over 3,300 of DOE's 10,000 trial cases) can be expected to have net cost outcomes. DOE's analysis assigned only 1,324 of those cases to represent rule outcomes because it absurdly assumed that – because over 62% of purchasers are already choosing standards-compliant products – over 62% of the purchasers *facing investments with these conspicuously bad outcomes* would choose to snap them up. In short, random assignment assumed that the probability that consumers would be deterred by *even the worst possible* economic outcomes is exactly zero.

Conversely, over 34% of DOE's total claimed benefits are provided by 575 individual trial cases in which the Standards-Compliant product is the option *with the lowest installed cost*. There is no basis to suggest that standards are necessary to induce purchasers to choose more efficient products when they cost less to start with, yet these 575 cases were assigned to represent rule outcomes

⁴⁵ To confirm that DOE's randomly selected rule outcomes are representative of all 10,000 trial cases, Joint Commenters assigned lower efficiency products to all of the trial cases that had been randomly assigned standards-compliant products in DOE's analysis. As expected, the results showed no significant difference in the distribution of economic outcomes. See Attachment A at 1-5.

because random assignment absurdly assumed that – because over 35% of consumers choose not to invest in standards-compliant GIWHs – over 35% of the purchasers presented with *these obvious opportunities to save money* would choose to pay more for less efficient products instead. In short, random assignment assumed that the probability that consumers would be attracted to investments that would provide windfall economic benefits is exactly zero.

These are two specific examples of objectively absurd and disproportionately consequential “assignment errors” attributable to the assumption that purchasing decisions are *never* influenced by economic considerations *regardless of the economic stakes involved*. In this case, it is not reasonable to conclude that purchasers acting on their own would make so many investments with conspicuously bad economics or turn down so many opportunities for windfall economic benefits. As these examples show, random assignment produces an analysis of rule impacts that is based on *the wrong set of trial cases*: one that is representative of all potential investments in standards-compliant products rather than of the investments that could reasonably be expected to occur as the result of a standard.

DOE’s failure to take any reasonable account of the impact that economic considerations are likely to have on purchasing decisions is unreasonable but is particularly egregious in the case of the high-consequence trial cases – good and bad – that disproportionately influence the results of its economic analysis.

d. DOE’s Failure to Address the Errors Created by Random Assignment is Unreasonable.

Interested parties have been pointedly challenging DOE’s random assignment methodology for a number of years, as demonstrated by numerous comments submitted in this and a variety of other DOE rulemaking proceedings.⁴⁶ The issue was raised in *American Public Gas Ass’n v. DOE*,⁴⁷ – a challenge to DOE’s commercial packaged boiler standards – and the Court found that DOE had failed to respond to the “substantial concerns” about this “crucial part of its analysis” and that its “failure to engage the arguments raised before it . . . bespeaks a failure to consider an important aspect of the problem.”⁴⁸ The NOPR exhibits the same failing.

The NOPR acknowledges previous comments expressing the concern that random assignment “completely ignores the fact that—in the absence of new standards—purchasers tend to make the most economically attractive efficiency investments and decline those with the most substantial net costs” and assigns “even the most economically attractive and highest net-cost efficiency investment outcomes to the base case for analysis randomly, as though purchasers never consider the economics of potential efficiency investments regardless of the economic stakes involved.”⁴⁹ The NOPR also acknowledges concerns about the absurd impacts of random assignment, including

⁴⁶ See e.g., Attachment C at 15-17; Attachment D at 54-67; Joint Commenter’s May 16, 2022, comments in this proceeding, identified in the docket as document No. EERE-2017-BT-STD-0019-0041, at Attachment A pp. 13-14 and Attachment B pp. 58-62.

⁴⁷ 22 F.4th 1018 (D.C. Cir. 2022) (“*APGA v. DOE*”).

⁴⁸ *Id.*, 22 F.4th at 1027-28.

⁴⁹ 88 Fed. Reg. at 49115.

the specific concern that “because there is no basis to suggest that standards are needed to ensure that consumers will choose more efficient products when those products have lower initial costs, DOE should assign such cases to the base case for analysis rather than assigning them to the base or standard cases randomly.”⁵⁰ Nevertheless, DOE has provided no meaningful response to these concerns and has done nothing to address the unreasonable impacts that random assignment has on the results of its analysis.

Instead, DOE responds to criticisms of random assignment with claims that assignment “based solely on economic measures . . . most likely would not fully and accurately reflect actual real-world installations” because alleged market failures suggest that decisions to make efficiency investments “are unlikely to be *perfectly correlated* with energy use.”⁵¹ DOE then claims that random assignment reasonably “simulates behavior in the water heater market, where market failures and other consumer preferences result in purchasing decisions not being *perfectly aligned* with economic interests more reliably than relying *only on apparent cost effectiveness criteria derived from the limited information in CBECS or RECS*.”⁵²

As already discussed, economic considerations often have a significant influence on consumer purchasing decisions and there is no remotely credible basis to assume that they do not. This does not mean that such decisions are *always* “based solely on economic measures” or are “*perfectly correlated with energy use*,” but it does mean that the core assumption embodied by random assignment – that base case purchasing decisions are *never* influenced by the economics of potential investments in Standards-Compliant products *regardless of the economic stakes involved* – is indefensible.

Again, random assignment is not a “reasonable approach” that “simulates behavior” in a market in which “purchasing decisions” are not “perfectly aligned” with economic interests; it is an approach that unreasonably assumes that economic considerations *never influence purchasing decisions at all*. DOE’s claim that random assignment simulates purchasing behavior in the market for water heaters “more reliably than relying *only on apparent cost effectiveness criteria derived from the limited information in CBECS or RECS*” is not even relevant, because the alternative to random assignment is not to rely on “apparent cost effectiveness criteria derived from the limited information in CBECS or RECS” as DOE seems to suggest.⁵³ The fundamental problem with random assignment is that it fails to address the impact that economic considerations have on consumer purchasing behavior (and hence the economic impact of new efficiency standards). By themselves, building characteristics do not provide a basis to determine case-specific economic outcomes, and it is those outcomes – which DOE’s individual trial case results already provide – that must be considered in determining the impact that economic considerations are likely to have on purchasing behavior. Moreover, it is the way that *individual trial cases* are assigned – not the *number of trial cases assigned* (as determined market share) – that DOE must correct. It is therefore no surprise that DOE’s 5% market share adjustments based on building characteristics⁵⁴

⁵⁰ *Id.*

⁵¹ 88 Fed. Reg. at 49115 (emphasis added).

⁵² *Id.* (emphasis added).

⁵³ *Id.*

⁵⁴ 88 Fed. Reg. at 49114.

did nothing to address the problems created by random assignment; in fact, these adjustments appear to have no material impact on the results of DOE's analysis.⁵⁵

Similarly, DOE's claim that random assignment would not skew its analysis where "most consumers will continue to be assigned the same efficiency regardless of the details of the methodology"⁵⁶ is in error, because the problem with random assignment is not *how many* trial cases are "assigned" products of particular efficiencies: it is the fact that the *individual trial cases* assigned to represent base case investments in Standards-Compliant products are selected without consideration of their economic consequences, as though base case purchasers never consider economic consequences of potential efficiency investments regardless of the stakes involved.

DOE's extended discussion of theoretical market failures⁵⁷ is also misdirected, for the simple reason that claims that consumers do not always make perfect economic decisions are facially insufficient to justify the assumption that purchasers are never influenced by economic considerations at all. For example, the NOPR cites one study for the proposition that a "significant subset of consumers appear to purchase appliances without taking into account their energy efficiency and operating costs at all,"⁵⁸ ignoring the fact that this proposition does not justify the assumption that *no* consumers consider such factors and the fact that the study it relies on concluded that – on average – consumers do consider such factors.⁵⁹ Indeed, the entire body of literature on market failures consists of efforts to identify and (in some cases) assess the impact of potential *exceptions to* (or *limitations on*) the general proposition that purchasers tend to act in their own economic interest.

DOE should also recognize that not all purported "market failures" represent "problems" that should – or in some cases can – be "corrected" by efficiency standards. As the study cited above found, the consumers most likely to prioritize initial costs over efficiency benefits are low-income consumers, and – as detailed in previous comment – it would be more cruel than wise to adopt standards designed to force such consumers to make efficiency investments they cannot afford.⁶⁰ Similarly, DOE should recognize that (at least in the case of appliances such as heating and water heating equipment) a tendency toward like-for-like replacements in "emergency replacements of essential equipment such as water heaters"⁶¹ is not a "market failure" at all, except in the sense that it does not prioritize energy efficiency over the consumer's need to restore service as quickly and easily as possible.

