Submitted via regulations.gov

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.

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 Trial Count	Affected	Total Negatively Affected	Average LCC Savings	Average First Year Savings	Higher Install Costs	Total Payback
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

	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	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

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[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 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."

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. <u>Cases in Which No "Investment" in Efficiency is Required</u>

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. <u>Investments with Very Obvious Economic Outcomes</u>

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

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

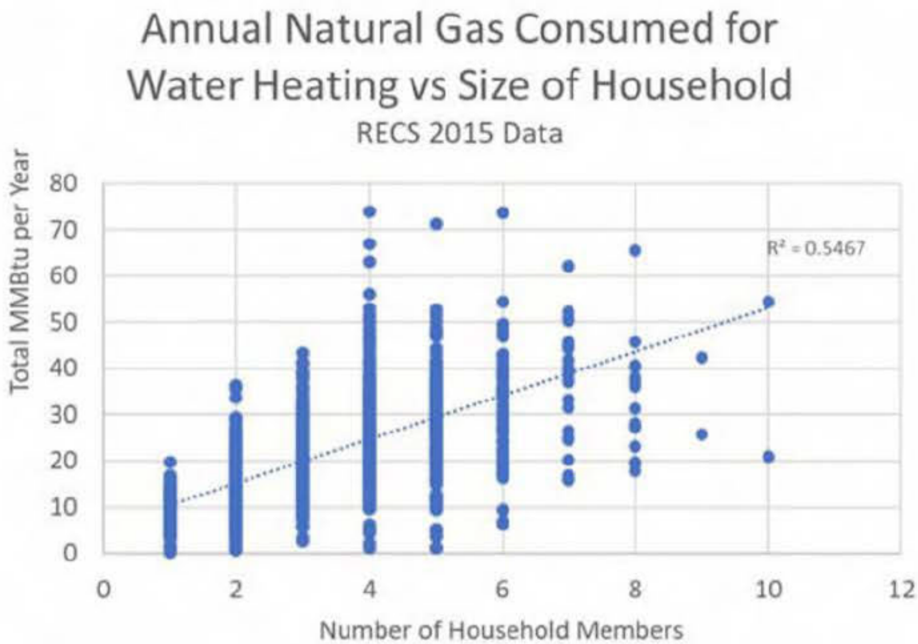
	Total Simulated Trial Count	Senior Weighted Trial Count	Percent Affected	Percent Senior Affected that are Negatively Impacted	Average LCC Savings for Seniors	Average First Year Savings for Seniors	Higher Install Cost for Seniors	Payback for Seniors
New England	484	14	3%	0%	$ 326	$ 1	$ 151	4.3
Middle 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

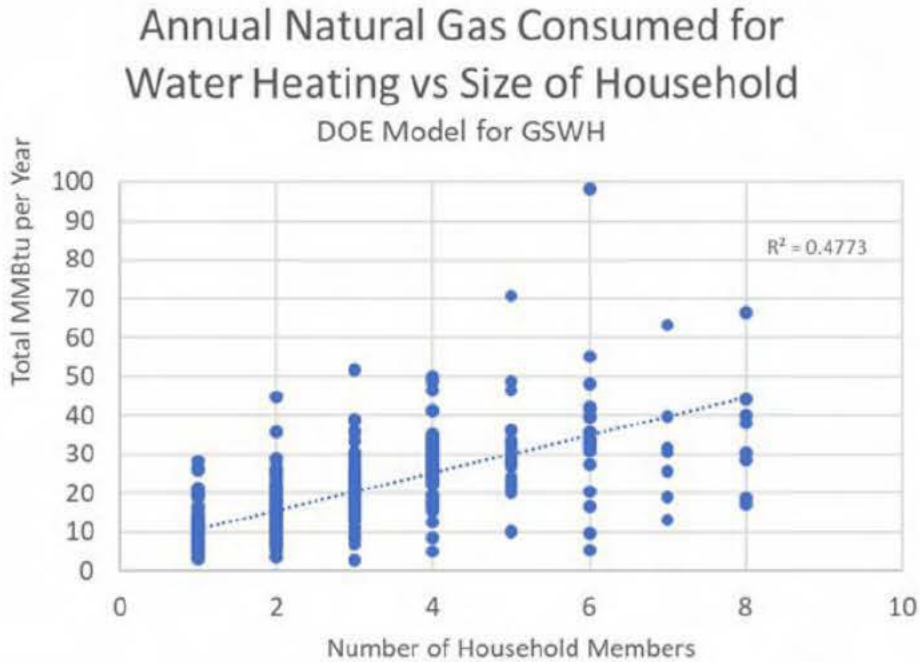
Size	1	2	3	4	5	6	7	8	9	10	Average
MMBtu/Year	9	15	21	26	29	32	38	32	34	38	18



