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[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 430 EERE–

2017–BT–STD–0009

RIN 1904-AD79

Energy Conservation Program: Energy Conservation Standards for Certain Commercial and Industrial Equipment; Early Assessment Review; Walk-in Coolers and Freezers

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

ACTION: Request for information.

SUMMARY: The U.S. Department of Energy ("DOE") is undertaking an early assessment review to evaluate whether to amend the energy conservation standards for walk-in coolers and freezers ("walk-ins" or "WICFs"). Specifically, through this request for information ("RFI"), DOE seeks data and information to evaluate whether amended energy conservation standards would result in significant savings of energy; be technologically feasible; and be economically justified. DOE welcomes written comments from the public on any subject within the scope of this document (including those topics not specifically raised in this RFI), as well as the submission of data and other relevant information concerning this early assessment review.

DATES: Written comments and information are requested and will be accepted on or before **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov*. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2017–BT–STD-0009, by any of the following methods:

1. *Federal eRulemaking Portal*: *www.regulations.gov*. Follow the instructions for submitting comments.
2. *E-mail*: to *ApplianceStandardsQuestions@ee.doe.gov*. Include docket number EERE–2017–BT–STD-0009 in the subject line of the message.

No telefacsimiles (“faxes”) will be accepted. For detailed instructions on submitting comments and additional information on this process, see section III of this document.

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including the Federal eRulemaking Portal, email, postal mail, or hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission process in light of the ongoing Covid-19 pandemic. DOE is currently suspending receipt of public comments via postal mail and hand delivery/courier. If a commenter finds that this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586-1445 to discuss the need for alternative arrangements. Once the Covid-19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submission, including postal mail and hand delivery/courier.

Docket: The docket for this activity, which includes *Federal Register* notices, comments, and other supporting documents/materials, is available for review at *https://www.regulations.gov*. All documents in the docket are listed in the *www.regulations.gov* index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

The docket webpage can be found at: *https://www.regulations.gov/#!docketDetail;D=EERE-2017-BT-STD-0009*. The docket webpage contains instructions on how to access all documents, including public comments, in the docket. See section III for information on how to submit comments through *https://www.regulations.gov*.

FOR FURTHER INFORMATION CONTACT: Dr. Stephanie Johnson, 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. Telephone: (202) 287-1943. E-mail: *ApplianceStandardsQuestions@ee.doe.gov*.

Mr. Michael Kido, U.S. Department of Energy, Office of the General Counsel, GC-33, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 586-8145. E-mail: *Michael.Kido@hq.doe.gov*.

For further information on how to submit a comment or review other public comments and the docket, contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by e-mail: *ApplianceStandardsQuestions@ee.doe.gov*.

SUPPLEMENTARY INFORMATION:

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I. Introduction

DOE has established an early assessment review process to conduct a more focused analysis to evaluate, based on statutory criteria, whether a new or amended energy conservation standard is warranted. Based on the information received in response to the RFI and DOE's own analysis, DOE will determine whether to proceed with a rulemaking for a new or amended energy conservation standard. If DOE makes an initial determination that a new or amended energy conservation standard would satisfy the applicable statutory criteria or DOE's analysis is inconclusive, DOE would undertake the preliminary stages of a rulemaking to issue a new or amended energy conservation standard. If DOE makes an initial determination based upon available evidence that a new or amended energy conservation standard would not meet the applicable statutory criteria, DOE would engage in notice and comment rulemaking before issuing a final determination that new or amended energy conservation standards are not warranted.

A. Authority

The Energy Policy and Conservation Act, as amended ("EPCA"),[1] among other things, authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291-6317) Title III, Part C[2] of EPCA, added by Public Law 95-619, Title IV, section 441(a) (42 U.S.C. 6311-6317, as codified), established the Energy Conservation Program for Certain Industrial

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116-260 (Dec. 27, 2020).
[2] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A-1.

Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This equipment includes walk-in coolers and freezers, the subject of this document. (42 U.S.C. 6311(1)(G))

Under EPCA, DOE's energy conservation program consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), energy conservation standards (42 U.S.C. 6313), and the authority to require information and reports from manufacturers (42 U.S.C. 6316(a); 42 U.S.C. 6299).

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297) DOE may, however, grant waivers of Federal preemption in limited instances for particular State laws or regulations, in accordance with the procedures and other provisions set forth under 42 U.S.C. 6316(a) (applying the preemption waiver provisions of 42 U.S.C. 6297).

DOE must follow specific statutory criteria for prescribing new or amended standards for covered equipment. EPCA requires that any new or amended energy conservation standard prescribed by the Secretary of Energy ("Secretary") be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(2)(A)) The Secretary may not prescribe an amended or new standard that will not result in significant conservation of energy, or is not technologically feasible or economically justified. (42 U.S.C. 6316(a); 42 U.S.C. 6295(o)(3))

EPCA specifies standards for walk-ins. First, all walk-in doors narrower than 3 feet 9 inches and shorter than 7 feet must have automatic door closers that firmly close all walk-in doors that have been closed to within 1 inch of full closure, and must also have strip doors, spring hinged doors, or other methods of minimizing infiltration when doors are open. Additionally, walk-ins must contain wall, ceiling, and door insulation of at least R-25 for coolers and R-32 for freezers, excluding glazed portions of doors and structural members, and floor insulation of at least R-28 for freezers. Walk-in evaporator fan motors of under 1 horsepower ("hp") and less than 460 volts must be electronically commutated motors (brushless direct current motors) or three-phase motors, and walk-in condenser fan motors of under 1 horsepower must use permanent split capacitor motors, electronically commutated motors, or three-phase motors. Interior light sources must have an efficacy of 40 lumens per watt or more, including any ballast losses; less-efficacious lights may only be used in conjunction with a timer or device that turns off the lights within 15 minutes of when the walk-in is unoccupied. See 42 U.S.C. 6313(f)(1).

Second, walk-ins have requirements related to electronically commutated motors used in them. See 42 U.S.C. 6313(f)(2)). Specifically, in those walk-ins that use an evaporator fan motor with a rating of under 1 hp and less than 460 volts, that motor must be either a three-phase motor or an electronically commutated motor.[3] (42 U.S.C. 6313(f)(2)(A))

Third, EPCA requires that walk-in freezers with transparent reach-in doors must have triple-pane glass with either heat-reflective treated glass or gas fill for doors and windows. Transparent walk-in cooler doors must have either double-pane glass with heat-reflective treated glass and gas fill or triple-pane glass with heat-reflective treated glass or gas fill. (42 U.S.C. 6313(f)(3)(A)-(B)) For walk-ins with transparent reach-in doors, EPCA also prescribes specific anti-sweat heater-related requirements: walk-ins without anti-sweat heater controls must have a heater power draw of no more than 7.1 or 3.0 watts per square foot of door opening for freezers and coolers, respectively. Walk-ins with anti-sweat heater controls must either have a heater power draw of no more than 7.1 or 3.0 watts per square foot of door opening for freezers and coolers, respectively, or the anti-sweat heater controls must reduce the energy use of the heater in a quantity corresponding to the relative humidity of the air outside the door or to the condensation on the inner glass pane. See 42 U.S.C. 6313(f)(3)(C)-(D).

Additionally, EPCA prescribed two cycles of WICF-specific rulemakings; the first to establish performance-based standards that achieve the maximum improvement in energy that the Secretary determines is technologically feasible and economically

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[3] The requirement regarding electronically commutated motors was predicated on DOE determining that more than one manufacturer offered such motors for sale. See 42 U.S.C. 6313(f)(2)(A). DOE documented this determination in Docket EERE-2008-BT-STD-0015-0072 (available at *www.regulations.gov/document/EERE-2008-BT-STD-0015-0072*).

justified, and the second to determine whether to amend those standards. (42 U.S.C. 6313(f)(4) and (5)) EPCA also requires that, not later than 6 years after the issuance of any final rule establishing or amending a standard, DOE evaluate the energy conservation standards for each type of covered equipment, including those at issue here, and publish either a notification of determination that the standards do not need to be amended, or a notice of proposed rulemaking ("NOPR") that includes new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6316(a); 42 U.S.C. 6295(m)(1)) DOE is publishing this RFI to inform its decision consistent with its obligations under EPCA.

