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[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket Number EERE–2014–BT–STD–0042]

RIN 1904-AD34

Energy Conservation Standards for Commercial Water Heating Equipment: Availability of Updated Analysis Results

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Notice of data availability (NODA).

SUMMARY: In this NODA, the U.S. Department of Energy (DOE) presents its updated analysis used to convert the potential energy conservation standard levels the Department has considered for residential-duty commercial gas-fired storage water heaters from thermal efficiency and standby loss metrics to the uniform energy factor (UEF) metric, as required by a recent change in law. In a notice of proposed rulemaking (NOPR) for energy conservation standards for commercial water heating equipment published on May 30, 2016 ("May 2016 CWH ECS NOPR"), DOE analyzed these potential standard levels for residential-duty commercial gas-fired storage waters in terms of thermal efficiency and standby loss, and converted the levels to UEF using conversion factors that were proposed in a separate NOPR published on April 15, 2015 ("April 2015 conversion factor NOPR"). 81 FR 34440; 80 FR 20116. However, DOE subsequently published a

supplemental NOPR ("August 2016 conversion factor SNOPR") in the conversion factor rulemaking in response to new data on August 30, 2016 (81 FR 59736), and recently issued a conversion factor final rule ("December 6, 2016 conversion factor final rule") based upon the August 2016 conversion factor SNOPR, which finalized updated conversion factor equations. (See Docket EERE-2015-BT-TP-0007) This NODA presents the thermal efficiency and standby loss levels analyzed in the May 2016 CWH ECS NOPR for residential-duty gas-fired storage water heaters in terms of UEF, using the recently updated conversion factors adopted in the December 6, 2016 conversion factor final rule.

DATES: DOE will accept comments, data, and information regarding this notice of data availability (NODA) no later than **[INSERT DATE 15 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Instructions: Any comments submitted must identify the NODA for commercial water heating equipment, and provide docket number EERE–2014–BT–STD–0042 and/or regulatory information number (RIN) number 1904-AD34. Comments may be submitted using any of the following methods:

1) Federal eRulemaking Portal: www.regulations.gov. Follow the instructions for submitting comments.
2) E-mail: ComWaterHeating2014STD0042@ee.doe.gov. Include the docket number and/or RIN in the subject line of the message.

3) Postal Mail: Ms. Ashley Armstrong, U.S. Department of Energy, Building Technologies Office, Mailstop EE-5B, 1000 Independence Avenue, SW, Washington, DC, 20585-0121. If possible, please submit all items on a compact disc (CD), in which case it is not necessary to include printed copies.

4) Hand Delivery/Courier: Ms. Ashley Armstrong, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza, SW, Suite 600, Washington, DC, 20024. Telephone: (202) 586-6590. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

For further information on how to submit a comment, review other public comments and the docket, contact the Appliance and Equipment Standards Program staff at (202) 586-6636 or by e-mail: ComWaterHeating2014STD0042@ee.doe.gov

5) Docket: The Docket Number EERE–2014–BT–STD–0042, is available for review at www.regulations.gov, including Federal Register notices, comments, and other supporting documents/materials. All documents in the docket are listed in the www.regulations.gov index. However, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

A link to the docket web page can be found at https://www.regulations.gov/docket?D=EERE-2014-BT-STD-0042. The www.regulations.gov web page contains instructions on how to access all documents in the docket, including public comments.

FOR FURTHER INFORMATION CONTACT: Ms. Ashley Armstrong, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies, EE-2J, 1000 Independence Avenue, SW, Washington, DC 20585-0121. Telephone: (202) 586-6590. E-mail: ApplianceStandardsQuestions@ee.doe.gov.

Ms. Jennifer Tiedeman, U.S. Department of Energy, Office of the General Counsel, GC-33, 1000 Independence Avenue, SW, Washington, DC, 20585-0121. Telephone: (202) 287-6111. Email: Jennifer.Tiedeman@hq.doe.gov.

SUPPLEMENTARY INFORMATION:

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I. Authority and Background

Title III Part C[1] of the Energy Policy and Conservation Act of 1975 ("EPCA" or, "the Act"), Public Law 94-163 (42 U.S.C. 6311-6317, as codified), added by Public Law 95-619, Title IV, Sec. 441(a), sets forth a variety of provisions designed to improve energy efficiency and established the Energy Conservation Program for Certain Industrial

[1] For editorial reasons, upon certification in the U.S. Code, Part C was re-designated Part A-1.

