Attachment E

Comments on the U. S. Department of Energy, "Notification of Availability of Preliminary Technical Support Document [pTSD] and Request for Comment

(May 16, 2022)

Comments on the U. S. Department of Energy, "Notification of Availability of Preliminary Technical Support Document [pTSD] and Request for Comment [EERE–2017–BT–STD–0019] RIN 1904–AD91

May 16, 2022

The fuel gas industry organizations presenting these comments ("Commenters") are pleased to provide their comments on the U. S. Department of Energy (the "Department"), "Notification of Availability of Preliminary Technical Support Document [pTSD][1] and spreadsheet analysis of consumer economics of proposed efficiency levels (EL) for federal minimum efficiency standards for these products.

Commenters were encouraged to comment constructively on the development of the final technical support document (TSD) for the subject rulemaking and appreciate the opportunity to comment on the Department's pTSD supporting the subject rulemaking. Detailed constructive review of the pTSD is hampered by three factors:

- The late release of the pTSD spreadsheet on April 22nd following the announcement of the pTSD document availability on March 1st, which itself was followed by the actual posting of the document on March 8th.

- The pTSD document explanatory coverage of the entire TSD documentation and models but the limitation of the spreadsheet to coverage of only the consumer life cycle cost (LCC) savings and payback period (PBP) analysis.

- The pTSD spreadsheet is limited to calculations of LCC cost savings and PBP analysis and supporting calculations and as a consequence limits stakeholder review of the Department's analysis of economic feasibility of analyzed efficiency levels (EL). It is unexplained why the Department has chosen to only release the posted spreadsheet. Commenters will focus review of future postings of economic analysis spreadsheets with an eye for indications that the economic justification of ELs might change.

Nevertheless, Commenters appreciate the Department's publication and posting of the available materials in advance of finalizing the TSD for the subject rulemaking. Past rulemakings have relied upon publication of completed TSD documents, affording stakeholders very limited opportunity to address the process and content issues crucial to cost and benefits calculations used to support federal minimum efficiency rulemakings. Review and comment on the pTSD give stakeholders an opportunity to address TSD process and content issues for development of the final TSD, and in that spirit, these comments are provided.

[1]U. S. Department of Energy, "PRELIMINARY ANALYSIS TECHNICAL SUPPORT DOCUMENT: ENERGY EFFICIENCY PROGRAM FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT: Consumer Water Heaters, March 2022.

However, the Department is accountable for responding to constructive comments offered by all stakeholders and, in particular, revising the pTSD to address deficiencies identified by stakeholders and to bolster the Department's responsibility to provide "substantial evidence" supporting proposed minimum efficiency standards for consumer water heaters as required by federal law. Commenters look forward to monitoring the Department's actions on and responsiveness to these comments and accountability to support minimum efficiency standards for consumer water heaters based upon substantial evidence.

Initial Review Observations

Based upon the spreadsheet "Summary" and "Statistics" work sheets and the pTSD document Chapter 8, Commenters note among other results the following preliminary results for consumer LCC savings and PBP analysis:

- For "gas-fired storage water heaters" greater than or equal to (>/=) 20 gallons and less than or equal to (</=) 55 gallons of hot water storage, EL 2 provides the economically justified set of design options for consideration in revising the current federal minimum efficiency standard for this product class. Tables 8.5.1 and 8.5.2 of the pTSD document these results for life cycle costs, but do not include the life cycle cost savings associated with the ELs.

Table 8.5.1 Average LCC and PBP Results by Draw Pattern and Efficiency Level for Gas-Fired Storage Water Heaters with a Rated Storage Volume Greater Than or Equal to 20 Gallons and Less Than or Equal to 55 Gallons

Efficiency Level	Average Costs (*2020$*)				Simple PBP (*Years*)	Average Lifetime (*Years*)
	Installed Cost	First Year's Operating Cost	Lifetime Operating Cost	LCC		
Low Draw Pattern						
Baseline	$958	$341	$3,981	$4,939		14.0
1	$990	$339	$3,955	$4,945	13.7	14.0
2	$1,051	$324	$3,791	$4,842	5.4	14.0
3	$1,429	$329	$3,842	$5,271	39.1	14.0
4	$1,666	$303	$3,543	$5,209	18.4	14.0
5	$1,816	$291	$3,406	$5,222	17.0	14.0
Medium Draw Pattern						
Baseline	$980	$335	$3,891	$4,871		14.0
1	$1,040	$333	$3,873	$4,913	33.7	14.0
2	$1,103	$320	$3,731	$4,834	8.4	14.0
3	$1,456	$325	$3,784	$5,240	50.2	14.0
4	$1,711	$301	$3,512	$5,223	21.5	14.0
5	$1,846	$289	$3,387	$5,232	19.1	14.0
High Draw Pattern						
Baseline	$1,093	$368	$4,272	$5,365		14.0
1	$1,109	$366	$4,255	$5,363	9.0	14.0
2	$1,170	$353	$4,107	$5,276	5.1	14.0
3	$1,489	$358	$4,158	$5,646	39.6	14.0
4	$1,754	$330	$3,850	$5,603	17.5	14.0
5	$1,910	$317	$3,706	$5,615	16.1	14.0
Weighted Average Over All Draw Patterns						
Baseline	$1,034	$351	$4,077	$5,111		14.0
1	$1,072	$349	$4,060	$5,132	21.5	14.0
2	$1,134	$336	$3,914	$5,048	6.7	14.0
3	$1,472	$341	$3,966	$5,437	44.7	14.0
4	$1,731	$315	$3,676	$5,407	19.4	14.0
5	$1,876	$303	$3,541	$5,417	17.5	14.0

Note: The results for each EL represent the average value if all purchasers in the sample use products with that efficiency level. The PBP is measured relative to the baseline product.