⁵⁵ Indeed, these adjustments had less impact on the results of DOE's analysis than a simple change in the random seed number used in DOE's analysis, which should not have a material impact on the results of the analysis. *See* Attachment A at 1-4 & Tables 2 and 3.

⁵⁶ 88 Fed. Reg. at 49118.

⁵⁷ 88 Fed. Reg. at 49115-18.

⁵⁸ 88 Fed. Reg. at 49116.

⁵⁹ Houde, S. "How Consumers Respond to Environmental Certification and the Value of Energy Information," cited at 49116 n. 91.

⁶⁰ *See* Joint Commenter's May 16, 2022, comments in this proceeding, identified in the docket as document No. EERE-2017-BT-STD-0019-0041, at Attachment B, pp. 38-41 (detailing the adverse health and safety impact of such standards in the context of furnaces).

⁶¹ 88 Fed. Reg. at 49116.

Alleged market failures must also be viewed in context. The potential that market failures might cause consumers to choose the low-cost option when they might be better off investing in a more efficient product cannot justify the random assignment of cases in which the more efficient product *is the low-cost option*. Concerns that consumers might have trouble making perfect economic decisions in close or complicated cases provides no basis for random assignment of cases that are obvious “no brainers” from an economic standpoint. The fact that “[t]here are consumers who are willing to pay a premium for more energy-efficient products”⁶² provides no basis to conclude that consumers have no statistically significant aversion to bad investments *regardless of the stakes involved* and certainly does not justify the random assignment of trial cases representing investments that, for example, have initial costs with an obvious potential to induce “sticker shock.” Even demonstrated market failures in the market at issue would – at most – have incremental impacts insufficient to justify random assignment.

Although DOE claims that it “minimizes any bias in the analysis by using random assignment, as opposed to assuming certain market conditions that are unsupported given the available evidence”⁶³, the opposite is true: random assignment creates a massive bias in DOE’s analysis by “assuming certain market conditions” that are unsupported by the available evidence. As a result, DOE’s analysis is arbitrary and insufficient to support the adoption of any standard.

e. Alternatives to Random Assignment

The obvious alternative to random assignment is to prepare a base case for analysis that reasonably represents actual market conditions and purchasing behavior. For purposes of the following discussion, Joint Commenters will assume that DOE:

- Retains an LCC analysis based on 10,000 trial cases representing the range and distribution of scenarios in which standards-compliant products can be expected to be installed; and
- Continues to determine the percentage of these trial cases that should represent base-case investments in standards-compliant products.

The sole issue is how the individual trial cases representing base-case investments in standards-compliant products should be selected.

As a preliminary step, DOE should assign lower-efficiency products to all 10,000 trial cases for purposes of determining the economic outcome of investments in standards-compliant products in each of its 10,000 trial cases. This step is necessary to enable DOE to consider the impact that those economic outcomes are likely to have on base case purchasing decisions.

While the specific methodology for the assignment of individual trial cases should vary depending on the nature of the product, the range and distribution of economic outcomes for potential investments in standards-compliant products, and evidence of specific market failures and other

⁶² *Id.*

⁶³ *Id.*

relevant market conditions. However, there are at least two core principles that should govern DOE's approach.

First, market failures, by definition, are limited exceptions to the principle that consumers can generally be expected to act in their own economic interest. Accordingly – to the extent there are demonstrated market failures – their impact should be simulated in a way that accounts for the circumstances in which each such failure is likely occur and the way in which each failure can be expected to influence purchasing decisions.

Second – while purchasing decisions are not always based on *perfect* economic decisions – DOE should recognize that the probability that a purchasing decision will be made on the basis of economic considerations increases as the economic consequences of that decision (good or bad) increases.

The approach described below provides a general (and admittedly abstract) illustration of how issues might be addressed in a manner consistent with the above principles.

1. Accounting for Consumers Willing to Pay a Premium for Energy Efficient Products

If there is sound basis to conclude that some percentage of purchasers are so willing to pay a premium for more energy-efficient products (and so insensitive to costs) that they would generally purchase standards-compliant products regardless of the economic consequences, DOE could:

- Select that percentage of the 10,000 trial cases – without considering their economic outcomes – by choosing individual trial cases that appropriately represent cases involving such purchasers (*i.e.*, cases involving installations in buildings likely to be owned by higher-income consumers and governmental or institutional purchasers with policies requiring investment in high-efficiency products); and
- Assign those trial cases to represent base case investments in standards-compliant products, subject to appropriate exceptions to address individual cases in which problematic outcomes are likely to cause even those prepared to pay a premium for higher efficiency to decline investments in Standards-Compliant products.

This approach would account for relatively extreme cases in which consumers value efficiency over economic considerations: *i.e.*, cases in which purchasers can be expected to be particularly insensitive to negative economic outcomes. At the same time, it would recognize that there are factors (such as a level of “sticker shock”) that would cause many such purchasers to decline unreasonably costly efficiency investments (DOE should note that many institutional policies favoring higher-efficiency products provide exceptions for such cases). Such cases would represent limited exceptions to the expected behavior of purchasers who are generally prepared to pay a premium for higher efficiency products. The result would be that a randomly-selected percentage of trial cases would assigned to represent base case investments in standards-compliant products, with the exception of cases with particularly negative outcomes (which would be

assigned lower efficiency products to represent cases in which even purchasers prepared to pay a premium for more efficient products would be expected to balk).

Cases in which decisions are less dramatically influenced by a willingness to pay a premium for higher-efficiency products could be addressed through criteria reflecting imperfect economic decision-making (described below).

2. “Split Incentives”/Extreme Sensitivity to Initial Costs

If there is a sound basis to conclude that some percentage of purchasers would generally choose the product with the lowest installed cost regardless of any other considerations:

- DOE should select that percentage of trial cases – without considering their economic outcomes – by choosing individual trial cases that appropriately represent cases involving such purchasers (*i.e.*, cases involving installations in buildings likely to be owned by low-income consumers and owners of low-income housing); and
- For the base case, DOE should assign each of these trial cases the product with the lowest installed cost, subject to appropriate exceptions for cases in which small differences in initial costs or high operating costs would likely cause purchasers otherwise inclined to choose the low-cost option to invest in Standards-Compliant products instead (*e.g.*, cases in which a landlord could expect a relatively modest investment to pay off through improved tenant retention).

This approach is designed to appropriately account for the circumstances in which extreme sensitivity to initial costs is likely to occur and simulates the impact such sensitivity would be likely to have on purchasing behavior.

Again, cases in which purchasing decisions are less dramatically influenced by sensitivity to initial costs can be addressed through criteria reflecting imperfect economic decision-making (described below).

3. Informational Market Failures

In the case of professionally-installed appliances for which certified efficiency ratings are required and products are differentiated largely on the basis of their cost and efficiency, concerns about the ability of consumers to make sound economic decisions should be limited to cases in which the economic stakes are relatively small and difficult to assess. As a result, these concerns can be appropriately addressed through criteria reflecting imperfect economic decision-making (described below).

4. Imperfect Economic Decision-Making

To simulate imperfect economic decision-making, DOE should – after accounting for significant demonstrated market failures as appropriate – attempt to identify (1) categories of trial cases in

which sound economic decision-making can be expected drive decisions, (2) categories of trial cases in which economic decision-making can be expected to drive decisions in a relatively large percentage of cases, and (3) categories of trial cases in which economic decision-making is significantly less likely to drive purchasing decisions.

The line drawing required for this purpose should be informed by the range and distribution of economic outcomes in DOE's 10,000 trial cases, the percentage of consumers expected to purchase standards-compliant products in the absence of a new standard, and relevant data concerning consumer purchasing behavior. However, DOE should start with the assignment of the trial cases in which purchasing decisions are most likely to be made on the basis of economic considerations (generally those in which the economic stakes are highest) and progress to the cases in which economic considerations are least likely to be decisive (generally those in which the economic stakes are lowest). This approach appropriately prioritizes the reasonable assignment of the trial cases with the greatest impact on the results of DOE's analysis, thereby reducing the potential impact of assignment errors. It should be noted that the approach described below assumes significant market failures as well as a significant disconnect between the kinds of outcomes DOE considers to be "economically beneficial" (*i.e.*, any investment that would provide non-zero life-cycle cost savings) and those consumers are likely to consider to be economically reasonable.

a. Cases in Which No "Investment" in Efficiency is Required

DOE should identify all trial cases in which the total installed cost of a Standards-Compliant product is lower than the total installed cost of a baseline efficiency product and would not impose higher operating costs. DOE should assign all of these cases to represent base case investments in standards-compliant products, because – in a context in which cost and efficiency are the principal significant variables – there is no basis to believe that consumers acting on their own would choose to pay more up-front for a less-efficient version of a Standards-Compliant product.

b. Investments with Very Obvious Economic Outcomes

DOE should identify and appropriately assign trial cases in which the economic consequences of investments in Standards-Compliant products are so obviously favorable or unfavorable that – in the absence of severe market failures of the kind already accounted for as described above – the economic consequences could not reasonably be expected to be overlooked or ignored.