Equipment, which includes the commercial water heating equipment that is the subject of this rulemaking.[2] (42 U.S.C. 6311(1)(K))

Under EPCA, DOE's energy conservation program generally consists of four parts: (1) testing; (2) labeling; (3) energy conservation standards; and (4) certification and enforcement procedures. The testing requirements consist of test procedures that manufacturers of covered products and equipment must use as the basis for certifying to DOE that their products and equipment comply with the applicable energy conservation standards adopted under EPCA, and for making other representations about the efficiency of those products. Similarly, DOE must use these test procedures to determine whether such products and certain equipment comply with any relevant standards promulgated under EPCA. (42 U.S.C. 6314) The initial Federal energy conservation standards and test procedures for commercial storage water heaters, instantaneous water heaters, and unfired hot water storage tanks (collectively referred to as "commercial water heating equipment" or "CWH equipment") were added to EPCA by the Energy Policy Act of 1992 (EPACT 1992), Public Law 102-486. (42 U.S.C. 6313(a)(5) and 42 U.S.C. 6314(a)(4)(A)) These initial CWH equipment standards corresponded to the efficiency levels and equipment classes contained in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1–1989, in effect on October 24, 1992. The statute provided that if the efficiency levels in ASHRAE Standard 90.1 were amended after October 24, 1992, the Secretary of Energy (Secretary) must establish an amended uniform national standard at new minimum levels for each equipment type

[2] All references to EPCA in this document refer to the statute as amended through the Energy Efficiency Improvement Act of 2015 (EEIA 2015), Public Law 114-11 (April 30, 2015).

specified in ASHRAE Standard 90.1, unless DOE determines, through a rulemaking supported by clear and convincing evidence, that national standards more stringent than the new minimum levels would result in significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)(I)-(II)) The statute was subsequently amended to require DOE to review its standards for commercial water heating equipment (and other "ASHRAE equipment") every six years. (42 U.S.C. 6313(a)(6)(C)) On January 12, 2001, DOE published a final rule for commercial water heating equipment that amended energy conservation standards by adopting the levels in ASHRAE Standard 90.1-1999 for all types of commercial water heating equipment, except for electric storage water heaters.[3] 66 FR 3336. Most recently, on July 17, 2015, DOE published a final rule for commercial water heating equipment, in which DOE adopted the thermal efficiency level for oil-fired storage water heaters that was included in ASHRAE 90.1-2013. 80 FR 42614.

On December 18, 2012, the American Energy Manufacturing Technical Corrections Act (AEMTCA), Public Law 112–210, was signed into law. In relevant part, it amended EPCA to require that DOE publish a final rule establishing a uniform efficiency descriptor and accompanying test methods for consumer water heaters and certain commercial water heating equipment within one year of the enactment of AEMTCA. (42 U.S.C. 6295(e)(5)(B)) The final rule must replace the energy factor (EF), thermal efficiency, and standby loss metrics with a uniform efficiency descriptor. (42

[3] For electric storage water heaters, the standard in ASHRAE Standard 90.1-1999 was less stringent than the standard prescribed in EPCA and, consequently, would have increased energy consumption, so DOE maintained the standards for electric storage water heaters at the statutorily prescribed level.

U.S.C. 6295(e)(5)(C)) On July 11, 2014, DOE published a final rule that fulfilled these requirements, establishing a uniform energy factor (UEF) as the uniform energy descriptor ("July 2014 final rule").[4] 79 FR 40542 (July 2014 final rule). AEMTCA requires that, beginning one year after the date of publication of DOE's final rule establishing the uniform descriptor (i.e., July 13, 2015), the efficiency standards for the consumer water heaters and residential-duty commercial water heaters identified in the July 2014 final rule must be denominated according to the uniform efficiency descriptor established in that final rule (42 U.S.C. 6295(e)(5)(D)), and that DOE must develop a mathematical conversion for converting the measurement of efficiency from the test procedures and metrics in effect at that time to the uniform efficiency descriptor. (42 U.S.C. 6295(e)(5)(E)(i))

Pursuant to 42 U.S.C. 6295(e)(5)(E)(ii) and (iii), the conversion factor must not affect the minimum efficiency requirements for covered water heaters, including residential-duty commercial water heaters. Furthermore, such conversions must not lead to a change in measured energy efficiency for covered residential and residential-duty commercial water heaters manufactured and tested prior to the final rule establishing the uniform efficiency descriptor. *Id.* EPCA also contains what is known as an "anti-backsliding" provision, which prevents the Secretary from prescribing any amended