Table 8.5.2 LCC Results Relative to the No-New-Standards Case Efficiency Distribution by Draw Pattern and Efficiency Level for Gas-Fired Storage Water Heaters with a Rated Storage Volume Greater Than or Equal to 20 Gallons and Less Than or Equal to 55 Gallons

Efficiency Level	Average LCC Savings (*2020$*)	% of Consumers that Experience Net Cost
Low		
1	($6)	45%
2	$95	21%
3	($336)	79%
4	($240)	77%
5	($255)	77%
Medium		
1	($41)	54%
2	$46	30%
3	($365)	78%
4	($295)	81%
5	($303)	80%
High		
1	$3	34%
2	$90	14%
3	($289)	72%
4	($201)	76%
5	($211)	76%
Average Over All Draw Patterns		
1	($20)	44%
2	$68	22%
3	($328)	75%
4	($249)	79%
5	($258)	78%

* The calculation considers only affected consumers. It excludes purchasers whose purchasing decision would not change under a standard set at the corresponding EL, i.e., those with zero LCC savings.

However, the spreadsheet Summary for gas-fired storage water heaters shows that EL 2 as a grouping of technologies is the only set of design options that produce positive LCC savings:

Simulation Results NATIONAL - 10000 samples — AEO 2021 - Reference Case

	Level	Description	Average LCC Results: Installed Price	First Year Oper. Cost	Lifetime Oper. Cost*	LCC	LCC Savings	Simple LCC Savings	Net Cost	No Impact	Net Benefit	Payback Results: Simple PBP	Average	Median
GSWH	0	GSWH SP, Atm. Vent	$1,034	$351	$4,078	$5,112	NA	NA	NA	100%	NA			
GSWH	1	GSWH SP, Atm. Vent	$1,072	$349	$4,061	$5,133	-$20	-$21	26%	39%	35%	21.5	10.2	6.4
GSWH	2	GSWH Multiple Designs	$1,134	$336	$3,915	$5,050	$68	$63	24%	24%	53%	6.7	10.7	6.0
GSWH	3	GSWH Elec. Ignition, Power Vent	$1,472	$341	$3,967	$5,439	-$328	-$326	70%	16%	14%	44.7	93.1	50.7
GSWH	4	GSWH Elec. Ignition, Condensing	$1,731	$315	$3,677	$5,408	-$249	-$296	76%	3%	21%	19.4	30.7	23.3
GSWH	5	GSWH Elec. Ignition, Condensing	$1,876	$303	$3,543	$5,419	-$258	-$306	76%	2%	22%	17.5	26.2	21.3
OSWH	0	OSWH 1" Insulation	$3,442	$574	$6,481	$9,924	NA	NA	NA	100%	NA			
OSWH	1	OSWH 2" Insulation	$3,494	$558	$6,300	$9,793	$131	$130	5%	51%	43%	3.1	3.2	3.0
OSWH	2	OSWH 2" Insulation	$3,626	$542	$6,129	$9,755	$127	$169	20%	27%	53%	5.6	6.9	6.2
ESWH	0	ESWH Elec. Resistance	$778	$469	$5,303	$6,081	NA	NA	NA	100%	NA			
ESWH	1	ESWH Elec. Resistance	$854	$465	$5,267	$6,121	-$40	-$40	77%	9%	14%	22.8	28.4	26.1
ESWH	2	ESWH Heat Pump	$1,406	$251	$2,934	$4,341	$1,736	$1,740	21%	7%	71%	2.9	20.1	3.4
ESWH	3	ESWH Heat Pump	$1,580	$241	$2,832	$4,412	$1,602	$1,669	29%	4%	68%	3.5	27.7	4.4
ESWH>55	0	ESWH>55 Heat Pump	$1,842	$302	$3,501	$5,342	NA	NA	NA	100%	NA			
ESWH>55	1	ESWH>55 Heat Pump	$1,900	$228	$2,698	$4,598	$755	$744	1%	91%	9%	0.8	1.1	0.9
ESWH>55	2	ESWH>55 Heat Pump	$2,069	$214	$2,541	$4,610	$86	$732	50%	26%	24%	2.6	17.8	12.0
GIWH	0	GIWH Non-Condensing	$1,666	$325	$5,049	$6,715	NA	NA	NA	100%	NA			
GIWH	1	GIWH Condensing	$1,842	$307	$4,772	$6,614	$99	$101	17%	63%	19%	9.4	22.7	13.0
GIWH	2	GIWH Condensing	$1,857	$296	$4,623	$6,480	$207	$235	18%	51%	32%	6.6	13.9	6.4
GIWH	3	GIWH Condensing	$1,900	$291	$4,540	$6,441	$150	$274	33%	9%	58%	6.8	15.9	9.2
GEWH	0	GEWH 2" Foam Insulation	$1,347	$517	$5,899	$7,246	NA	NA	NA	100%	NA			
GEWH	1	GEWH 4" Foam Insulation	$1,492	$512	$5,853	$7,345	-$99	-$99	96%	3%	1%	34.9	1.2	1.0