For example, DOE could identify cases with very short payback periods (*e.g.*, simple payback periods that do not exceed one year) and assign all of those cases to represent base case investments in standards-compliant products.

Similarly, DOE could identify cases with very long simple payback periods (*e.g.*, simple payback periods exceeding the expected life of the product) and assign all of those cases to represent investments in standards-compliant products that would occur as a result of the standard.

The criteria used as examples above should be designed to identify trial cases in which economic outcomes are too obvious to be obscured by realistic informational market failures, and the

economic stakes are high enough to ensure that purchasing decisions are unlikely to be swayed by preferences for more efficient products or sensitivity to initial costs less pronounced than that already accounted for as described above.

c. Investments with Less Obvious Economic Outcomes

Purchasing decisions with less obvious economic outcomes can be expected to be driven by economic decision-making in some cases but not in others. As a result, such cases could appropriately be addressed through a combination of random and non-random assignment that accounts for the probability that particular categories of purchasing decisions would be based on economic decision-making.

Such an approach should start by identifying trial cases in which economic considerations are *likely* to be decisive in a large percentage of cases. For example, it would probably be reasonable to assume that a relatively large percentage of purchasers facing efficiency investments with simple payback periods of between one and three years would choose to make those investments on the basis of economic considerations.⁶⁴ Conversely, it may make sense to assume that a large percentage of purchasers facing efficiency investments with simple payback periods of between ten years and the expected life of the product would decline to make such investments on the basis of economic considerations. For the trial cases defined by such criteria, the percentage of cases in which economic decision-making can be assumed should be selected randomly and assigned on the basis of their economic outcomes (*i.e.*, with the cases with favorable economic outcomes being assigned to represent base case investments in standards-compliant products and those with unfavorable outcomes being assigned to represent investments that would occur as a result of the standard). The remaining percentage of the cases defined by such criteria should then be *assigned randomly*, simulating the result that – for reasons not already accounted for – it is assumed that purchasing decisions would not be based on economic outcomes.

Additional criteria could then be developed to define categories of trial cases in which economic considerations are likely to drive decisions in a lower percentage of cases. For each such category, the individual trial cases could again be assigned through a combination of random and non-random assignment that reflects the probability that purchasing decision will be made on the basis of economic decision-making. A purely random approach to assignment would only be appropriate for cases in which the economic stakes of potential efficiency investments are so modest and difficult to assess that they are unlikely to have *any influence* on purchasing decisions.

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

The NOPR fails to address significant regional differences for all water heaters modeled, with GIWHs showing a greater need for more detailed data than GSWHs. Based on the results of DOE's current model, most regions resemble one another with similar LCC savings, for low

⁶⁴ Again, the sequence in which different considerations are addressed is important. Here the impacts of cases involving significant market failures have already been addressed (*see* Section C.2.b above), as have cases with simple payback periods *not exceeding one year* (*see* Section C.1).

income and senior subgroups, there are several regions with low or negative LCC savings that could have played a different role in the modeled outcome if better market share data had been incorporated in the final results. At the state level 12 out of 51 states saw negative impacts from the rule. For low-income and senior households, this total grew to 12 and 18 of all 51 states.⁶⁵

Table: Regional Impact of GIWH Rule

	Total Simulated Trial Count	Affected	Total Negatively Affected	Average LCC Savings	Average First Year Savings	Higher Install Costs	Total Payback
New England	484	40%	23%	\$ 294	\$ 22	\$ 71	7.9
Middle Atlantic	719	36%	37%	\$ 46	\$ 13	\$ 212	14.4
East North Central	1976	40%	37%	\$ 143	\$ 11	\$ 91	13.6
West North Central	699	40%	36%	\$ 22	\$ 16	\$ 33	12.5
South Atlantic	1661	34%	33%	\$ 154	\$ 8	\$ 47	8.0
East South Central	488	37%	32%	\$ 234	\$ 7	\$ 40	11.5
West South Central	1479	35%	44%	\$ 88	\$ 23	\$ 52	13.5
Mountain	522	39%	32%	\$ 78	\$ 20	\$ 37	10.1
Pacific	1972	38%	32%	\$ 169	\$ 21	\$ 232	9.6
	10000	38%	35%	\$ 135	\$ 16	\$ 105	11.3

Low-income and senior households installing or replacing GIWHs saw more than half the savings as the national average LCC with only \$67 and \$53 in savings with payback periods between 14 and 16 years. The equipment has an average lifespan of 20 years. At the regional level, five out of nine census regions saw low to negative LCC savings for low-income households with payback periods ranging from 12 to 31 years.

Low-income households in New England saw the best LCC savings but the worst net first year cost to operate the more efficient GIWH of negative \$10. The average installation cost for low-income households in New England was also \$81 higher because of the rule, yet the LCC suggests that a home can save \$259 with a short payback of just 7 years. Outcomes like these may not match consumer expectations and be heavily reliant on the price forecast provided by EIA to justify the savings. It is also possible that New England has a higher share of condensing products and would never have had so many rule affected trials run in the first place, resulting in a different outcome that has less influence on the final results.

⁶⁵ Tables showing the regional impacts of the GIWH rule generally, on low-income households, and on senior households are provided in Attachment E to these comments.

Table: Regional Impact of GIWH Rule on Low-Income Households

	Total Simulated Trial Count	Low Income Weighted Trial Count	Percent Affected	Percent of Low Income Affected that are Negatively Impacted	Average LCC Savings for Low Income	Average First Year Savings for Low Income	Low Income Higher Install Costs	Low Income Payback
New England	484	39	8%	19%	\$ 259	\$ (10)	\$ 81	7.0
Middle Atlantic	719	47	7%	37%	\$ 0	\$ 5	\$ 173	20.4
East North Central	1976	105	5%	50%	\$ 6	\$ 15	\$ 93	30.9
West North Central	699	16	2%	39%	\$ (35)	\$ 51	\$ 200	30.5
South Atlantic	1661	69	4%	44%	\$ 62	\$ 27	\$ 144	9.7
East South Central	488	22	5%	57%	\$ (1)	\$ 18	\$ 125	12.1
West South Central	1479	52	3%	34%	\$ 107	\$ 24	\$ 124	11.9
Mountain	522	68	13%	11%	\$ 212	\$ 6	\$ 50	8.9
Pacific	1972	192	10%	40%	\$ 23	\$ 2	\$ 203	12.5
	10000	609	6%	37%	\$ 67	\$ 11	\$ 138	15.8

Senior households saw more negative impacts than low-income households with the same five poor outcome census regions all showing negative LLC savings and long payback averages. East North Central, another cold climate with a high market share for condensing furnaces and boilers, had the lowest LCC savings and longest average payback of over 35 years. Both low-income and senior subgroups are of particular modeling importance because of the potential financial burden that this rule could impose. Unlike storage water heaters which are equally common amongst both subgroups, tankless gas-fired water heaters were modeled 3 times as frequently in senior households than in low-income households, with the worst results out of all gas-fired products subgroups analyzed.