[4] The uniform efficiency descriptor and accompanying test procedure apply to commercial water heating equipment with residential applications defined in the July 2014 final rule as a "residential-duty commercial water heater." Specifically, in the July 2014 final rule, DOE adopted a definition for "residential-duty commercial water heater" that included seven classes: gas-fired storage, oil-fired storage, electric storage, heat pump with storage, gas-fired instantaneous, electric instantaneous, and oil-fired instantaneous. 79 FR 40542, 40586. In a subsequent CWH equipment test procedure final rule published on November 10, 2016, DOE revised the definition by removing four classes; therefore, the revised definition for "residential-duty commercial water heater" includes three classes: gas-fired storage, oil-fired storage, and electric instantaneous. 81 FR 79261, 79289.

standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6295(o)(1); 6313(a)(6)(B)(iii)(I)) In the December 6, 2016 conversion factor final rule, DOE's methodology for translating the standards ensures equivalent stringency between the then-existing standards (in terms of EF, thermal efficiency and standby loss metrics) and the updated standards (in terms of UEF). (See Docket EERE-2015-BT-TP-0007)

DOE initially presented proposals for establishing mathematical conversion factors for residential-duty commercial water heaters in a NOPR published on April 14, 2015 ("April 2015 conversion factor NOPR") to be used to convert thermal efficiency and standby loss represented values to UEF represented values for residential-duty commercial water heaters. 80 FR 20116, 20143. DOE also proposed amendments to the minimum energy conservation standards for consumer water heaters and residential-duty commercial water heaters to translate the existing standards to the UEF metric without altering the stringency of the existing energy conservation standards. *Id.* at 20120. In a May 31, 2016 NOPR, DOE analyzed amended thermal efficiency and standby loss standards for residential-duty gas-fired storage water heaters, and used the conversion factors proposed in the April 2015 conversion factor NOPR to convert the analyzed thermal efficiency and standby loss levels to UEF.[5] ("May 2016 CWH ECS NOPR") DOE also used these conversion factors to develop UEF standard equations (dependent

[5] DOE initiated this rulemaking pursuant to EPCA's requirement that every 6 years, DOE must conduct an evaluation of its standards for CWH equipment and publish either a notice of determination that such standards do not need to be amended or a notice of proposed rulemaking, including proposed amended standards. (42 U.S.C. 6313(a)(6)(C)(i))

on rated volume) corresponding to the thermal efficiency and standby loss levels selected for each trial standard level (TSL) analyzed. 81 FR 34440, 34477.

Upon further analysis and review of the public comments received in response to the April 2015 conversion factor NOPR, DOE published a supplemental notice of proposed rulemaking on August 30, 2016 ("August 2016 conversion factor SNOPR"). In the SNOPR, DOE proposed revised mathematical conversion factors, as well as updates to the energy conservation standards for residential-duty commercial water heaters denominated in UEF. 81 FR 59736, 59793-59794, 59798. On December 6, 2016, DOE issued a final rule ("December 6, 2016 conversion factor final rule") that adopted the mathematical conversion factors used to convert thermal efficiency and standby loss to UEF for residential-duty commercial water heaters that were proposed in the August 2016 conversion factor SNOPR. DOE also adopted the energy conservation standards for residential-duty commercial water heaters that were proposed in the August 2016 conversion factor SNOPR and that translate the existing thermal efficiency and standby loss standards to UEF standards. (See Docket EERE-2015-BT-TP-0007) In this NODA, DOE has used the updated conversion factors adopted in the December 6, 2016 conversion factor final rule to convert the thermal efficiency and standby loss levels analyzed in the May 2016 CWH ECS NOPR (i.e., levels more stringent than the existing thermal efficiency and standby loss standards) to UEF levels.

II. Summary of the Updated Conversion Factor and Results

The purpose of this NODA is to present the thermal efficiency and standby loss levels that were considered for residential-duty gas-fired commercial water heaters in the

May 2016 CWH ECS NOPR in terms of UEF using the recently updated conversion factors adopted in the December 6, 2016 conversion factor final rule. In response to the May 2016 CWH ECS NOPR, DOE received feedback on the efficiency levels analyzed and the efficiency levels included in each TSL for residential-duty commercial gas-fired storage water heaters. DOE is considering this feedback, and will address the comments received in detail, along with any resulting changes to the analysis and relevant conclusions, in the forthcoming final rule. The NODA, however, does not reflect any change in the efficiency levels or TSLs considered in the May 2016 CWH ECS NOPR.