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

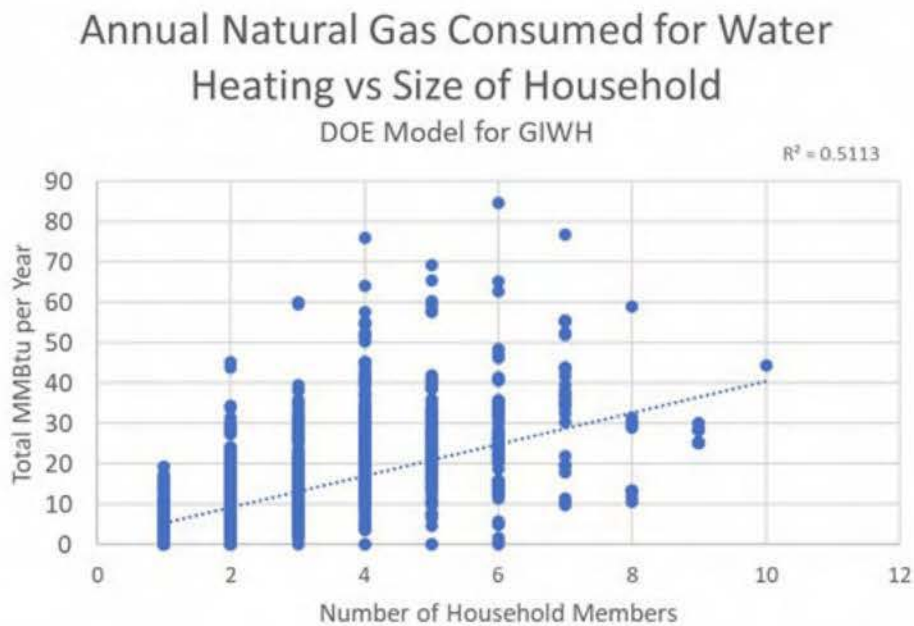
Size	1	2	3	4	5	6	7	8	9	10	Average
MMBtu/Year	9	15	21	28	30	34	42	30	43	37	19
Gal/Day	19	43	67	92	103	121	140	109	159	110	57