B. Rulemaking History

On June 3, 2014, DOE published a final rule ("June 2014 ECS final rule") establishing performance-based standards for the components of a walk-in: doors, panels, and refrigeration systems. 79 FR 32050. The standards were expressed in terms of daily energy consumption for walk-in doors, R-value for walk-in panels, and annual walk-in energy factor ("AWEF") for walk-in refrigeration systems. *Id*.

After publication of the June 2014 ECS final rule, the Air-Conditioning, Heating and Refrigeration Institute ("AHRI") and Lennox International, Inc. ("Lennox"), a manufacturer of walk-in refrigeration systems, filed petitions for review of DOE's final rule and DOE's subsequent denial of a petition for reconsideration of the rule (79 FR 59090 (October 1, 2014)) with the United States Court of Appeals for the Fifth Circuit. *Lennox Int'l v. Dep't of Energy*, Case No. 14-60535 (5th Cir.). As a result of this litigation, a settlement agreement was reached to address, and a controlling order from the Fifth Circuit vacated, standards for six of the refrigeration system equipment classes—the two energy conservation standards applicable to multiplex condensing refrigeration systems (subsequently re-named as "unit coolers") operating at medium and low temperatures and the four energy conservation standards applicable to dedicated condensing refrigeration systems operating at low temperatures.[4] After the Fifth Circuit issued its order, DOE established a Working Group to negotiate energy conservation standards to replace the six vacated standards. 80 FR 46521 (August 5, 2015). The Working Group assembled their recommendations into a Term Sheet (See Docket EERE-2015-BT-STD-0016-0056[5]) that was presented to, and approved by, the Appliance Standards and Rulemaking Federal Advisory Committee ("ASRAC") on December 18, 2015.

The Term Sheet contained recommended energy conservation standards to replace the six vacated standards, definitions for a number of WICF-related terms, and test procedure changes to implement the recommended energy conservation standards. Consequently, DOE initiated both an energy conservation standard rulemaking and a test procedure rulemaking in 2016 to implement these recommendations. The Term Sheet

[4] The thirteen other standards established in the June 2014 ECS final rule (*i.e.*, the four standards applicable to dedicated condensing refrigeration systems operating at medium-temperatures; the three standards applicable to panels; and the six standards applicable to doors) were not vacated.
[5] The docket can be accessed at *www.regulations.gov/docket/EERE-2015-BT-STD-0016*.

also recommended additional specific test procedure changes for future rulemaking to help improve its ability to be fully representative of walk-in energy use.

On July 10, 2017, DOE published a final rule adopting energy conservation standards for the six classes of walk-in refrigeration systems for which the prior standards were vacated. 82 FR 31808 ("July 2017 ECS final rule"). The energy conservation standards established in the July 2017 ECS final rule were consistent with those recommended by the Working Group and approved by ASRAC. 82 FR 31808, 31878. The current energy conservation standards for walk-ins are codified at 10 CFR 431.306.

II. Request for Information

DOE is publishing this RFI to collect data and information during the early assessment review to inform its decision, consistent with its obligations under EPCA, as to whether the Department should proceed with an energy conservation standards rulemaking. DOE has identified certain topics for which information and data are requested to assist in the evaluation of the potential for amended energy conservation standards. DOE also welcomes comments on other issues relevant to its early assessment that may not specifically be identified in this document.

A. Scope and Equipment Classes

This RFI covers equipment meeting the walk-in definition codified in 10 CFR 431.302: an enclosed storage space (*i.e.,* box) refrigerated to temperatures (1) above 32

°F for walk-in coolers and (2) at or below 32 °F for walk-in freezers, that can be walked into, and has a total chilled storage area of less than 3,000 square feet, but excluding equipment designed and marketed exclusively for medical, scientific, or research purposes. 10 CFR 431.302. (See also 42 U.S.C. 6311(20)) DOE has codified and established energy conservation standards applicable to the principal components that make up a walk-in (*i.e.*, doors, panels, and refrigeration systems). In addition to the prescriptive requirements for walk-ins established by EPCA (42 U.S.C. 6313(f)(3)(A)-(D)) and codified at 10 CFR 431.306(a)-(b), DOE established performance-based energy conservation standards for doors and refrigeration systems. 10 CFR 431.306(c)-(e).

When evaluating and establishing energy conservation standards, DOE may divide covered equipment into classes by the type of energy used, or by capacity or other performance-related features that would justify a different standard. (42 U.S.C. 6316(a); 42 U.S.C. 6295(q)(1)) In making a determination whether capacity or another performance-related feature justifies a different standard, DOE must consider such factors as the utility of the feature to the consumer and other factors DOE deems appropriate. *Id.*

DOE established standards for walk-in doors based on (1) whether they are used in a walk-in cooler (i.e., medium-temperature) or walk-in freezer (i.e., low-temperature), (2) whether they are display or non-display doors[6], and (3) if non-display, whether they

[6] A "display door" is a door that (1) is designed for product display, or (2) has 75 percent or more of its surface area composed of glass or another transparent material. 10 CFR 431.302.

are passage or freight doors.[7] 10 CFR 431.306(c)-(d). Table II.1 presents the equipment classes for all walk-in doors.

DOE codified standards for non-display panels: based on (1) whether they are used in a walk-in cooler (i.e., medium-temperature) or walk-in freezer (i.e., low-temperature), and (2) whether they are structural (wall or ceiling) or floor panels. 10 CFR 431.306(a)(3)-(4). Table II.2 presents the equipment classes for walk-in panels.

DOE established equipment classes for walk-in refrigeration systems based on (1) whether they are dedicated condensing systems[8] or unit coolers,[9] and (2) whether they are used in a walk-in cooler (i.e., medium-temperature) or walk-in freezer (i.e., low-temperature). 10 CFR 431.306(e). DOE further divided dedicated condensing refrigeration systems into "indoor" and "outdoor" equipment classes.[10] *Id.* "Indoor, low temperature" dedicated condensing systems, "outdoor, low temperature" dedicated condensing systems," and "low temperature" unit coolers are further divided based on net

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[7] A "freight door" is a door that is not a display door and is equal to or larger than 4 feet wide and 8 feet tall. 10 CFR 431.302. A "passage door" is a door that is not a freight or display door. *Id.*

[8] A "dedicated condensing system" is one of the following: (1) A dedicated condensing unit; (2) A single-package dedicated system; or (3) A matched refrigeration system. 10 CFR 431.302.

[9] The term, "unit cooler" means "an assembly, including means for forced air circulation and elements by which heat is transferred from air to refrigerant, thus cooling the air, without any element external to the cooler imposing air resistance." 10 CFR 431.302.

[10] An "indoor dedicated condensing refrigeration system" is a "dedicated condensing refrigeration system designated by the manufacturer for indoor use or for which there is no designation regarding the use location." 10 CFR 431.302. An "outdoor dedicated condensing refrigeration system" is a "dedicated condensing refrigeration system designated by the manufacturer for outdoor use." *Id.*

capacity. See 10 CFR 431.306(e). Table II.3 lists the equipment classes for WICF refrigeration systems.