The December 6, 2016 conversion factor final rule adopted conversion factors for residential-duty commercial water heaters for all four draw patterns: high, medium, low, and very small.[6] In the following equations, New UEF is the converted UEF value; E_t is the thermal efficiency in fractional form (e.g., 0.80 instead of 80 percent); SL is the standby loss (Btu/h); P is input rate (Btu/h); F and G are coefficients as specified in Table 1 based on the applicable draw pattern; and UEF_{rd} is a parameter for residential-duty commercial storage water heaters developed by DOE based on the water heater analysis model (WHAM) equation.[7] The methodology and data used to develop these conversion factors are discussed in detail in the August 2016 conversion factor SNOPR. 81 FR 59750-59751, 59776-59778 (August 30, 2016).

[6] The term "draw pattern" refers to the duration, flow rate, and timing of hot water draws during the test. The July 2014 final rule adopted four different draw patterns – very small, low, medium, and high – based on the delivery capacity (i.e., first hour rating or maximum gallons per hour rating) of the model under test. 79 FR 40542, 40550 (July 11, 2014). Because the UEF differs based on the draw pattern, separate conversion factors were established for each draw pattern.

[7] For more information see: http://aceee.org/files/proceedings/1998/data/papers/0114.PDF.

$$UEF_{rd} = \left[\frac{1}{E_t} + F * SL\left(G - \frac{1}{P\,E_t}\right)\right]^{-1}$$

$$New\ UEF = -0.0022 + 1.0002 * \mathrm{UEF}_{rd}$$

Table 1: Coefficients for the Analytical UEF Conversion Factor for Residential-Duty Commercial Storage Water Heaters

Draw Pattern	F	G
Very Small	0.821429	0.0043520
Low	0.821429	0.0011450
Medium	0.821429	0.0007914
High	0.821429	0.0005181

The thermal efficiency and standby loss levels analyzed in the May 2016 CWH ECS NOPR are shown in Table 2 (81 FR 34440, 34472 (May 31, 2016)), and the corresponding updated UEF levels are shown in Table 3. The standby loss and UEF levels correspond to the representative equipment capacities analyzed for residential-duty commercial gas-fired storage water heaters – 75 gallon rated storage volume and 76,000 Btu/h rated input. In Table 3, the UEF values correspond to the high draw pattern – DOE believes most, if not all, residential-duty gas-fired storage water heater models will fall into the high draw pattern bin. In the May 2016 CWH ECS NOPR, DOE selected standby loss levels in Btu/h, and translated these values to modified standby loss standard equations using standby loss reduction factors. As proposed in the May 2016 CWH ECS NOPR and presented in this NODA, the standby loss reduction factor is a factor that is multiplied by the current standby loss equation. Because the standby loss reduction factor is a multiplicative factor that is applied to the existing standby loss equation (in lieu of independently changing the coefficients for the volume and input terms of the equation), the standby loss reduction factor preserves the dependence of the existing

standby loss equation on rated input and storage volume. 81 FR 34440, 34476 (May 31, 2016).

Table 2: Thermal Efficiency and Standby Loss Levels for Residential-Duty Gas-Fired Storage Water Heaters Analyzed in the May 2016 CWH ECS NOPR (75 Gallon Rated Storage Volume, 76,000 Btu/h Rated Input)

Thermal Efficiency Level	Thermal Efficiency	Standby Loss (Btu/h)			
		SL EL0	SL EL1	SL EL2*	SL EL3*
E_t EL0	80%	1048	836	811	707
E_t EL1	82%	1022	816	791	690
E_t EL2	90%	624	503	-	-
E_t EL3	95%	624	503	-	-
E_t EL4	97%	624	503	-	-

*Electromechanical flue dampers, which were analyzed in SL ELs 2-3, were not considered as a technology option for E_r ELs 2-4 because these thermal efficiency levels can only be met by condensing water heaters. Flue dampers are not used with condensing water heaters because condensing water heaters include mechanical draft systems.
Note: EL stands for efficiency level, E_t stands for thermal efficiency, and SL stands for standby loss.

Table 3: Updated UEF Levels Corresponding to Thermal Efficiency and Standby Loss Levels for Residential-Duty Gas-Fired Storage Water Heaters Analyzed in the May 2016 CWH ECS NOPR (75 Gallon Rated Storage Volume, 76,000 Btu/h Rated Input)

Thermal Efficiency Level	Thermal Efficiency	Uniform Energy Factor*			
		SL EL0	SL EL1	SL EL**	SL EL3**
E_t EL0	80%	0.59	0.63	0.63	0.65
E_t EL1	82%	0.61	0.64	0.64	0.66
E_t EL2	90%	0.73	0.76	-	-
E_t EL3	95%	0.76	0.79	-	-
E_t EL4	97%	0.77	0.80	-	-

*UEF values were determined using the conversion factors for the high draw pattern adopted in the December 6, 2016 conversion factor final rule. (See Docket EERE-2015-BT-TP-0007)
**Electromechanical flue dampers, which were analyzed in SL ELs 2-3, were not considered as a technology option for E_r ELs 2-4 because these thermal efficiency levels can only be met by condensing water heaters. Flue dampers are not used with condensing water heaters because condensing water heaters include mechanical draft systems.
Note: EL stands for efficiency level, E_t stands for thermal efficiency, and SL stands for standby loss.