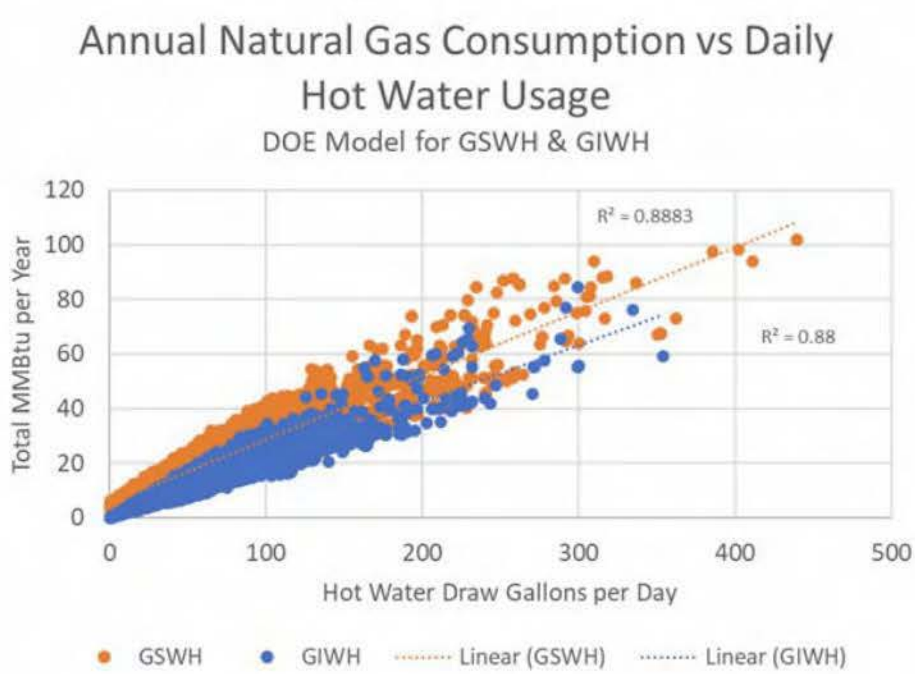
GIWHs, however, do follow the same pattern but have many cases that may go against conventional logic. For each size of household within the model, tankless water heaters result in greater outliers for usage than their storage unit equivalent. The model also results in unrealistic outliers with gas and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

Average GIWH ELO Usage Based on Household Size

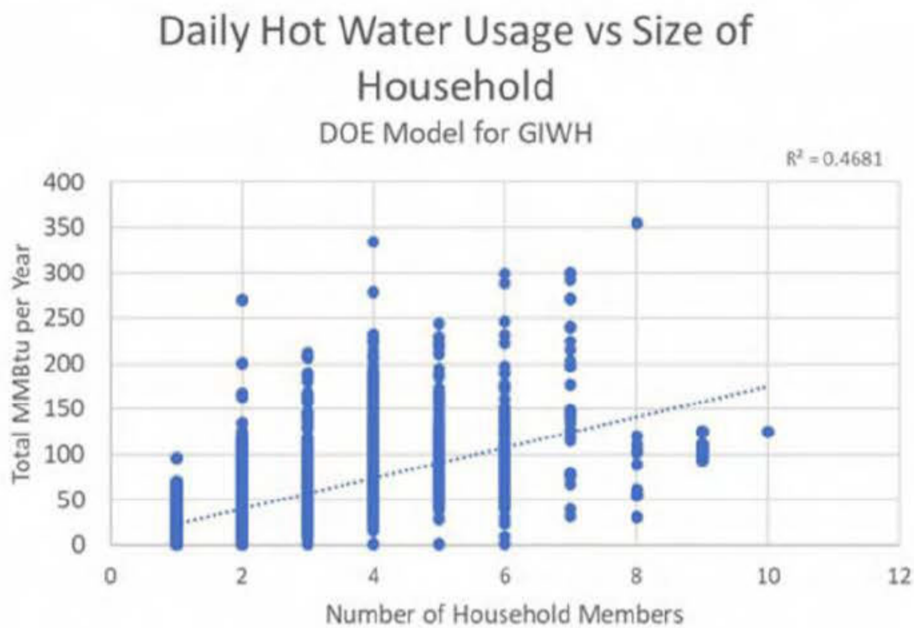
Size	1	2	3	4	5	6	7	8	9	10	Average
MMBtu/Year	5	9	14	18	22	22	38	22	27	44	12
Gal/Day	20	39	58	83	86	97	168	91	108	125	51



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.



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"

GSWHs

RECS ID	RECS 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

OSWHs

RECS ID	RECS 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

RECS ID	RECS 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

RECS ID	RECS Size Bin	Low Draw	Medium Draw	Large Draw	Draw Pattern ID
3	*Large storage tank (50 gallons or more)*	0%	20%	80%	3