Table II.1: Equipment Classes for Walk-in Doors

Utility	Temperature	Class Code
Display Door	Medium	DD.M
	Low	DD.L
Passage Door (Non-display)	Medium	PD.M
	Low	PD.L
Freight Door (Non-display)	Medium	FD.M
	Low	FD.L

Table II.2: Equipment Classes for Walk-in Panels

Utility	Temperature	Class Code
Floor Panel	Low	FP.L
Structural (Wall or Ceiling) Panel	Medium	SP.M
	Low	SP.L

Table II.3: Equipment Classes for Walk-in Refrigeration Systems

System Type	Temperature	Condenser Location	Refrigeration System Net Capacity (*Btu/h*)	Class Code
Dedicated Condensing	Medium	Indoor	All Capacities	DC.M.I
		Outdoor	All Capacities	DC.M.O
	Low	Indoor	< 6,500	DC.L.I, <6,500
			≥ 6,500	DC.L.I, ≥ 6,500
		Outdoor	< 6,500	DC.L.O, <6,500
			≥ 6,500	DC.L.O ≥ 6,500
Unit Cooler	Medium	-	All Capacities	UC.M
	Low	-	< 15,500	UC.L, < 15,500
			≥ 15,500	UC.L, ≥ 15,000

The applicability of these current equipment classes for certain walk-in products is discussed in more detail in sections II.A.1 through II.A.4 of this document.

1. Display Panels

A display panel is defined as a panel that is entirely or partially comprised of glass, a transparent material, or both, and is used for display purposes. 10 CFR 431.302. DOE has established a test procedure for calculating total daily energy consumption, based on measured thermal transmittance (also "U-factor"), of display panels. 10 CFR 431.304(b)(1). DOE has not, however, adopted standards for display panels based on energy consumption as at the time of the June 2014 ECS final rule such panels made up a small fraction of the panel market and had a limited energy savings potential. 79 FR 32049, 32067. DOE has identified two manufacturers of display doors who also manufacture display panels.[11] Some models of these display panels contain anti-sweat heaters to prevent condensation similar to display doors.

Issue 1: DOE seeks information regarding the thermal transmission through display panels and design characteristics which would affect the thermal transmission, specifically, "glass pack"[12] design and frame design. DOE also seeks information regarding the amount of direct electrical energy consumption of

[11] Display panel product information from two manufacturers can be found at *www.regulations.gov* Docket No. EERE-2017-BT-STD-0009-0001 and Docket No. EERE-2017-BT-STD-0009-0002.

[12] The "glass pack" in a display door or window of a non-display door is an assembly of glass layers typically filled with low thermal-conductivity inert gas and held together at the edges of the glass by low-conductivity leak-tight spacers.

electricity-consuming devices sited on or within display panels, including the amount of anti-sweat heat required, if any. DOE additionally requests information on any specific design or use characteristics differentiating display panels from display doors.

2. High-Temperature Freezers

DOE has established a test procedure for determining the net capacity and AWEF of walk-in refrigeration systems at appendix C to subpart R of 10 CFR part 431 ("Appendix C"), which incorporates by reference AHRI Standard 1250P (I-P), "2009 Standard for Performance Rating of Walk-In Coolers and Freezers," ("AHRI 1250-2009"). 10 CFR 431.304(b)(4). As defined previously, the storage space (*i.e.,* box) of a walk-in cooler is refrigerated to temperatures above 32 °F, while walk-in freezers are refrigerated to temperatures at or below 32°F. 42 U.S.C. 6311(20). See also 10 CFR 431.302. The current walk-in test procedure rates medium-temperature refrigeration systems (which are used in walk-in coolers) at 35 °F and low-temperature refrigeration systems (which are used in walk-in freezers) at -10 °F. (See section 5 of AHRI 1250-2009 (dry bulb temperature specifications) (incorporated by reference at 10 CFR 431.303(b))) Consequently, refrigeration system energy use for walk-in coolers is represented by performance at a 35 °F box temperature and refrigeration system energy use for walk-in freezers is represented by performance at a -10 °F box temperature.

As discussed in the July 2017 ECS final rule, stakeholders commented that so-called "high-temperature" freezer walk-ins are those with a box temperature range of 10

°F to 32 °F, and that medium-temperature refrigeration systems are generally used for this temperature range. 82 FR 31808, 31830. As discussed in a RFI published on June 17, 2021 ("June 2021 TP RFI"), high-temperature freezers would be considered walk-in freezers because their room temperature is less than or equal to 32 ºF, and would therefore be rated at –10 ºF. 86 FR 32332, 32349. To the extent a medium-temperature refrigeration system is used for high-temperature freezer applications, such a system may not be able to operate at the -10 ºF room temperature prescribed by the test procedure for freezers. 81 FR 95758, 95790. Although the capacity of medium-temperature models measured at high-temperature freezer application temperatures is commonly reported in product literature, energy use levels are not.[13]

Issue 2: DOE requests comment on (1) whether there are medium-temperature refrigeration system models that are used exclusively in high temperature freezers, and (2) if a medium-temperature refrigeration system is efficient for cooler applications, will it also be efficient for use in high-temperature freezer applications. To the extent available, DOE requests data on dedicated condensing unit energy efficiency ratio ("EER") at both high-temperature freezer and medium-temperature refrigeration operation.

See section II.C.2.a for more discussion on high-temperature freezers.

[13] Product literature showing capacity measurements of medium-temperature models used in high-temperature freezer applications from two manufacturers can be found at *www.regulations.gov* Docket No. EERE-2017-BT-STD-0009-0003 and Docket No. EERE-2017-BT-STD-0009-0004.

3. Single-Package Refrigeration Systems

Single-package refrigeration systems are considered a type of dedicated condensing refrigeration system. 81 FR 95758, 95763. Many single-package systems are constructed in such a way that the entire refrigeration system is located outside of the refrigerated space; the package is typically mounted either on top of, or directly adjacent to the walk-in enclosure. Due to this construction, single-package systems may experience additional thermal losses not observed in split systems. Specifically, single-package systems circulate air through a "cold section" (evaporator, fan(s), and internal ducting) that may have exterior surfaces exposed to the warm air outside of the walk-in enclosure and/or the warm condensing unit side of the refrigeration system. This configuration can lead to conduction and/or infiltration thermal losses which represent a reduction in net capacity and efficiency.

As discussed in the June 2021 TP RFI, DOE is considering whether test procedure modifications are necessary to more appropriately address the conduction and/or infiltration thermal losses for single-package systems. 86 FR 32332, 32343-32344. To the extent that these losses are accounted for in the test procedure, technology options that mitigate such losses would reduce energy consumption and increase AWEF. Given the differences in construction between single-package and split systems and the potential for differentiated design options, DOE intends to separately evaluate single-package system representative units in its engineering and downstream analyses.

Issue 3: DOE requests data and information on the impact of single-package system design limitations on efficiency and how single-package systems differ from split systems. DOE additionally requests information showing the trend of efficiency as a function of capacity for single-package refrigeration systems.

See section II.C.2.a for more discussion on single-package refrigeration systems.

4. Wine Cellar Refrigeration Systems

As discussed in the June 2021 TP RFI, DOE has received requests for waiver and interim waiver from several manufacturers from the test procedure in Appendix C for walk-in wine cellar refrigeration systems. 86 FR 32332, 32344-32346. These systems are typically designed to provide a cold environment at a temperature range between 45 – 65 °F with 50 – 70 percent relative humidity ("RH"), and typically are kept at 55 °F and 55 percent RH.

The wine cellar refrigeration systems addressed in waiver petitions are sold as single-package systems, matched-pair systems, and unit cooler-only systems. The minimum capacity of available wine cellar refrigeration systems is lower than that of other walk-in cooler units (e.g., capacity can be as low as 1,100 Btu/h[14] as compared with 4,200 Btu/h for the lowest-capacity medium-temperature dedicated condensing unit currently listed in the DOE Compliance Certification Management System ("CCMS")

[14] Product literature for a wine cellar refrigeration system with a capacity of 1,130 Btu/h from one manufacturer can be found at *www.regulations.gov* Docket No. EERE-2017-BT-STD-0009-0005.

database).[15] One manufacturer, Vinotheque, has noted that there are size constraints for wine cellar refrigeration systems. 86 FR 11961, 11972 (March 1, 2021). Additionally, certain wine cellar units can be ducted as an option – either on the condensing unit side, the evaporator side, or both – for greater installation flexibility. This factor increases fan energy use. Compressors that are typically available for use in lower-capacity wine cellar refrigeration systems are of a "hermetic reciprocating" design,[16] which generally has a lower efficiency than the larger-capacity compressors used for low- and medium-temperature walk-in refrigeration systems. Finally, as discussed previously, single-package wine cellar systems are also subject to additional thermal losses. DOE intends to conduct a separate analysis for wine cellar refrigeration systems in its engineering and downstream analyses.