Table: Regional Impact of GIWH Rule on Senior Households

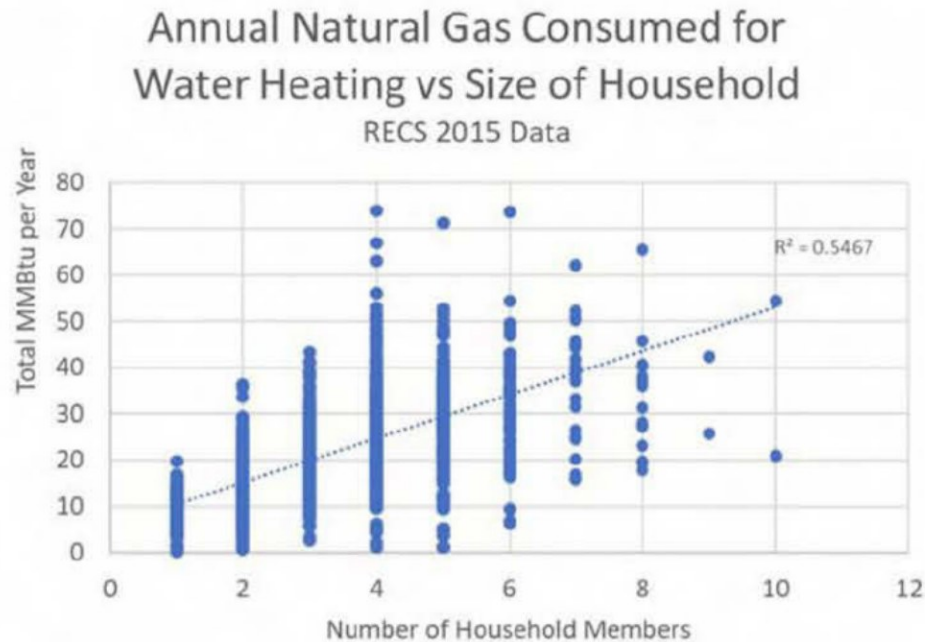
	Total Simulated Trial Count	Senior Weighted Trial Count	Percent Affected	Percent Senior Affected that are Negatively Impacted	Average LCC Savings for Seniors	Average First Year Savings for Seniors	Higher Install Cost for Seniors	Payback for Seniors
New England	484	14	3%	0%	\$ 326	\$ 1	\$ 151	4.3
Middle Atlantic	719	182	25%	47%	\$ (46)	\$ 27	\$ 288	24.5
East North Central	1976	218	11%	58%	\$ (15)	\$ 9	\$ 91	17.6
West North Central	699	57	8%	64%	\$ (116)	\$ 10	\$ 102	35.1
South Atlantic	1661	364	22%	36%	\$ 95	\$ 37	\$ 29	8.0
East South Central	488	171	35%	29%	\$ 111	\$ 20	\$ (15)	6.4
West South Central	1479	560	38%	29%	\$ 139	\$ 26	\$ 57	9.6
Mountain	522	137	26%	39%	\$ (15)	\$ 14	\$ 109	16.5
Pacific	1972	228	12%	52%	\$ (2)	\$ 25	\$ 197	18.7
	10000	1931	19%	40%	\$ 53	\$ 23	\$ 95	14.1

vi. DOE Incorrectly Modeled Home Water and Energy Usage Based on Household Characteristics

The EIA 2015 Residential Energy Consumption Survey (“RECS”) used to generate the sample buildings in the model shows a clear relationship between the energy used to heat water and the size of the household (not the size of the home). With more members in the household the average usage increases. During the DOE Webinar for the consumer water heating rule, held on 9/13/2023, Victor Franco of LBNL confirmed that this relationship is not considered within the model but should nonetheless show up in the results because of how the Energy Information Administration generated the average usage data for RECS. Additionally, DOE has referenced in the model the

importance of the square footage of the home to the efficiency of the water heaters, but the evidence doesn't support that in the original survey.

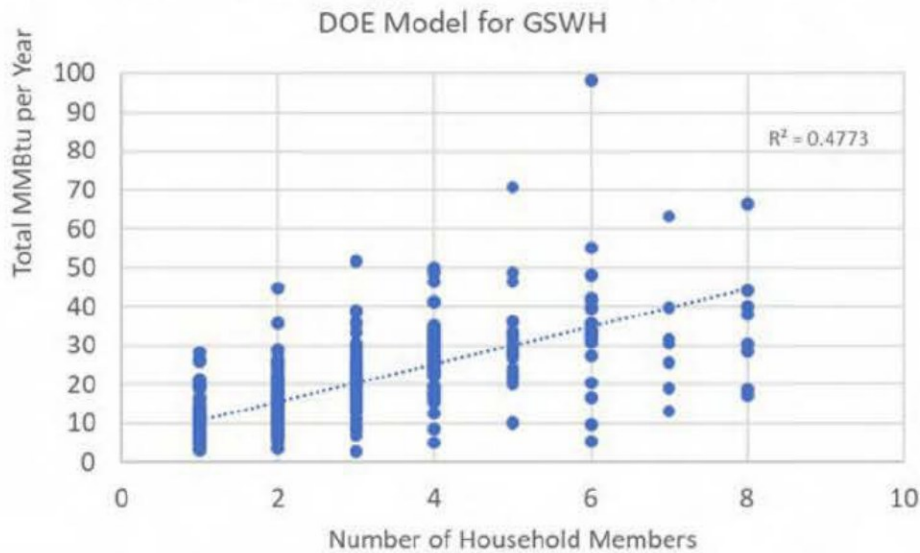
Average Usage Based on Household Size										
Size	1	2	3	4	5	6	7	8	9	10
MMBtu/Year	9	15	21	26	29	32	38	32	34	38
										Average
										18



Looking at DOE's Consumer Water Heater model's results, the GSWH resembles the same pattern found in the RECS 2015 Data. With more household members the average usage decreases. For the baseline EL0 water heater, the average usage matches the average usage in the 2015 survey. This is consistent with what DOE has said during publicly held meetings.

Average GSWH EL0 Usage Based on Household Size										
Size	1	2	3	4	5	6	7	8	9	10
MMBtu/Year	9	15	21	28	30	34	42	30	43	37
Gal/Day	19	43	67	92	103	121	140	109	159	110
										Average
										19

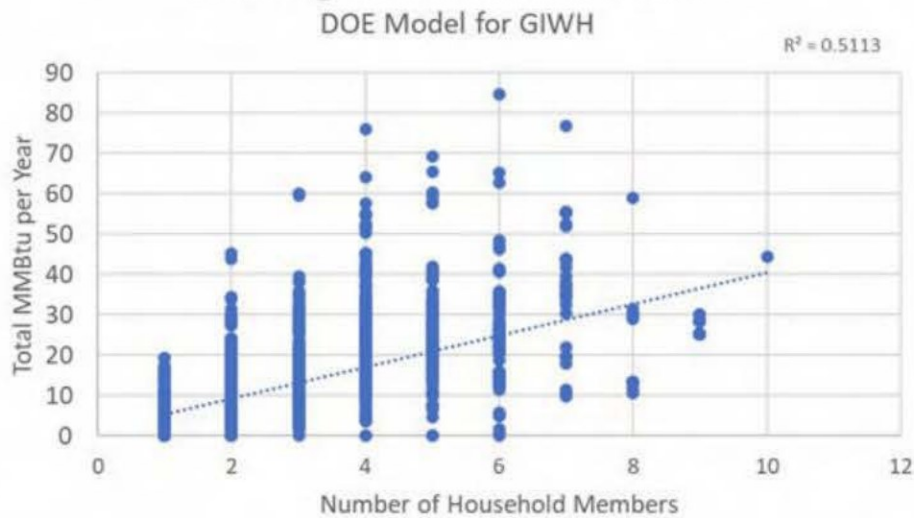
Annual Natural Gas Consumed for Water Heating vs Size of Household



GIWHs, however, do follow the same pattern but have many cases that may go against conventional logic. For each size of household within the model, tankless water heaters result in greater outliers for usage than their storage unit equivalent. The model also results in unrealistic outliers with gas and water usage for smaller households reaching consumption levels equal to space heating.

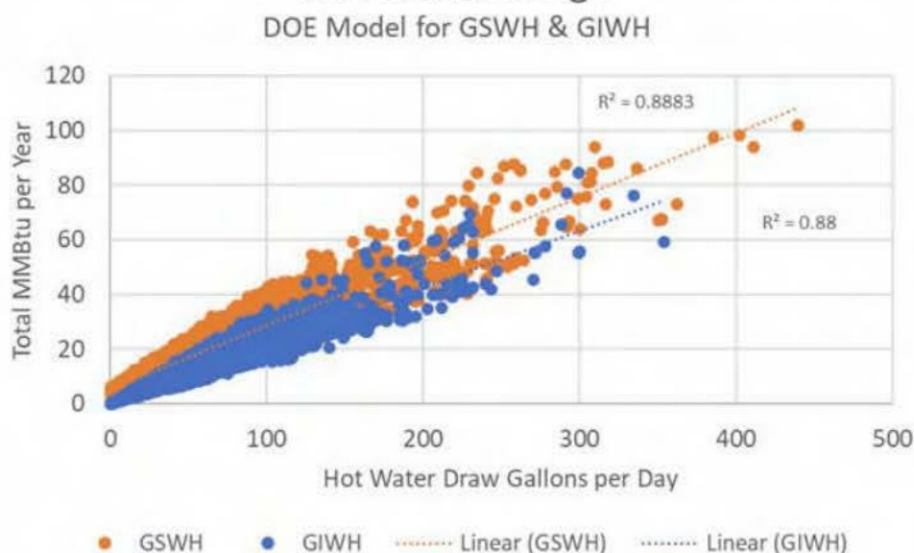
Average GIWH ELD Usage Based on Household Size										
Size	1	2	3	4	5	6	7	8	9	10
MMBtu/Year	5	9	14	18	22	22	38	22	27	44
Gal/Day	20	39	58	83	86	97	168	91	108	125
Average										12
										51