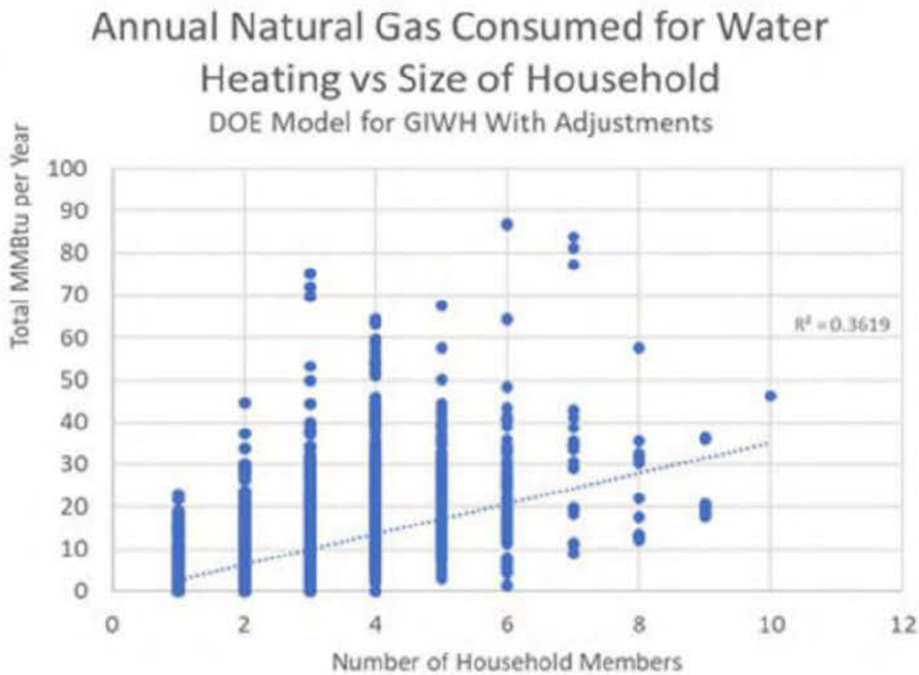
GIWH

RECS ID	RECS 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 ELO 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



Original Summary Output for GIWH

LCC Savings $135

Simulation Results NATIONAL - 10000 samples — AEO 2023 - Reference Case

	Level	Description	Installed Price	First Year Oper. Cost	Lifetime Oper. Cost	LCC	LCC Savings	Simple LCC Savings	Net Cost	No Impact	Net Benefit	Simple PBP	Average	Median
GIWH	0	GIWH Non-Condensing	$2,330	$362	[illegible]	[illegible]	NA	NA	NA	100%	NA			
GIWH	1	GIWH Condensing	$2,424	$348	[illegible]	$6,089	[illegible]	$78	13%	70%	17%	7.3	16.0	7.7
GIWH	2	GIWH Condensing	$2,447	$340	[illegible]	$6,004	$135	$163	13%	62%	24%	5.5	12.1	5.8
GIWH	3	GIWH Condensing	$2,465	$257	[illegible]	$5,973	$85	$162	29%	[illegible]	[illegible]	5.5	10.7	6.5
GIWH	4	GIWH Condensing	$2,493	$254	$3,448	$5,962	$95	$205	38%	9%	[illegible]	6.3	13.6	9.5

Adjusted Draw Rates Summary for GIWH

LCC Savings $36 (Negative $17 with EL1)

Simulation Results NATIONAL - 10000 samples — AEO 2023 - Reference Case

	Level	Description	Installed Price	First Year Oper. Cost	Lifetime Oper. Cost	LCC	LCC Savings	Simple LCC Savings	Net Cost	No Impact	Net Benefit	Simple PBP	Average	Median
GIWH	0	GIWH Non-Condensing	$2,321	[illegible]	[illegible]	[illegible]	NA	NA	NA	100%	NA			
GIWH	1	GIWH Condensing	$2,424	$194	[illegible]	$5,274	-$17	[illegible]	17%	70%	13%	10.3	27.0	9.9
GIWH	2	GIWH Condensing	$2,441	[illegible]	$2,770	$5,220	$36	$63	19%	63%	[illegible]	8.5	21.8	8.0
GIWH	3	GIWH Condensing	$2,466	[illegible]	[illegible]	$5,204	$31	$79	42%	16%	42%	8.4	16.3	8.6
GIWH	4	GIWH Condensing	$2,494	$183	$2,705	[illegible]	$34	$54	48%	9%	43%	8.3	23.3	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 data[69] 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 costs[70] 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

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[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) (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.