Issue 4: DOE seeks information on how trends in wine cellar installations (*e.g.,* commercial vs. residential, square footage, etc.) are expected to impact the type of refrigeration system (*i.e.,* single-package, matched-pair, dedicated condensing unit, or unit cooler system) used in wine cellars over the next 5 to

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[15] U.S. Department of Energy's Compliance Certification Database, *www.regulations.doe.gov/certification-data/CCMS-4-Walk-In_Coolers_and_Freezers_-_Refrigeration_Systems.html#q=Product_Group_s%3A%22Walk-In%20Coolers%20and%20Freezers%20-%20Refrigeration%20Systems%22*, Last Accessed: February 2, 2021.

[16] In a "hermetic" compressor, the compressor and motor are both contained in a single outer welded steel shell. Reciprocating compressors have a piston that slides back and forth in a cylinder. Refrigerant gas is drawn in through a suction valve as the piston moves away from the cylinder head, increasing the internal volume, and is compressed and discharged through a discharge valve as the piston returns. "Hermetic reciprocating" compressors are hermetically sealed with a reciprocating function.

10 years. Additionally, DOE requests information and data on the extent to which capacity may impact the efficiency of wine cellar refrigeration systems.

B. Significant Savings of Energy

As part of the rulemaking process, DOE conducts an energy use analysis to identify how a given equipment type is used, and thereby determine the energy savings potential of energy efficiency improvements.

The energy use analysis estimates the annual energy consumption of refrigeration systems (dedicated condensing systems and unit coolers) serving walk-ins, and the energy consumption, and losses, that can be directly ascribed to the selected components of the WICF envelopes (doors and panels). These estimates are used in the subsequent consumer, and National Impacts Analysis.

The estimates for the annual energy consumption of each analyzed representative refrigeration system were derived assuming that (1) the refrigeration system is sized such that it follows a specific daily duty cycle for a given number of hours per day at full-rated capacity, and (2) the refrigeration system produces no additional refrigeration effect for the remaining period of the 24-hour cycle. These assumptions are consistent with the present industry practice for sizing refrigeration systems. This methodology assumes that the refrigeration system is correctly paired with an envelope (*e.g.*, panels, door, etc.) that generates a load profile such that the rated hourly capacity of the paired refrigeration system, operated for the given number of run hours per day, produces sufficient refrigeration to meet the daily refrigeration load of the envelope with a safety margin to meet contingency situations. Thus, the annual energy consumption estimates for the refrigeration system depend on the methodology adopted for sizing, including implied assumptions and the extent of oversizing.

While DOE is particularly interested in comment, information, and data on the following issues, this request for information is not strictly limited to them.

1. Duty-Cycles and Typical Run Hours

For both the June 2014 ECS final rule and July 2017 ECS final rule analyses, DOE used nominal daily run-times of 16 hours for coolers, and 18 hours for freezers to estimate the in-field energy use of walk-in refrigeration systems.[17] These run-times assume a capacity for a "perfectly"-sized refrigeration system at specified reference ambient temperatures of 95 °F and 90 °F for refrigeration systems with outdoor and indoor dedicated condensing units, respectively. 79 FR 32050, 32083 and 82 FR 31808, 31842. Nominal run-time hours for coolers and freezers were adjusted to account for equipment over-sizing safety margins and capacity mismatch factors (see section II.B.2.

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[17] This methodology differs from the run-times established in DOE's test procedure, which assumes a high-load period of 8 hours corresponding to frequent door openings, equipment loading events, and other design load factors, and a low-load period for the remaining 16 hours. In the June 2014 ECS final rule analyses, DOE concluded that these duty cycle assumptions should not be used for sizing purposes because they may not represent the average conditions for WICF refrigeration systems for all applications under all conditions. 79 FR 32050, 32083. These assumptions were maintained in the July 2017 ECS final rule. 82 FR 31808, 31842. DOE also notes that while 16 and 18 hours were assumed for coolers and freezers, respectively, these assumptions may not be appropriate for wine cellars, for which test procedure waiver alternate test procedures were established based on an expectation that typical operating time is 50 percent. (See: *www.energy.gov/eere/buildings/current-test-procedure-waivers#walk-ins* for the list of all waivers to test procedures that DOE has granted for walk-in coolers and freezers)

of this document). They were further adjusted to account for the change in net capacity from increased efficiency projected to occur in the standards case, and, in the case of outdoor equipment, variations in ambient temperature.[18] As discussed in the prior section, single-package refrigeration systems, high-temperature freezers, and wine cellars may have different run-times or be subject to different assumptions regarding sizing and ambient temperatures.

Issue 5: DOE seeks input and data as to the daily run-time hours, sizing practice, and ambient conditions for the following: single-package refrigeration systems, high-temperature freezers, and wine cellars described in sections II.A.2 through II.A.4 of this document. DOE also requests information and data regarding any other aspects of the operation of such equipment that would influence run-time hours.

In its analysis supporting the June 2014 ECS final rule, DOE used the percent time off ("PTO") value defined in the test procedure and engineering analysis to adjust the nominal direct electrical energy usage attributed to the anti-sweat heater (in kilowatt-hours per day ("kWh/day")). The PTO values were applied as set forth in section 4.4.2(2) of appendix A to subpart R of 10 CFR part 431: 75 percent for anti-sweat heaters with timers, control systems, or other demand-based controls in cooler doors, and 50 percent for anti-sweat heaters with timers, control systems, or other demand-based

[18] See Chapter 6 of the Technical Support Document ("TSD") for the July 2017 ECS final rule. Docket EERE-2015-BT-STD-0016-0099.

controls in freezer doors. DOE is aware that some manufacturers design and market display doors for high-humidity cooler applications.[19]

Issue 6: DOE seeks input and data on the appropriate PTO values for display doors that would be exposed to higher levels of humidity. Specifically, DOE requests information on high-humidity walk-in cooler doors, including the range of typical installation conditions (e.g., relative humidity throughout the year in store). DOE also requests data on the average amount of time per day or per year that anti-sweat heaters with timers, control systems, or demand-based controls[20] are operating at their full power and partial power (if applicable) for walk-in cooler display doors marketed for high-humidity applications.

2. Oversizing Factors

In both the June 2014 ECS final rule and July 2017 ECS final rule, DOE assumed that WICF refrigeration condensing systems and unit coolers in the field are sized to account for a "worst case scenario" need for refrigeration to prevent food spoilage, and as such are oversized by a safety margin. 79 FR 32050, 32083 and 82 FR 31808, 31842. DOE found that it is customary in the industry to add a 10 percent safety margin to the aggregate 24-hour load, resulting in 10 percent oversizing of the refrigeration system. *Id.*

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[19] Product data sheets from two manufacturers that produce walk-in cooler display doors marketed for high-humidity applications can be found at *www.regulations.gov,* Docket No. EERE-2017-BT-STD-0009-0006 and EERE-2017-BT-STD-0009-0007.

[20] For anti-sweat heaters, demand-based controls monitor humidity and temperature external to the walk-in and regulate anti-sweat heater wire use on demand.

Additionally, DOE recognized that an exact match for the calculated refrigeration system capacity may not be available for the refrigeration systems available in the market because most refrigeration systems are produced in discrete capacities. To account for this situation, DOE applied a capacity mismatch factor of 10 percent to capture the inability to perfectly match the calculated WICF capacity with the capacity available in the market. 79 FR 32050, 32084 and 82 FR 31808, 31842. The combined safety margin factor and capacity mismatch factor result in a total oversizing factor of 1.2. With the oversize factor applied, the nominal run-time hours of the refrigeration system are reduced to 13.3 hours from 16 hours per day for coolers, and to 15 hours from 18 hours per day for freezers at their respective full design point capacity. 79 FR 32050, 32083 and 82 FR 31808, 31842.