All dollar values are in 2020$ — * discounted and summed over lifetime of product

- For competing "electric storage water heaters" >/= 20 gallons and </= 55 gallons of hot water storage, EL 3 and 4 provide the most economically justified set of design options for consideration. Table 8.5.6 documents these results.

Table 8.5.6 LCC Results Relative to the No-New-Standards Case Efficiency Distribution by Draw Pattern and Efficiency Level for Electric Storage Water Heaters with a Rated Storage Volume Greater Than or Equal to 20 Gallons and Less Than or Equal to 55 Gallons

Efficiency Level	Average LCC Savings (*2020$*)	% of Consumers that Experience Net Cost
Low		
1	($30)	74%
2	$1,673	15%
3	$1,539	22%
Medium		
1	($47)	86%
2	$1,780	17%
3	$1,646	24%
High		
1	$12	46%
2	$1,383	27%
3	$1,261	31%
Average Over All Draw Patterns		
1	($40)	81%
2	$1,736	17%
3	$1,602	24%

* The calculation considers only affected consumers. It excludes purchasers whose purchasing decision would not change under a standard set at the corresponding EL, i.e., those with zero LCC savings.

- Both of these two initial observations are consistent across the three hot water draw patterns represented by currently listed storage water heaters on the Air Conditioning, Heating, and Refrigeration Institute (AHRI) online Directory: "Low," "Medium," and "High" draw usages.

- For "gas-fired instantaneous water heaters" with a rated storage volume with < 2 gallons and an input rating greater than 50,000 British thermal units per hour (Btu/h), EL 3 provides the most economically justified set of design options for consideration. Table 8.5.9 documents these results.

Table 8.5.9 Average LCC and PBP Results by Draw Pattern and Efficiency Level for Gas-Fired Instantaneous Water Heaters with a Rated Storage Volume Less Than 2 Gallons and an Input Rating Greater Than 50,000 Btu/h

Efficiency Level	Average Costs (*2020$*)				Simple PBP (*Years*)	Average Lifetime (*Years*)
	Installed Cost	First-Year's Operating Cost	Lifetime Operating Cost	LCC		
Medium Draw Pattern						
Baseline	$1,638	$318	$5,013	$6,650		20.0
1	$1,798	$300	$4,744	$6,542	8.9	20.0
2	$1,811	$290	$4,600	$6,409	6.2	20.0
3	$1,845	$284	$4,520	$6,363	6.3	20.0
High Draw Pattern						
Baseline	$1,671	$326	$5,049	$6,718		20.0
1	$1,849	$307	$4,771	$6,619	9.5	20.0
2	$1,865	$297	$4,621	$6,484	6.7	20.0
3	$1,909	$292	$4,539	$6,446	6.9	20.0
Weighted Average Over All Draw Patterns						
Baseline	$1,666	$325	$5,044	$6,709		20.0
1	$1,842	$306	$4,767	$6,608	9.4	20.0
2	$1,857	$296	$4,618	$6,474	6.6	20.0
3	$1,900	$291	$4,536	$6,435	6.8	20.0

Note: The results for each EL represent the average value if all purchasers in the sample use products with that efficiency level. The PBP is measured relative to the baseline product.

However, these observations are based upon review of the calculated and documented LCC savings and PBP analysis results provided in the published pTSD document and the spreadsheet. The spreadsheet calculations have been a source of controversy in recent appliance efficiency rulemakings and deserve closer scrutiny. The limiting extended comment deadline of May 16, 2022 has served to focus Commenters' review on process and structural issues of the pTSD

through a preliminary review of the document and the spreadsheet with an aim of improving the final TSD. More detailed issues of the analysis are stated later in these comments. Once resolved, these more detailed concerns might change the LCC savings and PBP analysis outcome for gas-fired storage water heaters to justifying EL 1 instead of EL 2 since the average negative LLC savings for this product class is only - $20 over the life of the product at EL 2 in the current analysis.

pTSD Approach

More generally, past issues of random assignment of consumers to appliance purchase decisions in the base case life cycle cost analysis has been an enduringly contentious issue with the Department's TSD approach, and the Department appears to have not undertaken measures to address stakeholder concerns of that kind. More detailed review of this issue is ongoing. From recent Department responses to this concern, the Department has opined that random assignment is justified as a means of accounting for "market failure" in appliance purchase decisions. However, it has never presented analysis that justifies linkages between market failure and random purchase behavior.