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

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Historical Data	$ 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
Forecast Release Year Data	2010	$ 13.32	$ 13.87	$ 11.72	$ 11.21	$ 12.12	$ 12.21	$ 11.81	$ 11.74	$ 11.89	$ 11.99	$ 12.03	$ 12.10	$ 12.18	$ 12.30	$ 12.42	$ 12.62
	2011		$ 13.99	$ 12.20	$ 11.31	$ 10.56	$ 10.44	$ 10.39	$ 10.28	$ 10.39	$ 10.50	$ 10.61	$ 10.74	$ 10.90	$ 11.16	$ 11.38	$ 11.55
	2012			$ 12.25	$ 11.36	$ 10.65	$ 10.78	$ 10.69	$ 10.38	$ 10.56	$ 10.61	$ 10.67	$ 10.80	$ 10.94	$ 11.11	$ 11.42	$ 11.76
	2013				$ 11.62	$ 11.05	$ 10.71	$ 10.72	$ 10.49	$ 10.39	$ 10.91	$ 11.24	$ 11.66	$ 11.89	$ 12.05	$ 12.24	$ 12.48
	2014					$ 11.22	$ 10.69	$ 10.62	$ 11.44	$ 11.24	$ 10.92	$ 11.25	$ 11.71	$ 11.88	$ 11.85	$ 12.06	$ 12.16
	2015						$ 10.86	$ 10.29	$ 10.80	$ 10.62	$ 10.48	$ 10.65	$ 10.84	$ 11.38	$ 11.92	$ 12.29	$ 12.50
	2016								$ 11.08	$ 10.40	$ 9.70	$ 9.87	$ 10.28	$ 10.67	$ 11.08	$ 11.19	$ 11.30
	2017									$ 10.58	$ 10.22	$ 10.91	$ 10.92	$ 11.06	$ 11.20	$ 11.31	$ 11.39
	2018										$ 10.30	$ 11.17	$ 10.77	$ 11.19	$ 11.47	$ 11.59	$ 11.69
	2019											$ 11.18	$ 10.75	$ 10.71	$ 11.00	$ 11.08	$ 11.24
	2020													$ 10.80	$ 10.39	$ 10.53	$ 10.45
	2021														$ 10.54	$ 10.81	$ 10.74
	2022															$ 12.15	$ 12.60
	2023																$ 14.29

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

Actual Commerical Historical Prices vs Annual Energy Outlook Forecast

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Historical Data	$ 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
Forecast Release Year Data	2010	$ 11.53	$ 12.29	$ 9.31	$ 8.92	$ 10.01	$ 10.36	$ 10.20	$ 10.14	$ 10.28	$ 10.38	$ 10.40	$ 10.46	$ 10.53	$ 10.65	$ 10.76	$ 10.96
	2011		$ 12.32	$ 9.94	$ 9.15	$ 9.30	$ 9.03	$ 8.80	$ 8.52	$ 8.60	$ 8.68	$ 8.74	$ 8.84	$ 8.96	$ 9.19	$ 9.37	$ 9.51
	2012			$ 10.06	$ 9.32	$ 8.82	$ 8.90	$ 8.86	$ 8.67	$ 8.82	$ 8.82	$ 8.85	$ 8.94	$ 9.06	$ 9.21	$ 9.49	$ 9.79
	2013				$ 9.61	$ 9.04	$ 8.26	$ 8.66	$ 8.42	$ 8.29	$ 8.76	$ 9.03	$ 9.38	$ 9.57	$ 9.69	$ 9.83	$ 10.05
	2014					$ 9.16	$ 8.29	$ 8.49	$ 9.29	$ 9.11	$ 8.91	$ 9.21	$ 9.62	$ 9.76	$ 9.70	$ 9.90	$ 9.97
	2015						$ 8.36	$ 8.35	$ 8.82	$ 8.73	$ 8.76	$ 8.77	$ 8.81	$ 9.32	$ 9.82	$ 10.15	$ 10.34
	2016								$ 9.24	$ 7.92	$ 7.46	$ 7.93	$ 8.54	$ 9.19	$ 9.58	$ 9.67	$ 9.76
	2017									$ 8.28	$ 7.42	$ 8.14	$ 8.69	$ 9.33	$ 9.96	$ 10.07	$ 10.14
	2018										$ 7.50	$ 8.11	$ 7.96	$ 8.33	$ 8.69	$ 8.88	$ 9.08
	2019											$ 8.12	$ 8.01	$ 7.94	$ 8.14	$ 8.26	$ 8.44
	2020													$ 7.80	$ 7.43	$ 7.58	$ 7.60
	2021														$ 7.51	$ 7.95	$ 8.20
	2022															$ 8.76	$ 9.13
	2023																$ 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