The energy conservation standards for residential-duty commercial water heaters adopted in the December 6, 2016 conversion factor final rule (i.e., denominated in UEF and translated from the existing thermal efficiency and standby loss standards) are linear equations dependent on rated volume. Therefore, the converted UEF standard equations for residential-duty gas-fired storage water heaters presented in this NODA are consistent

with this equation format. DOE based its methodology for developing UEF standard equations for more-stringent thermal efficiency and standby loss levels on the "representative model" method used for determining the converted standards equations in terms of UEF in the December 6, 2016 conversion factor final rule, as outlined below. (See Docket EERE-2015-BT-TP-0007)

DOE developed UEF standard equations corresponding to each combination of thermal efficiency and standby loss levels that DOE selected in the TSLs analyzed in the May 2016 CWH ECS NOPR. DOE converted the thermal efficiency level and standby loss value to UEF for each identified rated volume on the market and for each draw pattern using the conversion factors adopted in the December 6, 2016 conversion factor final rule. (See Docket EERE-2015-BT-TP-0007) To develop the UEF standard equation for each draw pattern and TSL, DOE used a linear regression between volume and UEF (see the December 6, 2016 conversion factor final rule for more details).

Table 4 shows the thermal efficiency and standby loss levels included in each TSL in the May 2016 CWH ECS NOPR for residential-duty commercial gas-fired storage water heaters. 81 FR 34440, 34504 (May 31, 2016). Table 5 shows the updated UEF standard equations, dependent on rated volume, that were developed for each TSL and draw pattern using the conversion factors adopted in the December 6, 2016 conversion factor final rule. (See Docket EERE-2015-BT-TP-0007)

Table 4: Trial Standard Levels from the May 2016 CWH ECS NOPR for Residential-Duty Gas-fired Storage Water Heaters by Efficiency Level

	Trial Standard Level

	0	1	2	3	4
Thermal Efficiency	80%	82%	90%	90%	97%
Standby Loss Reduction Factor	1.00	0.77	0.48	0.48	0.48

Table 5: Updated UEF Equations for Trial Standard Levels from the May 2016 CWH ECS NOPR for Residential-Duty Gas-Fired Storage Water Heaters

Draw Pattern*	TSL 0	TSL 1	TSL 2	TSL 3	TSL 4
High	0.6597 - (0.0009 x Vr)	0.7205 - (0.0008 x Vr)	0.8107 - (0.0008 x Vr)	0.8107 - (0.0008 x Vr)	0.8675 - (0.0009 x Vr)
Medium	0.6002 - (0.0011 x Vr)	0.6749 - (0.0010 x Vr)	0.7686 - (0.0010 x Vr)	0.7686 - (0.0010 x Vr)	0.8192 - (0.0011 x Vr)
Low	0.5362 - (0.0012 x Vr)	0.6227 - (0.0012 x Vr)	0.7192 - (0.0012 x Vr)	0.7192 - (0.0012 x Vr)	0.7631 - (0.0013 x Vr)
Very Small	0.2674 - (0.0009 x Vr)	0.3590 - (0.0012 x Vr)	0.4459 - (0.0014 x Vr)	0.4459 - (0.0014 x Vr)	0.4622 - (0.0015 x Vr)

* Draw pattern is a classification of hot water use of a consumer water heater or residential-duty commercial water heater, based upon the first-hour rating. The draw pattern is determined using the Uniform Test Method for Measuring the Energy Consumption of Water Heaters in in appendix E to subpart B of 10 CFR Part 430.
Note: TSL 0 represents the baseline, and Vr is rated volume in gallons. UEF values were determined using the conversion factors adopted in the December 6, 2016 conversion factor final rule. (See Docket EERE-2015-BT-TP-0007)

III. Issues on which DOE seeks public comment

DOE is interested in receiving comments on the conversion of the thermal efficiency and standby loss levels for residential-duty gas-fired storage water heaters that were considered in the May 2016 CWH ECS NOPR to UEF levels and UEF standard equations using the conversion factors adopted by DOE in its December 6, 2016 final rule.

Issued in Washington, DC, on December 7, 2016.

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