Issue 7: DOE seeks input on whether the combined safety and capacity mismatch oversizing factors for adjusting daily nominal run-time hours relied on in the June 2014 ECS final rule and the July 2017 ECS final rule are appropriate for single-package refrigeration systems, high-temperature freezers, and wine cellars as described in sections II.A.2 through II.A.4 of this document. If different factors would be appropriate for such equipment, DOE requests data in support of alternate assumptions.

3. Base-Case Efficiency Distribution

DOE measures savings of potential standards relative to a "no-new-standards" case that reflects conditions without new and/or amended standards. The no-new-standards case reflects the distribution of equipment efficiency or energy use beginning at the baseline performance level. The baseline performance level in each equipment class represents the characteristics of common or typical equipment in that class. If there is an established DOE energy conservation standard for the class, the baseline performance level coincides with the current minimum energy conservation standard and provides basic end-user utility. However, not all models in an equipment class may be rated at the baseline performance level. DOE uses efficiency market shares to characterize the no-new-standards case equipment mix. By accounting for consumers who already purchase more-efficient equipment, DOE avoids overstating the potential benefits from potential standards.

In the July 2017 ECS final rule, DOE assumed that 100 percent of WICF refrigeration equipment is sold at the baseline efficiency level in the absence of new and/or amended standards. (Docket No. EERE–2015–BT–STD–0016, Public Meeting, No. 68 at pp. 53–54) These assumptions did not include medium-temperature condensing systems (which were not within the scope of that rulemaking). Medium-temperature condensing systems were included in the June 2014 ECS final rule where DOE assumed that 75 percent of shipments were baseline equipment, with the remaining 25 percent at the efficiency of the first design option above baseline. 79 FR 32050, 32087. DOE understands that these assumptions may not reflect the current state of the market due to adoption of more stringent efficiency standards.

Next, DOE examined the ratings for walk-in refrigeration systems reported in DOE's CCMS.[21] The number of models at or above the current standards are shown in Table II.4. These data show the count of models distributed in commerce with their respective efficiency ratings; however, these data do not indicate the volume of shipments of each model.

Table II.4: Distribution of Efficiencies for Refrigeration Systems

Equipment Class	Count of Models	Count of Models at Baseline	Percent of Models at Baseline
UC.L	3899	1618	41%
DC.L.O	1780	1438	81%
DC.L.I	877	825	94%
UC.M	5228	3222	62%
DC.M.O	2722	2057	76%
DC.M.I	1145	956	83%

In the June 2014 ECS final rule DOE assumed that: (1) all panels and non-display door shipments were at the baseline; (2) 25 percent of display low-temperature door shipments were at the baseline, with the remaining 75 percent at a higher efficiency (45 percent were assumed to have light emitting diode ("LED") lighting, corresponding to the first design option above the baseline in the engineering analysis, and 30 percent were assumed to have LED lighting plus anti-sweat heater wire controls, corresponding to the second design option above the baseline); and (3) 80 percent of medium-temperature

[21] Please see footnote 15.

display doors shipments were at baseline and the remaining 20 percent would have LED lighting, corresponding to the first design option above the baseline for low-temperature display doors. 79 FR 32050, 32087. DOE understands that these assumptions may not reflect the current state of the market due to adoption of more stringent efficiency standards.

Next, DOE examined the ratings for walk-in doors and panels reported in the CCMS. The number of models at or above the current standards are shown in Table II.5.[22] Again, these data show the count of models distributed in commerce with their respective efficiency ratings; however, these data do not indicate the volume of shipments of each model.

Table II.5: Distribution of Efficiencies for Panels and Doors

Equipment Class	Count of Models	Count of Models at Baseline	Percent of Models at Baseline
DD.M	2861	2785	97%
DD.L	1213	1108	91%
PD.M	1872	334	18%
PD.F	1124	604	54%
FD.M	631	0	0%
FD.L	274	95	35%
SP.M	87	14	16%
SP.L	98	50	51%
FP.L	77	13	17%

[22] U. S. Department of Energy's Compliance Certification Database, *www.regulations.doe.gov/certification-data/CCMS-4-Walk-In_Coolers_and_Freezers_-_Doors.html#q=Product_Group_s%3A%22Walk-In%20Coolers%20and%20Freezers%20-%20Doors%22*; and *www.regulations.doe.gov/certification-data/CCMS-4-Walk-In_Coolers_and_Freezers_-_Panels.html#q=Product_Group_s%3A%22Walk-In%20Coolers%20and%20Freezers%20-%20Panels%22*, Last Accessed: March 17, 2021.

Issue 8: DOE seeks data and information regarding the current, and projected future market shares of WICF equipment by efficiency level (e.g., expressed in terms of increments of 10 percent improvement in AWEF, R-values, and kWh/day for refrigeration systems, panels, and doors, respectively, above or below the existing standards in 10 CFR 431.306) to establish market trends in equipment efficiency over time. DOE also seeks information on how the current regulatory environment has affected the market share of WICF equipment by efficiency rating.

C. Technological Feasibility

During the June 2014 ECS final rule and July 2017 ECS final rule, DOE considered a number of technologies for reducing walk-in cooler and freezer energy consumption.[23] DOE is interested in understanding any technology improvements for walk-in doors, panels, and refrigeration systems since the previous energy standards rulemaking. Additionally, DOE is interested in any changes to the technologies it evaluated in the rulemakings for the June 2014 ECS final rule and July 2017 ECS final rule that may affect whether DOE could propose a "no-new-standards" determination,

[23] For a complete list of technology options analyzed during the June 2014 and July 2017 ECS final rules, see chapter 3 of "TSD" for each rulemaking. Docket EERE-2008-BT-STD-0015-0131 (June 2014) and Docket EERE-2015-BT-STD-0016-0099 (July 2017).

such as an insignificant increase in the range of efficiencies and performance characteristics of these technologies.

While DOE is particularly interested in comment, information, and data on the following issues, this request for information is not strictly limited to them.

1. Doors and Panels

a. Technology Options

A complete list of options evaluated in preparation for the June 2014 ECS final rule and explained in the TSD are listed in Table II.6 for doors and Table II.7 for panels.[24] Table II.8 lists additional technology options that DOE may consider in a future WICF energy conservation standard.

Table II.6 Technology Options Considered for WICF Doors from the June 2014 ECS Final Rule

Component	Technology Options
Display Doors	Non-electric anti-sweat systems
	Anti-sweat heater wire controls
	Removal of heater wire
	High-efficiency lighting
	Lighting sensors
	Occupancy sensors
	Automatic insulation deployment systems
	Enhanced glass systems
Non-Display Doors	Increased insulation thickness
	Improved insulation material

[24] See sections 3.3.3 to 3.3.6 at pp. 3-26 to 3-30 of the TSD for the June 2014 ECS final rule. Docket EERE-2008-BT-STD-0015-0131.

	Improved framing materials
	Heater wire controls
	Enhanced glass systems

Table II.7 Technology Options Considered for WICF Panels from the June 2014 ECS Final Rule

Component	Technology Options
Panels	Increased insulation thickness
	Improved insulation material

Table II.8 Potential New Technology Options for WICF Doors

Component	Technology Options
Display and Non-Display Doors	Vacuum insulated glass

Walk-in doors typically use anti-sweat heater wires to prevent (1) condensation from collecting on the glass, frame, or any other portion of the door, which can puddle and be hazardous to consumers, (2) fogging of the glass, and (3) the collecting of condensation that may lead to doors freezing shut. DOE has observed that anti-sweat heater wires for display doors may be placed within the door rail surrounding the glass pack and/or within the surrounding frame. For display doors, display panels, and non-display doors with viewing windows, as the thermal performance of the glass pack improves, the amount of anti-sweat heat required for the glass pack decreases. With a more insulative glass pack, there is a smaller temperature difference between the interior and exterior faces of the glass and the interior walk-in and exterior air temperatures, resulting in less condensation on the glass. As mentioned in the TSD for the June 2014

ECS final rule, DOE based the amount of anti-sweat heater wire energy consumption on the glass packs selected.[25] If a frame does not contain a thermal break or has poor insulative properties, despite having a glass pack with better insulative performance, the door assembly may still require more anti-sweat heat on the surrounding frame to prevent the condensation and fogging issues noted earlier.