Commenters specifically note the letter sent to Department Secretary Granholm by the U. S. Small Business Administration ("SBA"), Office of Advocacy on Friday, May 13th calling on the Department to reopen comments on the Process Rule.[2] Substantive recommendations of SBA include the calls for the Department to use the framework laid out in the Office of Management and Budget's Circular A-4 to organize the Department's regulatory impact analysis for its energy efficiency rulemakings,[3] but most immediately important is the recommendation to include in its analysis consideration of non-regulatory measures in its analysis of economic justification of minimum energy efficiency standards proposals. Commenters note that action on this recommendation would most efficiently allow the Department to address issues of market failure and direct action toward enhancing these measures rather than unjustified reliance upon minimum energy efficiency standards to address market failure.

Additionally, the findings of the National Academies of Sciences ("NAS") peer review report referred to in the SBA letter on the Department's implementation of the Process Rule for appliance efficiency rulemaking4 calls on the Department to improve its coverage of market failure in relation to the setting of appliance minimum efficiency standards, but no evidence is

[2] U. S. Small Business Administration, "Re: Request to Reopen Comments on 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. 18901; April 12, 2021), May 13, 2022.
[3] Office of Management and Budget, Circular A-4, Regulatory Analysis, To the Heads of Executive Agencies and Establishments, (Sept. 17, 2003), Circular A-4 (whitehouse.gov). See also Review of Methods Used by the U.S. Department of Energy in Setting Appliance and Equipment Standards, National Academies of Sciences, Engineering, and Medicine, The National Academies Press, (Dec. 28, 2021).
[4] National Academies of Sciences, Engineering, and Medicine 2021. *Review of Methods Used by the U.S. Department of Energy in Setting Appliance and Equipment Standards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25992.

provided in the pTSD document that the Department has included additional consideration of that recommendation.

RECOMMENDATION: To address the issues in consumer base case definition and for LCC evaluation and beyond the SBA recommendations, it is recommended that the Department modify the spreadsheet in one of two ways:

- Correlated Consumer Attributes Approach: Under a Correlated Consumer Attribute Approach, the Department would use the functionality of the Monte Carlo software to avoid presumed non-rational economic decision making by implementing simulation correlations of these variable and develop base case conditions that better approximate consumer decision making. Additionally, stakeholders need to understand how the Department is justifying distributional data on key inputs to account for consumer population diversity and data uncertainty. Efforts to account for correlated variables in the life cycle cost analysis, a key aspect of good practice for implementation of the Monte Carlo methods, needs to be accounted for and justified.

- Rational Consumer Economic Choice Approach: Assuming that market failure and other non-rational decision-making criteria can be handled elsewhere and outside the setting of minimum efficiency standards, the Rational Consumer Economic Choice Approach would calculate for each simulated consumer the most life cycle cost efficient alternative among available water heating products and assign that as the base case over which improvements provided by higher efficiency options would be evaluated. As economic conditions in out-years of the analysis would change, optimal life cycle cost options would also change.

RECOMMENDATION: Since the step of developing the pTSD affords the Department to revise its TSD approach in light of these concerns and the NAS peer review recommendations, Commenters strongly recommend the Department to sponsor a workshop of stakeholders, Department staff, and technical contractors covering these and other unresolved issues of the approach prior to its expenditure of addition financial and time resources on TSD development and rulemaking. Now is the time to fix the TSD approach. A workshop would be the first tangible step toward implementing either of the approaches proposed above or other alternatives that stakeholders might proposed and agree to.

Commenters are disappointed in the Department's decision[5] not to prepare and issue a framework document as part of pre-NOPR stages of rulemaking as a deviation from 10 CFR part 430, subpart C, appendix A. That decision by the Department is ill-advised given the significant specific recommendations of the NAS peer review report and the need to reconsider rulemaking procedures in light of those recommendations, including development of TSDs for proposed minimum efficiency rules. Not preparing a framework document in advance of the presentation of the preliminary TSD or in the absence of addressing the NAS peer review findings essentially makes the findings of the peer review moot and voids its constructive recommendations to

[5] Federal Register, Vol. 87, No. 40, March 1, 2022, p. 11330.

improve Department's minimum efficiency standards rulemaking process. Instead, the Department's decision appears to have been motivated by an interest expressed in the March 1st Federal Register announcement for "expeditiously clear[ing] the backlog of missed regulatory deadlines."[6] Subsequent rulemaking decisions related to length of comment period and use of unchanged analytical methods could be ill-founded in light of the decision not to prepare a framework document. The Department has effectively avoided making changes to its "Process Rule" responsibilities since its second determination on the final rule[7] was issued before the NAS report on the subject was published. But the specific issues of this action do not need to be raised here. The overall objective is to identify procedural issues identified by Commenters as a means of amplifying long-standing criticism of the Department's propensity to use procedural shortcuts.