Square Footage	Fraction
>= 1500	-5%
1500 to 2500	0%
2500+	5%

Adjustment Range Used in Model

Square Footage	Fraction
>= 2000	-5%
2000 to 3000	0%
3000+	5%

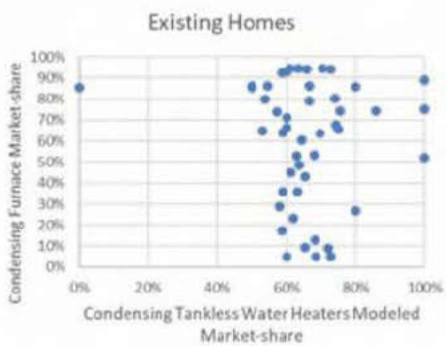
The use of the adjustment factor also does not make any sense for this analysis. Water use is typically not dependent on the size of a home. The use of total household members would be a better statistic to use for any adjustment to consumer preference for more efficient water heating.

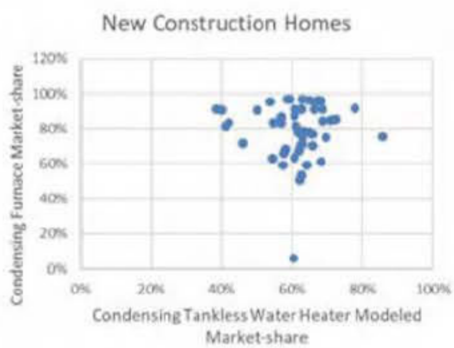
- Based on the TSD, Table 6A.8.5 "Estimated Fraction of Shipments by Market Segment", DOE uses slightly different values to determine the share of new construction vs. replacement as well as residential vs. commercial. In the TSD 13% of gas-fired storage units are new builds while the model reports 10% 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.

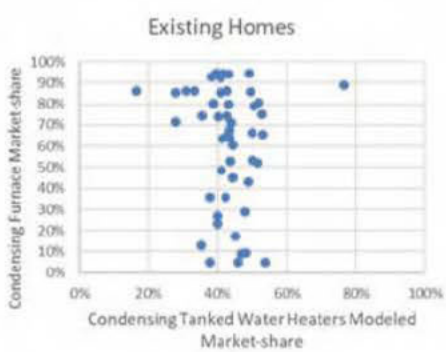
Insufficient market data for this analysis:

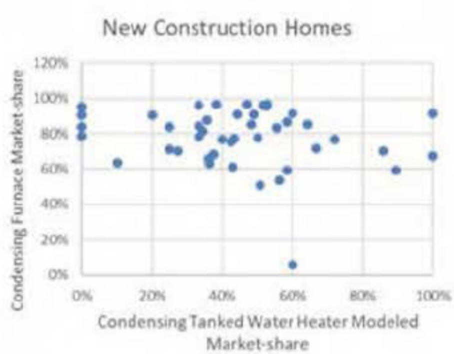
This rulemaking relies on data that is inconsistent with other current rulemaking. DOE uses national-level statistics and not state-level without differentiation for new vs. replacements for market shares of each efficiency level. This data is necessary for determining the baseline for potential savings 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

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Attachments