Issue 9: DOE seeks information on how the physical construction of a display door, including the glass pack and the frame, impact the amount of anti-sweat heater wire power needed to prevent condensation accumulating on any part of the door. Specifically, DOE seeks quantitative data, if available, on the change in anti-sweat heater power (1) with a specific change in door frame design but no change in glass pack design, (2) with a specific change in glass pack design but no change in door frame design, and/or (3) with specific changes to the entire assembly. If there are specific design choices which are more costly but result in less or no anti-sweat heat, DOE requests cost data based on the capability of the door to prevent condensation from forming and the respective design options chosen. DOE also requests comment on any other considerations which may impact the use and power of anti-sweat heaters.

As stated previously, DOE is aware that some manufacturers design and market display doors for high-humidity applications. These doors generally have anti-sweat

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[25] See section 5.5.2.3 at p. 5-19 of the TSD for the June 2014 ECS final rule. Docket EERE-2008-BT-STD-0015-0131.

heaters with higher rated power than those of standard medium-temperature display doors but lower than the power required for low-temperature display doors. For example, data from the CCMS database show that doors marketed for high-humidity applications have a range of anti-sweat heater power per door opening area from 0.39 to 5.59 watt (“W”) / square foot (“ft^2”), with the average being 1.66 W/ft^2. By comparison, the range of anti-sweat heater power is between 0 to 3.74 W/ft^2 for cooler doors not marketed for high-humidity applications made by the manufacturers who also produce doors marketed for high-humidity applications, with the average being 1.01 W/ft^2.

Issue 10: DOE seeks specific data and information on the correlation between relative humidity conditions at installation and the anti-sweat heater power needed to prevent condensation from accumulating on a walk-in door.

DOE is also aware that walk-in display door manufacturers may produce glass doors for other kinds of refrigeration equipment. DOE has specifically observed that some glass doors for commercial refrigeration equipment, while appearing very similar in design to their walk-in door counterparts, do not include any anti-sweat heaters around the door or frame.

Issue 11: DOE requests comment on the differences in design, typical conditions, and usage of a walk-in display door as compared to a display door for commercial refrigeration equipment which result in commercial refrigeration equipment door designs with no anti-sweat heaters.

Non-display doors (passage and freight doors) typically have better insulative properties than display doors because they have little or no glass needed for viewing purposes. Door insulation is also subject to a minimum R-value. 10 CFR 431.306(a)(3). DOE expects that less anti-sweat heat may be needed to prevent condensation accumulation for non-display doors because of their improved overall resistance to heat flow as compared to display doors. Certified data from DOE's CCMS database,[26] presented in Table II.9, shows that passage and freight doors have lower average anti-sweat heater power per area of door opening than display doors and a higher percentage of passage and freight doors certify 0 W/ft^2 of anti-sweat heater power per area of door opening than display doors. However, the maximum anti-sweat heater power per area of door opening for low-temperature passage and freight doors is higher than the average for these equipment classes, and the maximum for these equipment classes is also higher than the maximum for low-temperature display doors.

Table II.9: Certified ranges of anti-sweat heater power per area of door opening for each walk-in door equipment class

	Display Door, Medium Temperature	Display Door, Low Temperature	Passage Door, Medium Temperature	Passage Door, Low Temperature	Freight Door, Medium Temperature	Freight Door, Low Temperature
Minimum (W/ft^2)	0.00	0.00	0.00	0.00	0.00	0.00
Maximum (W/ft^2)	5.59	5.39	6.80	7.08	3.40	7.00
Average (W/ft^2)	1.37	2.99	0.42	1.15	0.11	0.16
Percent of Models without Anti-sweat Heat	5%	3%	60%	46%	63%	77%

[26] Please see footnote 22.

Issue 12: DOE seeks specific data and information on how the physical construction of both passage and freight doors impact the amount of anti-sweat heater wire power needed to prevent condensation accumulation on any part of the door. DOE requests specific comment on any technologies that may reduce or eliminate the need for anti-sweat heat on passage or freight doors. DOE also requests door design information and data that explain why many passage and freight doors are able to perform without any anti-sweat heater power in the field but some doors, specifically low-temperature passage and freight doors, still require anti-sweat power that is greater than that required for display doors to prevent condensation accumulation.

As stated previously, DOE may consider technology options for walk-in doors that were not considered in the June 2014 ECS final rule, specifically vacuum-insulated glass packs for display doors and windows in non-display doors. DOE has identified two manufacturers that produce display doors with vacuum-insulated glass packs.[27]

Issue 13: DOE requests comment on the prevalence of vacuum-insulated glass for walk-in doors and whether other manufacturers are considering adopting this technology. DOE requests specific feedback on any obstacles or concerns (e.g., patents, proprietary use, durability, practicability to manufacture, etc.)

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[27] Product data sheets from two manufacturers that produce display doors with vacuum-insulated glass can be found at *www.regulations.gov,* Docket No. EERE-2017-BT-STD-0009-0008 and Docket No. EERE-2017-BT-STD-0009-0009.

which would prevent manufacturers from using vacuum-insulated glass in walk-in doors. DOE also requests cost data for implementing vacuum-insulated glass in walk-in display doors.

b. Screening of Technology Options

Table II.10 lists the technology options that DOE screened out for walk-in doors and panels in the TSD for the June 2014 ECS final rule and the applicable screening criteria.[28]

Table II.10 Doors and Panels Technology Options Screened from the June 2014 ECS Final Rule

	EPCA Criteria (X = Basis for Screening Out)				
Screened Technology Option	**Technological Feasibility**	**Practicability to Manufacture, Install, and Service**	**Adverse Impact on Product Utility**	**Adverse Impacts on Health and Safety**	**Unique-Pathway Proprietary Technologies**
Non-electric anti-sweat systems	X				
Automatic insulation deployment systems	X				
Insulation thicker than 6 inches		X	X		

Issue 14: DOE requests feedback on what impact, if any, DOE's screening criteria (technological feasibility; practicability to manufacture, install, and service; adverse impacts on product utility or product availability; adverse impacts on

[28] See section 4.3 at p. 4-5 of the TSD for the June 2014 ECS final rule. Docket EERE-2008-BT-STD-0015-0131.

health or safety; and unique-pathway proprietary technologies) would have on each of the technology options listed in Table II.6, Table II.7, and Table II.8 of this document. DOE also seeks information regarding how these same criteria would affect any other technology options not already identified in this document with respect to their potential use in walk-in doors and panels.

For the 2014 ECS final rule analyses, DOE screened out insulation thickness greater than six inches for panels and doors due to concerns about panels and doors becoming extremely heavy and unwieldy, long cure times for the insulation, and reduced space within the walk-in to store product.[29] DOE has identified one manufacturer that markets panels with a thickness range from 2-inches to 10-inches.[30]

Issue 15: DOE requests comment on whether 6 inches is an appropriate upper limit for screening out insulation thickness for panels and doors. For manufacturers that produce and certify panels with insulation thicknesses exceeding 6 inches, DOE requests feedback on what manufacturing investments have been made to do so. For manufacturers that do not produce panels with insulation thicknesses exceeding 6 inches, DOE requests feedback on the obstacles preventing them from increasing panel thickness.

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[29] See section 4.3.5 at p. 4-5 of the TSD for the June 2014 ECS final rule. Docket EERE-2008-BT-STD-0015-0131.

[30] Technical data from one manufacturer that produces panels ranging from 2-inches to 10-inches thick can be found at *www.regulations.gov,* Docket No. EERE-2017-BT-STD-0009-0010.

c. Representative Units

In the June 2014 ECS final rule, DOE analyzed representative walk-in cooler and freezer doors and panels. 79 FR 32050, 32072-37073. The representative walk-in doors are presented in Table II.11.