It is noted that neither the Federal Register announcement nor the preliminary TSD raised the subject of the NAS peer review and that the work of the NAS peer review committee appears to be not considered in the development of the TSD, most notably relating to the consumer economic analysis. Several of the NAS peer review recommendations on consumer impacts are noteworthy but appear to be missing within the development and issuing of the preliminary technical support document. The following are just examples of the considerations voiced by the NAS peer review committee that are not addressed in the TSD:

- No deliberate attempts appear to have been made to address consumer choice and trade-offs (NAS RECOMMENDATION 4-3), and instead assignment of consumer purchase decisions again appears to be continuing to use a random assignment of consumers across the design options considered in the life-cycle cost analysis.

  Consumer choice and decision making is not accounted for in rational economic terms among the options of: (1) savings that could be demonstrated among the choices of a baseline water heater against the proposed efficiency levels (EL) that are ultimately likely to be proposed or (2) savings that could accrue from continuing to own a baseline product versus purchasing an EL-rated product (NAS RECOMMENDATION 4-5).

- Representation in the variability and uncertainty are not fully considered around installation costs of water heaters, particularly in storage gas water heater replacement applications requiring a shift in venting systems from atmospheric venting to power venting and the consequences to venting of other appliances. A proper probabilistic characterization is needed, which would identify the loss of consumer economic value from not being able to replace gas water heaters with compatible water heater models (NAS RECOMMENDATION 4-6).

Additionally, the assumption that the Department makes across all water heater replacement consumers is a simplistic presumption of a single-family household replacing its water heater with some accounting for variability in installation requirements (e.g., venting into masonry chimneys and some consideration of common venting with the dwelling unit furnace). These

[6] Federal Register, Vol. 86, No. 236, December 13, 2021, p. 70893.
[7] *Id.*

simplifications miss entire classes of consumers such as multifamily housing households whose water heater vents atmospherically into a common vent shared with other households. That scenario, in of itself, represents a significant concern if one household's replacement and the unavailability of models of atmospherically vented water heaters compromises proper venting of other households' water heaters since the atmospheric venting system is likely to now be oversized.

RECOMMENDATION: Commenters strongly recommend that the final TSD maintain its LCC analysis breakout of Category I consumer storage gas water heaters and separate analysis of efficiency levels (EL) for Categories I, III, and IV, all three categories being specifically represented in the pTSD efficiency levels. The Department cannot fulfill its objective stated in its Federal Register announcement to "evaluate the significance of energy savings on a case-by-case basis"[8] if it were unwilling to consider storage water heaters as independent products according to category. Each category has its unique installation environments within building structures, including venting systems, which are structural features of buildings first and foremost and outside the scope of the covered products outline under EPCA.

ELs and Product Classes

While the Department has determined that efficiency standards rulemaking of products to separate "product classes" based upon condensing/non-condensing combustion and power venting/atmospheric venting water heaters do not provide unique consumer utility, that determination is being challenged in federal court at this time.[9] Availability of Category I consumer storage water heaters, which use atmospheric venting, is needed to meet the needs of consumers who must replace their water heaters with compatible produces and where abandonment of exist housing venting systems serving water heaters would both deprive consumers of the utility of simple, low-cost water heater replacement, availability of only power vented water heaters that may not be easily replaced due to housing structural design, and where consumer safety might be compromised. As shown in the spreadsheet, 85% of gas-fired storage water heater shipments are for the water heater replacement market.

Aside from separate product class treatment of gas-fired storage water heaters by the categories as described in the ELs, Commenters note that the Department under EPCA is required to separately consider minimum efficiency standards for "covered products that [have] two or more subcategories."[10] Under 42 U.S.C. 6295(q)(1):

> *"…DOE must specify a different standard level for a type or class of product that has the same function or intended use, if DOE determines that products within such group: (A) Consume a different kind of energy from that consumed by other covered products within such type (or class)* [emphasis added]*; or (B)*

[8] Federal Register, Vol. 87, No. 40, March 1, 2022, p. 11328.
[9] American Gas Association, American Public Gas Association, Spire, Inc., Spire Alabama, Inc., Spire Missouri, Inc, and Thermo Products, LLC, petitioners, v. U. S. Department of Energy and Jennifer Granholm, U. S. Department of Energy, respondents, United States Court of Appeals for the District of Columbia Circuit, No. 22-1030, February 25, 2022.
[10] Federal Register, Vol. 87, No. 40, March 1, 2022, p. 11329.

have a capacity or other performance-related feature which other products within such type (or class) do not have and such feature justifies a higher or lower standard [emphasis added]."[11]

With respect to the quoted EPCA language under (A) quoted above, many models of Category I gas storage water heaters require no electric power to operate whereas all models of Category III and Category IV require electric power. As a consequence, separate minimum efficiency requirements "must" be promulgated between storage water heaters that require and do not require electric power, if the EPCA language is taken literally.

With respect to (B) in the quoted language, recognition of this "feature" of power supply requirements defines that the Department must justify separate "higher or lower" minimum efficiency standards. This effectively renders moot the issue of potential "backsliding" if powered and unpowered Category I water heaters call for separate minimum efficiency standards and are economically justified. Commenters seek the Department's commentary on why requiring electricity consumption in one set of Category I gas-fired storage water heaters (EL 2 designs incorporating powered vent dampers and inducer fans for venting) does not qualify as products "consuming a different kind of energy" from unpowered Category I products within the balance of EL 2 as well as EL 1 and the base case.