Annual Natural Gas Consumed for Water Heating vs Size of Household

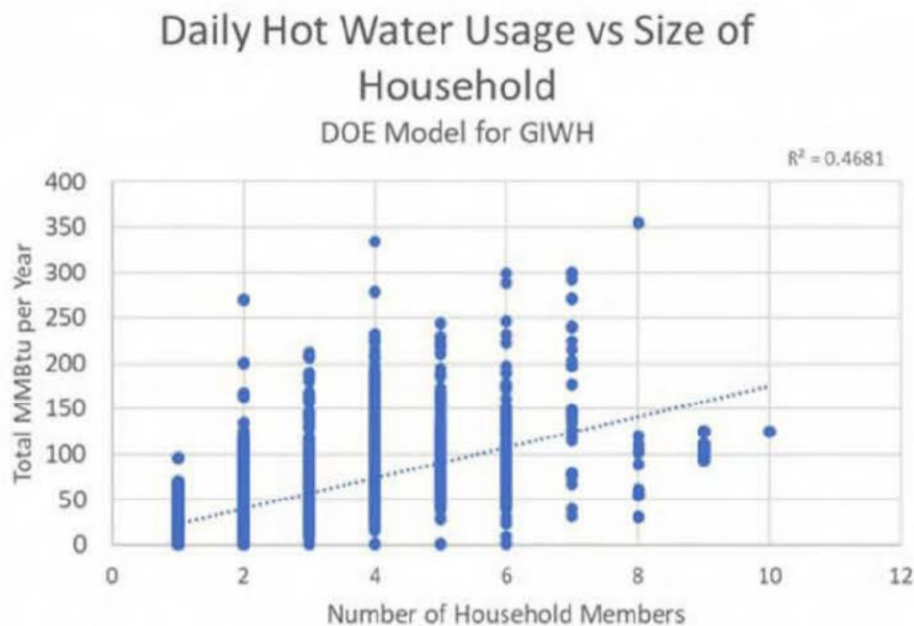


A potential reason for this failure to model energy usage and household size is how the model calculates daily water usage which influences energy usage. For both GSWHs and GIWHs, usage and daily water consumption follow a logical pattern. A linear relationship exists between using more hot water and using more energy. If smaller households are using more energy than larger households, then it is likely that DOE has incorrectly determined the water use for GIWH.

Annual Natural Gas Consumption vs Daily Hot Water Usage



As expected, comparing water consumption with household size fits the same pattern found when comparing household size and energy usage. This means that reviewing how water consumption is calculated may show a better solution to the model so that usage fits the size of the household better. It is also important to note that for smaller households not only is the water usage higher, but the outliers result in more than just high energy usage but also extreme water use. At 200 to 350 gallons a day, an individual would need to fill a bathtub four to seven times daily to use that much hot water 365 times a year. Even a rental unit or single-member housing unit sharing resources amongst more individuals than listed would likely not use this much water at the same consistency shown by DOE's model. This issue decreases with one or two occupant, with the largest households using enough water on average to supply only two or three baths total, ignoring everyone's needs and other end uses entirely.



Draw Pattern ID, which determines how much water is being consumed, is based on a randomly assigned distribution. DOE has pre-determined that households will always use more water if they use an instantaneous unit. For the smallest storage units, most likely to fit a household of one or two members, there is a 5 percent chance of a large draw pattern but a 75 percent chance for instantaneous.

Screen Capture of DOE Model – Tab “Building Sample”

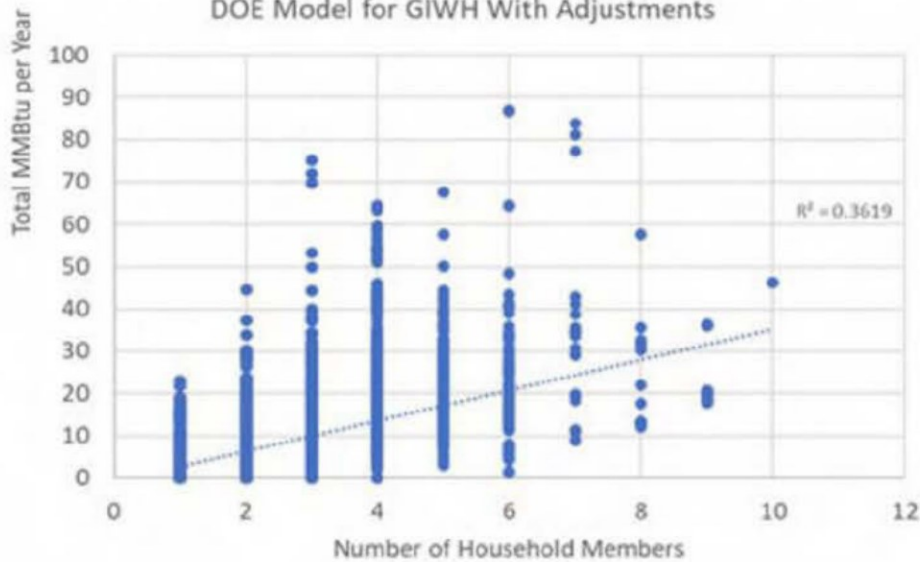
GSHWs					
REC S ID	REC S Size Bin	Low Draw	Medium Draw	Large Draw	Draw Pattern ID
1	Small storage tank (30 gallons or less)	15%	80%	5%	2
2	Medium storage tank (31 to 49 gallons)		70%	30%	2
3	Large storage tank (50 gallons or more)		10%	90%	3
O SHWs					
REC S ID	REC S Size Bin	Low Draw	Medium Draw	Large Draw	Draw Pattern ID
1	Small storage tank (30 gallons or less)	0%	0%	100%	3
2	Medium storage tank (31 to 49 gallons)	0%	0%	100%	3
3	Large storage tank (50 gallons or more)	0%	0%	100%	3
ESWHs ≤ 55 gallons					
REC S ID	REC S Size Bin	Low Draw	Medium Draw	Large Draw	Draw Pattern ID
1	Small storage tank (30 gallons or less)	0%	100%	0%	2
2	Medium storage tank (31 to 49 gallons)	15%	85%	0%	2
3	Large storage tank (50 gallons or more)	5%	85%	10%	1
ESWHs > 55 gallons					
REC S ID	REC S Size Bin	Low Draw	Medium Draw	Large Draw	Draw Pattern ID
3	Large storage tank (50 gallons or more)	0%	20%	80%	3
GIWH					
REC S ID	REC S Size Bin	Low Draw	Medium Draw	Large Draw	Draw Pattern ID
1	Small storage tank (30 gallons or less)		25%	75%	2
2	Medium storage tank (31 to 49 gallons)		15%	85%	3
3	Large storage tank (50 gallons or more)		10%	90%	3
4	Tankless or on-demand		15%	85%	3

Copying the draw pattern statistics and the logical code used to determine the water heater size bin ID from the gas storage unit and using it for the instantaneous unit has the following impact. While consumer preferences for usage may change with an instantaneous unit according to DOE's modeling, this would go in contradiction to conventional knowledge about how much water a single person may use in a home. Outliers still exist with high gas usage and water usage, however assuming consumption behavior consistent with a gas-fired storage water heater results in much lower LCC savings compared to the default assumptions used by DOE.

Average Adjusted GIWH ELD Usage Based on Household Size											
Size	1	2	3	4	5	6	7	8	9	10	Average
MMBtu/Year	2	6	12	15	17	17	33	22	21	46	9
Gal/Day	8	25	50	70	67	76	136	92	85	163	38

Annual Natural Gas Consumed for Water Heating vs Size of Household

DOE Model for GIWH With Adjustments



Original Summary Output for GIWH

LCC Savings \$135

Simulation Results NATIONAL - 10000 samples										ASD 2025 - Reference Case			
Level	Description	Installed Price	First Year Oper. Cost	Life-Span Oper. Cost	Average LCC Results					Simple Payback	Payback Results		
					LCC	LCC Savings	Simple LCC Savings	Net Cost	No Impact	Net Benefit	Average	Median	75th
0.0004	0	\$2,321	\$203	\$1,546	\$1,566	NA	NA	NA	100%	NA	7.3	16.0	7.7
0.0004	1	\$2,424	\$181	\$1,165	\$1,080	\$166	\$78	17%	70%	17%	5.5	12.1	5.8
0.0004	2	\$2,447	\$160	\$1,116	\$1,064	\$135	\$63	17%	62%	24%	5.5	10.7	6.9
0.0004	3	\$2,465	\$157	\$1,108	\$1,075	\$105	\$52	21%	60%	30%	6.3	13.0	6.5
0.0004	4	\$2,491	\$154	\$1,448	\$1,362	\$105	\$25	38%	5%	39%			

Adjusted Draw Rates Summary for GIWH

LCC Savings \$36 (Negative \$17 with EL1)