Table II.11 Representative Walk-in Doors Evaluated in June 2014 ECS Final Rule*

Utility	Temperature	Representative Unit Size	Dimensions (height × length, ft)	Window Area (ft^2) for Non-Display Doors
Display Door	Cooler	Small	5.25 × 2.25	-
		Medium	6.25 × 2.25	-
		Large	7 × 3	-
	Freezer	Small	5.25 × 2.25	-
		Medium	6.25 × 2.25	-
		Large	7 × 3	-
Passage Door	Cooler	Small	6.5 × 2.5	2.25
		Medium	7 × 3	2.25
		Large	7.5 × 4	2.25
	Freezer	Small	6.5 × 2.5	2.25
		Medium	7 × 3	2.25
		Large	7.5 × 4	2.25
Freight Door	Cooler	Small	8 × 5	2.25
		Medium	9 × 7	4.00
		Large	12 × 7	4.00
	Freezer	Small	8 × 5	2.25
		Medium	9 × 7	4.00
		Large	12 × 7	4.00

*See section 5.3.1 at p. 5-3 of the TSD for the June 2014 ECS final rule, Docket EERE-2008-BT-STD-0015-0131.

For the 2014 ECS final rule, DOE only analyzed single-width display doors as representative units in the engineering analysis. However, many display doors are sold as multi-door configurations with 2-, 3-, 4-, or 5-door openings encapsulated within one outer frame. The relationship of energy use for a single-width display door may not linearly extrapolate for multi-door configurations. For example, a single-width door may include two light fixtures, one on each side of the door opening, whereas additional doors may add one light fixture per door opening. Thus, a single-width door of equal area to a double-width door would use less lighting power than the double-width door, despite being equal in area.

Issue 16: DOE requests feedback on the representative units for display doors used for the 2014 ECS final rule engineering analysis and whether multi-door configurations should be included as representative units. If so, DOE seeks comment on panel size and the number of panels that would be most representative for multi-door configurations. Additionally, DOE seeks specific data on the appropriate number of door openings and door sizes to consider and the additional electrical component power (e.g., anti-sweat heater power, lighting, etc.) required for each additional door opening. DOE is also interested in any other differences between single-door and multi-door configurations that would impact energy use.

In the June 2021 TP RFI, DOE requested feedback on the current definitions of passage and freight doors and whether there were any attributes, including size, which distinguish them from each other. 86 FR 32332, 32335.

Issue 17: DOE seeks comment on the appropriateness of the representative units chosen for the previous analysis of passage and freight doors. DOE requests specific feedback on what the minimum and maximum sizes of both passage and freight doors are and if there are other attributes besides size which differentiate passage doors from freight doors and vice versa.

As discussed in the June 2021 TP RFI, DOE received multiple test procedure waivers requesting to increase the percent time off ("PTO") for motorized walk-in door openers. 86 FR 32332, 32338. In the engineering analysis for the June 2014 ECS final rule, the representative units of walk-in doors analyzed did not include motorized door openers. DOE is considering whether motorized door openers should be considered in its representative models.

Issue 18: DOE seeks comment on the prevalence of motorized door openers for both display and non-display doors. DOE requests specific feedback on the prevalence of motorized door openers by equipment class, the minimum door size that might have a motorized door opener, the percentage of doors sold which typically include a motorized door opener, and any data relating power of a motorized door opener to door size.

2. Refrigeration Systems

a. Technology Options

A complete list of technology options evaluated for refrigeration systems in preparation for the June 2014 ECS final rule and July 2017 ECS final rule is presented in

Table II.12.[31] Table II.13 lists additional technology options that DOE may consider in a future WICF energy conservation standard.

Table II.12 Technology Options Considered for WICF Refrigeration Systems in the June 2014 ECS Final Rule and July 2017 ECS Final Rule

Component	Technology Options
Refrigeration Systems	Energy storage systems
	Refrigeration system override
	Automatic evaporator fan shut-off
	Improved evaporator and condenser fan blades
	Improved evaporator and condenser coils
	Evaporator fan control
	Ambient sub-cooling
	Higher-efficiency fan motors
	Higher-efficiency compressors
	Variable-speed compressors
	Liquid suction heat exchanger
	Adaptive Defrost
	Hot gas defrost
	Floating head pressure
	Condenser fan control
	Economizer cooling

Table II.13 Potential New Technology Options for WICF Refrigeration Systems

Component	Technology Options
Refrigeration Systems	Improved Thermal Insulation

[31] See sections 3.3.1 and 3.3.7-3.3.10 at pp. 3-24 through 3-25 and 3-30 through 3-33 of the TSD for the June 2014 ECS final rule. Docket EERE-2008-BT-STD-0015-0131. See section 3.3 at pp. 3-14 through 3-18 of the TSD for the July 2017 ECS final rule. Docket EERE-2015-BT-STD-0016-0099.

	Crankcase Heater Controls
	Refrigerant

As discussed in sections II.A.2, II.A.3, and II.A.4 of this document, DOE is interested specifically in high-temperature freezers, single-package refrigeration systems, and wine cellar refrigeration systems and how their particular applications may influence the use of the technology options listed in Table II.12 and Table II.13 of this document.

Issue 19: DOE requests comment on whether there are technology options or other design features that would be unique to high-temperature freezer refrigeration systems (i.e., medium-temperature systems operating at a temperature between 10°F to 32°F) as compared to technology options or design features for medium-temperature refrigeration systems operating at above-freezing (cooler) temperatures. If high-temperature freezer refrigeration systems have certain unique features, DOE seeks information on those features and how they impact refrigeration system performance.

As discussed in section II.A.3 and II.A.4 of this document, single-package and wine cellar refrigeration systems have structural designs different from other walk-in split systems. Due to differences in design, DOE expects that the design options for these products may be different from dedicated condensing units and unit coolers sold separately.

Issue 20: DOE requests comment on which of the technology options listed in Table II.12 and Table II.13 of this document are available and used in single-package refrigeration systems. DOE also requests comment on whether there are other technologies that apply to single-package refrigeration systems not mentioned in Table II.12 or Table II.13 of this document. Additionally, DOE requests comment on which technology options are feasible for dedicated condensing systems and unit coolers but may not be feasible for single-packaged refrigeration systems due to structural design constraints.

Issue 21: DOE requests comment on which of the technology options listed in Table II.12 and Table II.13 of this document are available and used in wine cellar refrigeration systems. DOE also seeks information on whether there are additional technologies that apply to wine cellar refrigeration systems that are not mentioned in Table II.12 or Table II.13 of this document. Additionally, DOE requests comment on the specific design constraints for wine cellar refrigeration systems and how these constraints may impact the use of certain technology options.

In the July 2017 ECS final rule, DOE considered and ultimately screened out improved compressor technology options, such as multiple-capacity or variable-capacity compressors. 82 FR 31808, 31839. The current DOE test procedure does not allow testing of multiple-capacity or variable-capacity systems using the condenser-alone rating method. Although the test procedure does have provisions for testing multiple-capacity and variable-capacity matched-pair refrigeration systems, DOE did not analyze matched-pair systems in the engineering analysis and thus did not further consider this option. 82 FR 31808, 31839. DOE requested information and comment on testing multiple-capacity and variable-capacity compressors in the June 2021 TP RFI. 86 FR 32332, 32348-32349.

Issue 22: DOE seeks information on the availability of multiple-capacity or variable-capacity compressors in the current market. DOE is also interested in any end-user requirements that may restrict the use of, or reduce the potential benefits of, multi- or variable-capacity compressors in the field.