RECOMMENDATION: The Department should maintain its break-out of the gas storage water heater analysis in the pTSD by Category I, III, and IV products and consider subdividing analysis of Category I into subcategories that require electric power (such as for induced draft and power damper models) and those that do not. This split in the analysis would support compliance with 42 U.S.C. 6295(q)(1).

Non-Regulatory Alternatives and Disadvantaged Consumers

Given that the Department has alternatives within building codes and voluntary programs such as ENERGY STAR to increase the "fleet average" of energy efficiency for consumer water heaters, Commenters strongly endorse use of these alternatives as a means for addressing energy efficiency and greenhouse gas emissions from gas-fired consumer appliances such as the current review of ENERGY STAR for consumer water heaters. Burdening consumers who are economically dependent and, in some cases, representing economically disadvantaged consumer groups, should not bear the burdens of market transition by having consumer options removed. Commenters are working with ENERGY STAR program staff on consumer water heater performance specifications, internal programs on consumer energy efficiency, and economically disadvantaged consumers it serves and sees retention of unpowered Category I water heaters as a key measure to maintain affordable, increasingly efficient water heating appliances. Commenters also note the role of voluntary programs play in providing alternative paths to higher efficiency and as supplement to federal minimum efficiency standards.

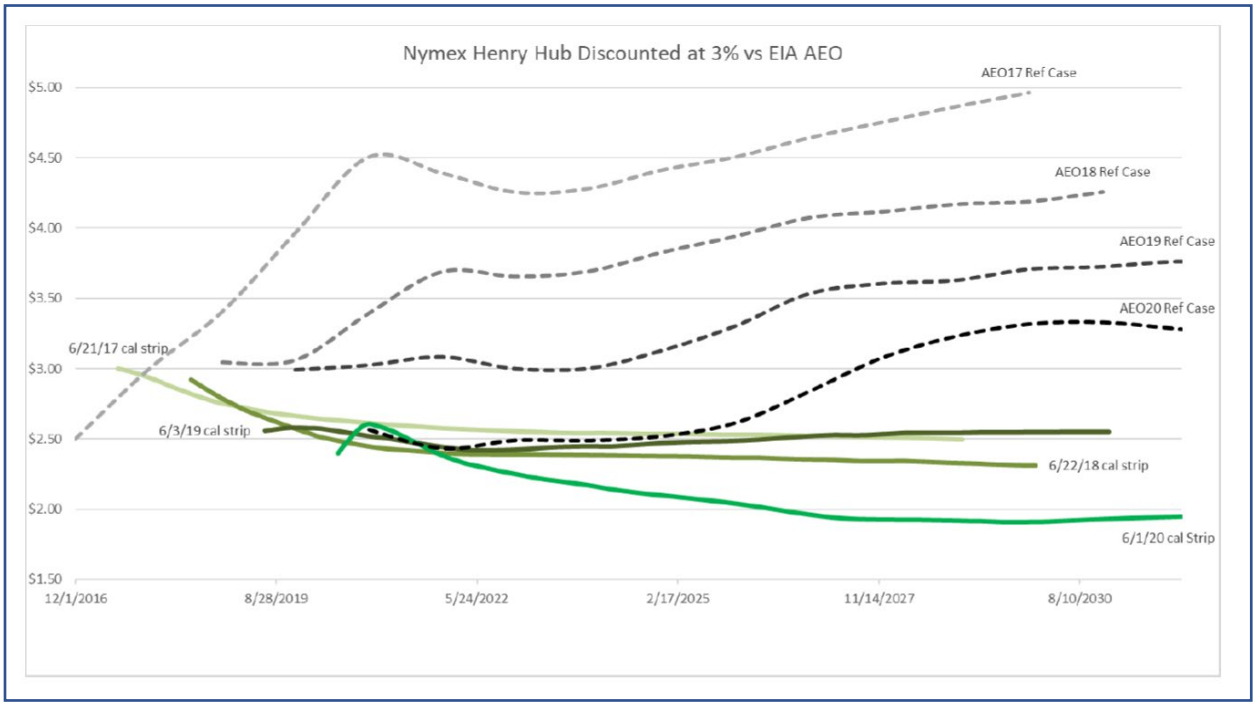
[11] *Id.*

Commenters also recognize that the alternatives available to the Department provide it with the most efficient and effective means of addressing most market failure causes, such as purchase decisions not being made available to consumers inhabiting a dwelling.