Simulation Results NATIONAL - 10000 samples										ASD 2025 - Reference Case			
Level	Description	Installed Price	First Year Oper. Cost	Life-Span Oper. Cost	Average LCC Results					Simple Payback	Payback Results		
					LCC	LCC Savings	Simple LCC Savings	Net Cost	No Impact	Net Benefit	Average	Median	75th
0.0004	0	\$2,321	\$203	\$2,592	\$1,263	NA	NA	NA	100%	NA	5.3	27.0	9.9
0.0004	1	\$2,424	\$164	\$2,830	\$1,274	-\$17	\$1	17%	70%	17%	6.3	21.6	8.0
0.0004	2	\$2,447	\$166	\$2,770	\$1,220	\$16	\$63	19%	63%	19%	6.4	16.3	8.6
0.0004	3	\$2,465	\$166	\$2,739	\$1,264	\$11	\$79	42%	16%	42%	6.4	16.3	8.6
0.0004	4	\$2,494	\$163	\$2,705	\$1,199	\$34	\$54	49%	5%	49%	6.5	13.3	12.4

A better solution would be to use the test procedure for water heaters as a basis for modeling energy usage rather than assuming draw rates based on the size of the original equipment in the RECS survey. By utilizing the size of the tank and determining draw rates, DOE's modeled results contradict the actual collected water heating data found in the Residential Energy Consumption Statistics ("RECS") survey. Another solution is to model GIWHs the same as gas-fired storage units with the assumption that households will consume hot water in the same way.

C. DOE Incorrectly Relies on Outdated Data in Its Analysis

Throughout the NOPR, DOE states that it relies upon data from the 2015 RECS to establish samples and calculate data.⁶⁶ DOE claims that the 2015 RECS is the most recent such survey that is currently available. However, DOE last accessed the data on May 1, 2023,⁶⁷ while the NOPR was published on July 28, 2023. According to the Energy Information Administration, the final set of data for the 2020 RECS was released on June 15, 2023, almost six weeks prior to publication.⁶⁸ Rather than use the most recent and reliable data available, DOE chose to use outdated, inapplicable data for a preponderance of its calculations. DOE cherry-picked data from the 2020 data⁶⁹ and chose to use current and outdated data at its convenience. DOE's use of outdated data for lifecycle costs, payback period, installation costs, product literature and other analyses questions the validity and quality of their analysis. Rather than rely on questionable data, DOE should recalculate and reexamine its conclusions based on the best available, most current data.

D. DOE Failed to Appropriately Consider Manufacturer Burden in Its Analysis

DOE's proposed regulation would be an enormous burden on manufacturing and on competition. A rule with, by its own estimates, \$2,235,000 in costs⁷⁰ fails to meet EPCA's three-year rebuttable presumption of economic justification under pure economic terms.⁷¹ DOE concedes that it is creating an enhanced market for heat pumps, noting that heat pump production for electric storage water heaters will go from 5% of electric storage water heaters to 63% in 2030.⁷² The consequences of DOE's proposed rule are an impermissible burden on the water heater market and diminishes competition between gas and electric water heaters.

For example, Rinnai America, Inc ("Rinnai"). commented that they opened a facility in Griffin, Georgia in 2022 at a cost of \$70 million, which exclusively makes non-condensing tankless water heaters.⁷³ The facility employs approximately 122 employees and makes a product more efficient than 75% of the market.⁷⁴ According to Rinnai, the facility's products would not meet the proposed standard, would be rendered a stranded asset, and the proposed standard for GIWHs would eliminate almost 20 years of improvements in the non-condensing tankless water heater market.⁷⁵ Rinnai stated that it would not make economic sense to update the plant, as Rinnai's

⁶⁶ NOPR at 49101 (*generally*); NOPR at 49107 (Life Cycle Costs); NOPR at 49107 (Payback Period); NOPR at 49107 (Installation Costs); NOPR at 49112 (Energy Prices); NOPR at 49112 (Product Literature); NOPR at 49125 (Consumer Subgroup Analysis).

⁶⁷ NOPR at 49101-102, fn. 46.

⁶⁸ [Residential Energy Consumption Survey \(RECS\) - Energy Information Administration \(eia.gov\)](https://www.eia.gov/energyconsumption/survey/research/2020/2020%20RECS%20Final%20Report.pdf) (last accessed Sept. 11, 2023).

⁶⁹ NOPR at 49119 (looking at homes capacity to install a natural gas water heater from 2020 data).

⁷⁰ NOPR at 49162.

⁷¹ NOPR at 49073 (noting the payback period) and 49153 (claiming that the rule would be justified without monetizing the reduction in greenhouse gas emissions).

⁷² NOPR at 49160.

⁷³ DOE Public Meeting, Sept. 13, 2023, at 1:12 PM.

⁷⁴ *Id.*

⁷⁵ *Id.*; see also *id.* at 3:11 PM and 3:27 PM.

parent company makes condensing tankless water heaters in Japan, and Rinnai would find it more cost-effective to import the products than manufacture them domestically.⁷⁶ Consequently, the proposed regulation for instantaneous water heaters would result in the offshoring of manufacturing capacity and manufacturing jobs currently in Georgia.⁷⁷

Another concern is DOE's expectation of manufacturers meeting the anticipated demand from the proposed rule. DOE anticipates that manufacturers will need to produce an additional 3-4 million electric heat pumps per year,⁷⁸ with no corresponding increase in gas-fired heat pumps because it claims they cannot be produced at scale.⁷⁹ DOE provides no analysis supporting how either claim is true or realistic. Public comment showed no capacity to produce or install electric heat pumps at the level anticipated.⁸⁰ DOE's manufacturing burden shows a clear fuel preference and a goal of eliminating consumer choice with respect to energy source.

E. DOE Failed to Consider the Counterproductive Impacts of its Proposed Standards

DOE has failed to consider the potentially counterproductive impacts of its proposed standard for GIWHs. DOE claims that consumers will not switch products due to the cost but has failed to consider the real-world impacts that a condensing standard would have in the context of product replacements.⁸¹ Conceivably, in order to avoid excessive installation burdens (or make replacement of an existing non-condensing GIWH feasible), an apartment owner may choose a non-condensing GSWH as a replacement. Therefore, the efficiency of their water heater will go from 0.81, the current standard for non-condensing GIWHs, to 0.59. The potential for this 25% drop in efficiency is ignored by DOE but is a likely consequence of a standard that would make non-condensing GIWHs unavailable.⁸² The same net reduction in efficiency (and thus energy savings) would occur to the extent that the higher costs imposed by the proposed condensing standard for GIWHs makes instantaneous water heaters generally less competitive with GSWHs.

⁷⁶ *Id.* at 3:27 PM.

⁷⁷ *Id.*; *see also id.* at 1:25 PM.

⁷⁸ NOPR at 49147.

⁷⁹ NOPR at 49084.

⁸⁰ DOE Public Meeting, Sept. 13, 2023, at 1:23 PM and 2:54 PM (NW Energy Alliance stating they were installing 20,000 electric heat pumps per year).

⁸¹ DOE Public Meeting, Sept. 13, 2023, at 3:11 PM.

⁸² DOE should fully examine any unintended consequences of its proposal, including those impacting safety and jurisdictional building codes. For instance, in multifamily properties, furnaces and gas water heaters from several units commonly share a chimney vent, or a gas furnace and a water heater within one apartment will share a venting system. If a new condensing gas water heater cannot be accommodated in an apartment due to building construction limitations, then it is likely the unit will be replaced with an electric unit. Venting systems are designed to work with a certain volume of gases; changes in the volume of gas being vented will affect the draw of the venting system and could result in combustion gases being drawn back into the building. In short, eliminating a non-condensing water heater from a venting stack may initiate a cascade of equipment replacements due to venting requirements or force additional venting changes. It is foreseeable that local building inspectors will have concerns about the adequacies of the draw of a vent when it is carrying a reduced volume of gases. *See* NMHC/NAA Comments.

F. DOE Relied on Flawed Energy Price Assumptions in Its Analysis

In the NOPR, DOE is using an energy price forecast based on the AEO which 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 70% of the time for residential consumers and 86% of the time for commercial consumers nationally. The only years with higher actual versus forecasted prices are the most recent two years or 2021 and 2022 (“2022 and 2023 AEO”) which is heavily impacted by the COVID-19 economy. The consumer water heater rule uses the 2023 release year AEO.

While uncertainty is a major factor in any forecast, the statistically bias outcome towards higher prices in the AEO compared to what is actual reported historically presents a need for energy prices to be modeled based on a distribution of prices and not a forecasted mean. The figures below include a comparison between what EIA reports as actual prices versus what was forecasted in each AEO.