Preliminary Spreadsheet Observations

The short amount of time provided by the April 22nd posting of the spreadsheet and review of the pTSD document limited the ability to conduct detailed review of the spreadsheet. However, several characteristics of the analysis were observed from the Chrystal Ball simulation as posted and will be reported to the docket as review moves forward. At this time, Commenters have two observations to report:

Consumer energy prices. Where the Department's spreadsheet relies heavily upon distributional data inputs to the Monte Carlo analysis of life cycle cost and paybacks, the Department uses single time series average and marginal consumer energy price forecasts for consumer electricity and gaseous fuels to support the pTSD analysis. Ironically and historically, consumer energy price forecasts from the U. S. Energy Information Administration (EIA) have been shown to be unreliable from forecasting year to forecasting year, with diminishing accuracy and reliability in out years of the forecast period. Shown below is a record of EIA Henry Hub natural gas prices from successive editions of the "Annual Energy Outlook, Reference Cases" from 2017 through 2020.[12]



[12] Spire, Inc., "Comments of Spire, Inc. in Response to the Request for Information Entitled 'Energy Conservation Program: Energy Conservation Standards for Air-Cooled Commercial Package Air Conditioning and Heating Equipment and Commercial Warm Air Furnaces; Request for information,'" 85 Fed. Reg. 27941 (May 12, 2020), submitted July 1, 2020.

As shown, successive forecasts reported in the Annual Energy Outlook (AEO) show overprediction of natural gas prices over time. Since the spreadsheet currently reports results for prices used from the AEO, 2021 edition, it can be expected that once again the prices forecasted and used in the analysis overpredict prices to expect in the future and against future forecasts. Additionally, the "Energy Price Trends" reported in the spreadsheet show systematic increases in natural gas prices in the future, including a 36% increase between 2020 to 2050 and an annual increase of 0.37% per year in the years following 2050. At the same time, the trends reported for electricity show prices changing between a decline of 6% and a rise of 6% between 2020 and 2050 and declines of between 0.46% and 0.85% annually in the years following 2050. For analysis of gas-fired consumer water heaters, these trends and disparities work to overstate the LCC savings and paybacks for higher efficiency minimum efficiency standards for natural gas alternatives, and it is expected that similar biases to exist for propane consumer water heaters.

RECOMMENDATION: The Department should, as a minimum measure, augment its current use of single time series forecasts of average and marginal consumer energy prices with forecast adjustments to account for forecasting errors and upward bias on natural gas prices and run the analysis under the resulting alternative price forecast trends. For parity with forecasts of electricity prices, error factors of plus or minus 6% in forecast prices appears reasonable alternative price trends for natural gas and propane. Furthermore, a systematic adjustment in the AEO 2021 natural gas price out to 2050 and beyond is justified based on forecast history and there a downward adjustment in price growth on the order of 15% appears reasonable. These alternative prices should be run as sensitivity cases through the analysis to specifically document changes in consumer LLC savings and paybacks and to monitor changes in national savings associated with energy efficiency standards alternatives.

Commenters look forward to conducting a more thorough review of the Department's spreadsheet and analytical models used in developing the TSD and ultimately minimum energy efficiency standards proposals.

Economically Justified Standards Levels for Storage Water Heaters (</=20;</=55 gallons)

At this time, and based upon consumer economics, EL 2 for gas-fired storage water heaters represents various combinations of design features in Category I compliant designs and exhibits the highest LCC savings and shortest PBP as well as having the lowest proportion of consumers experiencing "Net Cost." This result holds for all three of the significant draw patterns: Low, Medium, and High. Characteristics of EL 2 and other gas-fired storage water heaters are reported in Table ES.3.3:

Table ES.3.3 Efficiency Levels for Gas-Fired Storage Water Heaters with a Rated Storage Volume Greater Than or Equal to 20 Gallons and Less Than or Equal to 55 Gallons that Use a Standard or Low NO_X Burner

ELs	UEF*				Technology Options
	Very Small	Low	Medium	High	
0	N/A	0.54	0.58	0.63**	Standing Pilot, Foam Insulation - Side: 1 in., Top: 1 in., Venting Category: I, Outlet Venting: Atmospheric Vent, Heat Exchanger: Straight Flue
1	N/A	0.57	0.60	0.64	Standing Pilot, Foam Insulation - Side: 2 in., Top: 2 in., Venting Category: I, Outlet Venting: Atmospheric Vent, Heat Exchanger: Straight Flue
2	N/A	0.59	0.64	0.68	Standing Pilot, Foam Insulation - Side: 2 in., Top: 2 in., Venting Category: I, Outlet Venting: Thermopile Flue Damper, Heat Exchanger: Straight Flue
	N/A	0.59	0.64	0.68	Electronic Ignition, Foam Insulation - Side: 2 in., Top: 2 in., Venting Category: I, Outlet Venting: Electric Flue Damper, Heat Exchanger: Straight Flue
	N/A	0.59	0.64	0.68	Electronic Ignition, Foam Insulation - Side: 2 in., Top: 2 in., Venting Category: I, Outlet Venting: Fan Assist, Heat Exchanger: Straight Flue, Increased Baffling
3	N/A	0.60	0.65	0.69	Electronic Ignition, Foam Insulation - Side: 2 in., Top: 2 in., Venting Category: III, Outlet Venting: Power Vent, Heat Exchanger: Straight Flue, Increased Baffling
4	N/A	0.71	0.75	0.80	Electronic Ignition, Foam Insulation - Side: 2 in., Top: 2 in., Venting Category: IV, Outlet Venting: Power Vent, Condensing, Heat Exchanger: Axial Flue
5	N/A	0.77	0.81	0.86	Electronic Ignition, Foam Insulation - Side: 3 in., Top: 3 in., Venting Category: IV, Outlet Venting: Power Vent, Condensing, Heat Exchanger: Axial Flue, Increased Surface Area

*There are no gas-fired storage water heaters with standard or low NO_X burners on the market within the very small draw pattern.
**The side and top insulation thicknesses are 1.5 in. and 1.5 in., respectively.

For electric storage water heaters, EL 2 incorporating heat pump compression cycle technology as reported in Table ES.3.6 meets the comparable economic justification:

Table ES.3.6 Efficiency Levels for Electric Storage Water Heaters with a Rated Storage Volume Greater Than or Equal to 20 Gallons and Less Than or Equal to 55 Gallons

ELs	UEF*				Technology Options
	Very Small	Low	Medium	High	
0	N/A	0.92**	0.92	0.93	Primary Heating Type: Electric Resistance, Tall Aspect Ratio, Foam Insulation - Side: 2 in., Top: 3 in., Short Aspect Ratio, Foam Insulation - Side: 2 in., Top: 3 in.
1	N/A	0.93***	0.93	0.94	Primary Heating Type: Electric Resistance, Tall Aspect Ratio, Foam Insulation - Side: 4 in., Top: 4 in., Short Aspect Ratio, Foam Insulation - Side: 4 in., Top: 4 in.
2	N/A	3.30	3.35	3.47	Primary Heating Type: Heat Pump, Evaporator: Tube and Fin, Condenser: Aluminum tubing around tank, Compressor: Rotary Tall Aspect Ratio, Foam Insulation - Side: 2 in., Top: 2 in., Short Aspect Ratio, Foam Insulation - Side: 2 in., Top: 2 in.
3	N/A	3.70	3.75	3.87	Primary Heating Type: Heat Pump, Increased Evaporator and Condenser Heat Exchange Area, Increased Capacity of Compressor Tall Aspect Ratio, Foam Insulation - Side: 2 in., Top: 2 in., Short Aspect Ratio, Foam Insulation - Side: 2 in., Top: 2 in.

*There are no electric storage water heaters on the market within the very small draw pattern.
**The top insulation thickness for the tall and short aspect ratios is 2 in.
***The tall aspect ratio top insulation thickness is 3 in., and the short aspect ratio side and top insulation thicknesses are 3 in. and 3 in., respectively.

Commenters expect that this observation will hold and EL 2 levels to remain the economically justified levels through the completion of the analysis. Commenters are applying the same criteria of other gas-fired consumer water heaters.

Department "Issues on Which It Seeks Public Comments"

With respect to the Department's issues offered for comment, Commenters have the following response:

- Combine storage and instantaneous product classes – Commenters strongly oppose combining storage and instantaneous consumer water heaters because of the unique consumer utility provided by these alternatives, particularly in the water heater replacement market as discussed above.

- Product databases – Commenters have no comment at this time.

- Shipments information – Commenters have no comment at this time.

- Design option technologies – Commenters support the Department's definitions of design options from its review of AHRI Directory listed consumer water heater models and review of associated product literature.

- Efficiency levels and cost estimates– Commenters agree with the Department's characterizations of UEF-rated energy performance based on its review of the design option technologies (mentioned above) and use of the UEF energy descriptor. At this time, Commenters have no comment on product cost estimates as documented, although it strongly recommends (as recommended in the NAS peer review) that the Department actively develop and implement a "ground truthing" of consumer product costs for comparison to its teardown analysis approach. Inconsistencies between actual prices and DEPARTMENT's analytical approach is a persistent objection to the Department's approach. Commenters are most concerning with the Department's installation cost adders and analysis, which is incompletely documented in the pTSD. Without more detailed explanation in the final TSD, Commenters will resort to deducing the Department's assumptions and calculation approach from the spreadsheet.

- Energy use analysis – Commenters generally support energy use analysis that is tied to the UEF energy descriptor. Having gone to great lengths to develop and justify the UEF metric upon consumer use assumptions, the resulting consensus behind UEF should serve as the basis for energy use analysis.

- Maintenance and repair costs – Commenters have no comment at this time but will be reviewing analysis of maintenance and repair costs particularly for instantaneous water heaters, which have specific maintenance needs and challenges and high repair costs.

- Efficiency distribution – Product efficiency as represented in UEF characteristics in Table ES3.3, Table ES3.6, and elsewhere appear to be consistent with review of AHRI Directory data.

- Historical shipments – Commenters have no comment at this time.

- Small domestic manufacturers – Commenters have no comment at this time.

In conclusion, Commenters again encourage the Department to use the pTSD review and comment as an opportunity to address stakeholder issues and concerns with the TSD process and give conscientious consideration to modifications to the TSD for consumer water heaters, which Commenters believe could be implemented rapidly. Commenters would look forward to contributing positively to improvements to the TSD development process.

This concludes the comments of Commenters. We look forward to additional information from the Department regarding the TSD and its supporting analysis.