Actual Residential Historical Prices vs Annual Energy Outlook Forecast

Historical Data	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
2010	\$ 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	\$ 12.18	\$ 14.80
2011	\$ 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	\$ 12.62
2012		\$ 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	\$ 11.55
2013			\$ 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	\$ 11.76
2014				\$ 11.62	\$ 11.05	\$ 10.71	\$ 10.72	\$ 10.49	\$ 10.39	\$ 10.91	\$ 11.24	\$ 11.66	\$ 11.89	\$ 12.05	\$ 12.24	\$ 12.48
2015					\$ 11.22	\$ 10.69	\$ 10.62	\$ 11.44	\$ 11.24	\$ 10.92	\$ 11.25	\$ 11.71	\$ 11.88	\$ 11.85	\$ 12.06	\$ 12.16
2016						\$ 10.86	\$ 10.29	\$ 10.80	\$ 10.62	\$ 10.48	\$ 10.65	\$ 10.84	\$ 11.38	\$ 11.92	\$ 12.29	\$ 12.50
2017								\$ 11.08	\$ 10.40	\$ 9.70	\$ 9.87	\$ 10.28	\$ 10.67	\$ 11.08	\$ 11.19	\$ 11.30
2018									\$ 10.58	\$ 10.22	\$ 10.91	\$ 10.92	\$ 11.06	\$ 11.20	\$ 11.31	\$ 11.39
2019										\$ 10.30	\$ 11.17	\$ 10.77	\$ 11.19	\$ 11.47	\$ 11.59	\$ 11.69
2020											\$ 11.18	\$ 10.75	\$ 10.71	\$ 11.00	\$ 11.08	\$ 11.24
2021													\$ 10.80	\$ 10.39	\$ 10.53	\$ 10.45
2022														\$ 10.54	\$ 10.81	\$ 10.74
2023															\$ 12.15	\$ 12.60
2024																\$ 14.29

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

Actual Commercial Historical Prices vs Annual Energy Outlook Forecast

Historical Data	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
2010	\$ 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	\$ 8.79	\$ 11.34
2011	\$ 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	\$ 10.96
2012		\$ 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	\$ 9.51
2013			\$ 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	\$ 9.79
2014				\$ 9.61	\$ 9.04	\$ 8.26	\$ 8.66	\$ 8.42	\$ 8.29	\$ 8.76	\$ 9.03	\$ 9.38	\$ 9.57	\$ 9.69	\$ 9.83	\$ 10.05
2015					\$ 9.16	\$ 8.29	\$ 8.49	\$ 9.29	\$ 9.11	\$ 8.91	\$ 9.21	\$ 9.62	\$ 9.76	\$ 9.70	\$ 9.90	\$ 9.97
2016						\$ 8.36	\$ 8.35	\$ 8.82	\$ 8.73	\$ 8.76	\$ 8.77	\$ 8.81	\$ 9.32	\$ 9.82	\$ 10.15	\$ 10.34
2017								\$ 9.24	\$ 7.92	\$ 7.46	\$ 7.93	\$ 8.54	\$ 9.19	\$ 9.58	\$ 9.67	\$ 9.76
2018								\$ 8.28	\$ 7.42	\$ 8.14	\$ 8.69	\$ 9.33	\$ 9.96	\$ 10.07	\$ 10.14	
2019									\$ 7.50	\$ 8.11	\$ 7.96	\$ 8.33	\$ 8.69	\$ 8.88	\$ 9.08	
2020										\$ 8.12	\$ 8.01	\$ 7.94	\$ 8.14	\$ 8.26	\$ 8.44	
2021													\$ 7.80	\$ 7.43	\$ 7.58	\$ 7.60
2022														\$ 7.51	\$ 7.95	\$ 8.20
2023															\$ 8.76	\$ 9.13
2024																\$ 10.99

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

G. Errors Found in the Model

In addition to the above analysis concerns, Joint Commenters also found a number of errors in the model DOE uses to justify the proposed rulemaking:

- DOE has utilized single-year weather data despite the availability of 10-year average data. This has a small but real impact on instantaneous gas water heaters.

- DOE references on the tab “No-New Standards Case UEF” an equation that adjusts the likelihood of more efficient appliances based on square footage. The model in writing has one equation but DOE has coded a different version that relies on larger square footage residences. This equation ultimately changes the randomly assigned baseline efficiency levels. Larger homes that use more energy might on average install more efficient appliances based on this equation.

Adjustment Range Used in TSD		Adjustment Range Used in Model	
Square Footage	Fraction	Square Footage	Fraction
>= 1500	-5%	>= 2000	-5%
1500 to 2500	0%	2000 to 3000	0%
2500+	5%	3000+	5%

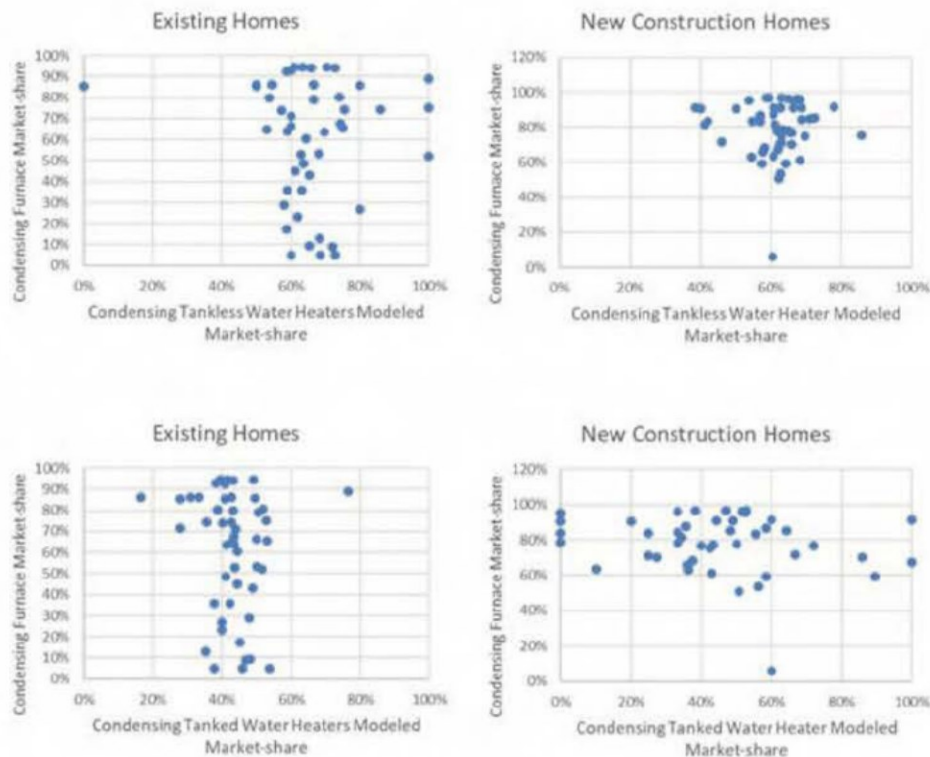
The use of the adjustment factor also does not make any sense for this analysis. Water use is typically not dependent on the size of a home. The use of total household members would be a better statistic to use for any adjustment to consumer preference for more efficient water heating.

- Based on the TSD, Table 6A.8.5 “Estimated Fraction of Shipments by Market Segment”, DOE uses slightly different values to determine the share of new construction vs. replacement as well as residential vs. commercial. In the TSD 13% of gas-fired storage units are new builds while the model reports 10% of all trials. For tankless units, the TSD uses 35% while the model reports 32% for all trials. Based on Table 6A.8.6 “Estimated Fraction of Shipments by Residential/Commercial Applications” DOE references 7% and 20% for the share of commercial units of storage and instantaneous gas-fired water heaters. Within the model, DOE reports 2% and 9% of all trials for storage and instantaneous gas-fired water heaters.

Insufficient market data for this analysis:

This rulemaking relies on data that is inconsistent with other current rulemaking. DOE uses national-level statistics and not state-level without differentiation for new vs. replacements for market shares of each efficiency level. This data is necessary for determining the baseline for potential savings from the rule and the geographical location of products. Having more or fewer rule-impacted trial runs within a given state can have a different impact on overall LCC savings by using different energy or installation cost data more frequently. It is more likely that homes will share venting methods and install more condensing products in states with more condensing furnaces or boilers. Comparing the results of the model with the shipment data from the pending DOE furnace rule, there is a notable disconnect between the existing buildings modeled and the market share for other condensing products like gas furnaces.

PC	EL	Design Options	Distributions	Percentiles	EL
GSWH	0	GSWH SP, Atm. Vent	62%	0%	0
GSWH	1	GSWH SP, Atm. Vent	15%	62%	1
GSWH	2	GSWH Multiple Designs	7%	77%	2
GSWH	3	GSWH Elec. Ignition, Power Vent	15%	84%	3
GSWH	4	GSWH Elec. Ignition, Condensing	1%	99%	4
GSWH	5	GSWH Elec. Ignition, Condensing	0%	100%	5
OSWH	0	OSWH 1" Insulation	50%	0%	0
OSWH	1	OSWH 2" Insulation	25%	50%	1
OSWH	2	OSWH 2" Insulation	25%	75%	2
ESWH	0	ESWH Elec. Resistance	90%	0%	0
ESWH	1	ESWH Elec. Resistance	2%	90%	1
ESWH	2	ESWH Heat Pump	4%	92%	2
ESWH	3	ESWH Heat Pump	4%	96%	3
ESWH>55	0	ESWH>55 Heat Pump	10%	0%	0
ESWH>55	1	ESWH>55 Heat Pump	65%	10%	1
ESWH>55	2	ESWH>55 Heat Pump	25%	75%	2
GIWH	0	GIWH Non-Condensing	37%	0%	0
GIWH	1	GIWH Condensing	13%	37%	1
GIWH	2	GIWH Condensing	42%	50%	2
GIWH	3	GIWH Condensing	8%	92%	3
GEWH	0	GEWH 2" Foam Insulation	99%	0%	0
GEWH	1	GEWH 4" Foam Insulation	1%	99%	1



For new construction, the national average distribution and that of each state is a lot closer to one another. This is because condensing furnaces already have a very high market share in new construction and less variation between regions, even for states with low space heating

requirements. More than 70% of all trials are for retrofitting residential buildings and the lack of market share data would impact these trials most.

H. The NOPR Did Not Provide Adequate Opportunity to Comment

On July 28, 2023, DOE published in the Federal Register a proposed rule to revise energy conservation standards for consumer water heaters. DOE provided stakeholders only 60-days, or until September 26, 2023, to comment on the NOPR. Moreover, many stakeholders have limited staff available to review the various pending proposed rules and to provide meaningful comments during overlapping and concurrent comment periods. In this case, DOE had also issued various other proposed and final rules that warranted stakeholder attention with overlapping comment periods, including proceedings for consumer water heaters, conventional cooking products, and consumer boilers.⁸³

In the NOPR, DOE deviates from its own procedures, aka the “Process Rule,”⁸⁴ in two ways that prejudice stakeholders. DOE determined not to conduct an Advanced Notice of Proposed Rulemaking.⁸⁵ Then DOE determined to shorten the comment period because “stakeholders have already been afforded multiple opportunities to provide comments on this rulemaking.”⁸⁶ This is despite the fact that multiple proposals had been filed in this proceeding and this is the first time DOE has publicly responded to such proposals. Importantly, the Process Rule states that “[t]here will be not less than 75 days for public comment on the NOPR, with at least one public hearing or workshop.”⁸⁷ It was unreasonable on its face for DOE to shave 15 days off of its own procedures when the statutory deadline has been exceeded not by days or months but by years. By denying our request for extension of the comment period, Joint Commenters and other stakeholders were unfairly prejudiced for DOE’s own administrative deficiency. It is an important tenet of administrative law that a federal agency adhere to its own policies, rules and regulations. Ad hoc departures are not proper, for such activities disrupt orderly processes and harm predictability, which are the hallmarks of lawful administrative action.⁸⁸

⁸³ See e.g., *Energy Conservation Program: Energy Conservation Standards for Consumer Conventional Cooking Products*, 88 Fed. Reg. 50810 (Aug. 2, 2023) (comment period ending September 1, 2023); *Energy Conservation Program: Energy Conservation Standards for Consumer Boilers*, EERE-2019-BT-STD-0036, 88 Fed. Reg. 55128 (Aug. 14, 2023) (comment period ending October 13, 2023); *Energy Conservation Program: Energy Conservation Standards for Commercial Water Heating Equipment*, EERE-2021-BT-STD-0027 (prepublication final rule posted).

⁸⁴ *Energy Conservation Program for Appliance Standards: Procedures, Interpretations, and Policies for Consideration in New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Commercial/Industrial Equipment*, 86 Fed Reg. 70892 (Dec. 13, 2021) (“Process Rule”). See also 10 C.F.R. Part 430, Subpart C, Appendix A.

⁸⁵ NOPR at 49075.

⁸⁶ NOPR at 49068.

⁸⁷ Process Rule at 70927; see Section 6(f)(2) of Appendix A. The Process Rule also states that “[t]he length of the public comment period for pre-NOPR rulemaking documents will vary depending upon the circumstances of the particular rulemaking, but will not be less than 75 calendar days.” Process Rule at 70926; see Section 6(d)(2) of Appendix A.

⁸⁸ See, e.g., *Reuters Ltd. v. FCC*, 781 F.2d 946, 950-51 (D.C. Cir. 1986) (“[I]t is elementary that an agency must adhere to its own rules and regulations. Ad hoc departures from those rules, even to achieve laudable aims, cannot be sanctioned . . . for therein lie the seeds of destruction of the orderliness and predictability which are the hallmarks of lawful administrative action. Simply stated, rules are rules, and fidelity to the rules which have been properly

While the Administrative Procedure Act (“APA”) does not establish a minimum comment period for rulemakings, courts require that agencies provide a “meaningful” opportunity for comment.⁸⁹ In short, “[t]he opportunity for comment must be a meaningful opportunity” and “in order to satisfy this requirement, an agency must also remain sufficiently open-minded.”⁹⁰

To sufficiently analyze the NOPR and the related documents, additional time was required. DOE’s determinations in this proceeding will have significant implications for consumers and the energy industry. Any modifications to the efficiency standards, large or small, will have significant ramifications on suitable water heater availability for consumers and the marketplace for years to come. Despite the numerous compounding factors impacting stakeholders’ ability to develop meaningful comments in the allotted time, as well as its legal responsibilities, DOE denied the request to extend the comment period, which unreasonably prejudiced Joint Commenters and all stakeholders. As a result, as these comments are being submitted, Joint Commenters are still identifying significant additional issues that they have not had sufficient time to consider or address in this submission.

I. Executive Orders 12866, 13563, and 14094

Executive Order (“EO”) 12866, “Regulatory Planning and Review,”⁹¹ as supplemented and reaffirmed by EO 13563, “Improving Regulation and Regulatory Review,”⁹² and amended by EO 14094, “Modernizing Regulatory Review,”⁹³ requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible.⁹⁴ DOE has unequivocally failed to follow these EOs, as it has used outdated data to quantify present and future benefits and costs, when current and applicable data was available prior to publication. DOE’s extraordinary reliance on the 2015 RECS is a clear violation of these EOs.

J. Regulatory Flexibility Act

The proposed rule also fails to comply with Executive Order 13272, “Proper Consideration of Small Entities in Agency Rulemaking.”⁹⁵ DOE identified 22 original equipment manufacturers,⁹⁶ of which it only found 2 that satisfied the criteria to be considered small businesses.⁹⁷ Further,

promulgated, consistent with applicable statutory requirements, is required of those to whom Congress has entrusted the regulatory missions of modern life.”); *Brock v. Cathedral Bluffs Shale Oil Co.*, 796 F.2d 533, 536 (D.C. Cir. 1986) (“It is axiomatic that an agency must adhere to its own regulations.”); *Mine Reclamation Corp. v. FERC*, 30 F.3d 1519, 1524 (D.C. Cir. 1994) (on its way to decision an agency must follow its own regulations).

⁸⁹ 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).

⁹⁰ *Rural Cellular Ass’n*, 588 F.3d at 1101.

⁹¹ 58 Fed. Reg. 51735 (Oct. 4, 1993).

⁹² 76 Fed. Reg. 3821 (Jan. 21, 2011).

⁹³ 88 Fed. Reg. 21879 (April 11, 2023).

⁹⁴ NOPR at 49168.

⁹⁵ 67 Fed. Reg. 53461 (Aug. 16, 2002).

⁹⁶ This acronym is used, but not defined in the proposed rule.

⁹⁷ NOPR at 49169.

neither of the small businesses which qualified produced gas-fired water heaters.⁹⁸ Based on its analysis and the results of its interviews, DOE does not have sufficient information pertaining to the NOPR's effect on small businesses who manufacture gas-fired water heaters. DOE has no data on their redesign costs, product availability, or whether or not the proposed efficiency levels will force these manufacturers to leave the market. DOE's failure to properly identify affected parties is a glaring informational liability in the rule and must be addressed pursuant to Executive Order 13272.

V. Conclusion

Joint Commenters thank the Department of Energy for its review and consideration of these comments. If you have any questions regarding this submission, please do not hesitate to contact the undersigned.

Respectfully submitted,

⁹⁸ *Id.*



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Attachments