In the July 2017 ECS final rule, DOE evaluated scroll compressors for smaller capacity systems (capacities between 6,000 Btu/h and 25,000 Btu/h) and semi-hermetic compressors for larger capacity systems (capacities between 25,000 Btu/h and 72,000 Btu/h). 82 FR 31808, 31837-31838. For most evaluated representative capacities, DOE assigned the expected compressor type and did not evaluate compressor type as a design option. (At the 25,000 Btu/h overlap representative capacity, DOE applied a blended analysis, but also did not consider compressor type as a design option for efficiency improvement.) However, DOE is aware that some compressor types are more efficient than others. For example, a preliminary evaluation of DOE's CCMS database indicates that for those reported models with an AWEF value higher than the minimum standard, low-temperature dedicated condensing units (less than 25,000 Btu/h) with semi-hermetic compressors have reported AWEF values six percent, on average, higher than similar units that use a scroll compressor. DOE is interested in understanding how manufacturers select compressors when designing their equipment and the utility advantages and disadvantages of scroll versus semi-hermetic compressors over a range of capacities for which both compressors types could be considered.

Issue 23: DOE requests comment on the relative efficiency difference between scroll and semi-hermetic compressors in the range of capacities in which both are available. DOE also requests comment on other design parameters that would lead a manufacturer to select a certain compressor design over another and would represent potential utility differences of different compressor designs, specifically, (1) compressor weight relative to the final equipment weight and its impact on equipment shipping, installation, and end-use; (2) compressor durability, equipment warranty, and equipment lifetime; and (3) any other relevant differences.

DOE is also interested in understanding if other higher efficiency single-capacity compressors have become available for use in walk-in systems since the last rulemaking. For instance, DOE is interested in information on whether some compressors are more efficient than others at certain walk-in capacity ranges or operating conditions..

Issue 24: DOE seeks information on the availability and efficiencies of single-speed compressors (*e.g.*, scroll compressors, rotary compressors, semi-hermetic compressors) that were not available or were not considered in the analysis during the rulemaking finalized in 2017. Additionally, DOE is interested in understanding the availability of rotary compressors for use in single-package and wine cellar refrigeration systems.

As shown in Table II.13 of this document, DOE is investigating crankcase heater controls to understand how they are used in, and the field requirements for, outdoor walk-in refrigeration systems. There are several types of crankcase heater control systems that are available on the market for other types of equipment, specifically, central air conditioners and heat pumps ("CACs"). The technical support document from the direct final rule amending standards for CACs published on January 6, 2017 ("CAC 2017 direct final rule") provides descriptions of different crankcase heater control systems.[32] Thermostatically-controlled crankcase heaters adjust whether the heater is on or off based on a temperature sensor that measures outdoor ambient air. When the outside ambient temperature is high enough the heater turns off, thus reducing energy use. (*Id*.). Self-regulating crankcase heaters have control systems that vary the resistivity as a function of temperature, thus providing "internal" thermostatic control to reduce energy use. (*Id*.) In its testing, DOE has observed that some walk-in refrigeration systems have the crankcase heater energized 100 percent of the time including when the compressor is operating, without demand-based controls. DOE is considering whether crankcase heater control technology might be applied to WICF refrigeration systems to improve efficiency.

[32] See sections 3.4.1 at p. 3-34 of the TSD for the CAC 2014 direct final rule. Docket EERE-2014-BT-STD-0048-0098. The docket and supporting materials for the CAC 2017 direct final rule can be accessed at *www.regulations.gov/docket/EERE-2014-BT-STD-0048*.

Issue 25: DOE seeks comment on the prevalence of the use of crankcase heater controls for walk-in refrigeration systems. Additionally, DOE requests information on what type of crankcase heater controls are considered viable, and what application circumstances would make certain control approaches inappropriate *e.g.*, by unacceptably increasing the chance of compressor failure.

As discussed in section II.A.3 of this document, single-package refrigeration systems are susceptible to thermal losses associated with the structural design. Table II.13 lists thermal insulation as a potential technology option for these systems. Improved thermal insulation may reduce conduction losses, and better sealing of cabinet air leaks may reduce infiltration of warm outdoor air.

Issue 26: DOE seeks information on the potential for improved thermal insulation and sealing of air leaks to improve the efficiency of single-package refrigeration systems. Specifically, DOE is interested in data on the range of typical insulation thickness used in single-package systems to insulate the indoor portion, in addition to the insulation materials that are typically used. Additionally, DOE requests information on the processes and materials that manufacturers utilize to ensure airtight enclosures. DOE is also interested in understanding the quality control processes manufacturers have in place to ensure that airtight units are released to the market.

Evaluation of outdoor dedicated condensing units in DOE's CCMS database[33] indicate that 86 percent of medium-temperature and 91 percent of low-temperature models are offered with R-404A, R-407A, R-448A/R-449A, or R-507A. R-448A/R-449A has low Global Warming Potential ("GWP") compared to R-407A, which in turn has lower GWP than R-404A and R-507A. The remaining medium- and low-temperature condensing unit models are offered with R-407C, R-407F, and R-52A. Additionally, DOE is aware that wine cellar walk-in refrigeration systems are currently offered with R-134A.

In past rulemakings, DOE has conducted its walk-in refrigeration system engineering analysis using a single refrigerant – using R-404A for the June 2014 ECS final rule and using R-407A for the July 2017 ECS final rule. 79 FR 32050, 32073-32074 and 82 FR 31808, 31835-31836. However, for basic models certified with an AWEF value higher than the minimum standard in DOE's CCMS database, DOE observes that some refrigerants provide efficiency advantages over others for products with similar rated capacities. For instance, between certified capacities of 13,500 Btu/h and 16,500 Btu/h, one low-temperature condensing unit basic model was certified with a reported AWEF range from 3.5 to 3.87 and from 3.49 to 4.43 with R-407A and R-448A/R-449A, respectively.

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[33] Please see footnote 15.

Issue 27: DOE requests comment and data to support whether it should include refrigerant as a design option in its engineering analysis for walk-in refrigeration systems. DOE also requests information on the availability and relative utility of R-452A, R-407C, and R-407F compared to R-407A and R-448A/R-449A for use in walk-in dedicated condensing units and single-package systems. Additionally, DOE is interested in understanding the availability and relative utility of R-450A, R-513A/R-513B, and R-515A compared to R-134A for wine cellar walk-in refrigeration systems. DOE is also interested in understanding what domestic and international activities may be driving trends in the market adoption of low GWP refrigerants.

In addition to evaluating low GWP refrigerants, DOE is investigating the potential use of non-traditional refrigerants, such as hydrocarbon refrigerants.

Issue 28: DOE requests information on the availability of specific non-traditional (e.g. hydrocarbon) refrigerants for use in dedicated condensing unit, unit cooler, single-package, and wine cellar walk-in refrigeration systems. DOE is interested in understanding what domestic and international activities may be driving trends in market adoption of non-traditional (e.g. hydrocarbon) refrigerants. DOE also seeks comment on whether and how the availability of higher-efficiency compressors might be impacted by the use of non-traditional (e.g. hydrocarbon) refrigerants. DOE requests information on whether charge limits or safety standards (*e.g.,* standards issued by Underwriter's Laboratory) would restrict the use of non-traditional (e.g. hydrocarbon) refrigerants in walk-in refrigeration systems. Finally, DOE requests comment on any additional design changes or safety measures that may be necessary for WICFs to incorporate non-traditional (e.g. hydrocarbon) refrigerants.

In its supporting analysis to the June 2014 ECS final rule, DOE evaluated evaporator coils with either 4 or 6 fins per inch for both low- and medium-temperature unit coolers.[34] For the July 2017 ECS final rule, DOE's engineering analysis included evaporator coils with 4 fins per inch for low-temperature and 6 fins per inch for medium-temperature unit coolers.[35] An evaluation of DOE's CCMS database[36] indicates a minimum of 4 fins per inch and a maximum of 8 fins per inch for both low-temperature and medium-temperature units, with higher certified AWEF values for models with a higher number of fins per inch. Roughly 65 percent of low-temperature models have more than 4 fins per inch, while about 10 percent of medium-temperature models have more than 6 fins per inch.

Issue 29: DOE seeks comment on if 4 fins per inch and 6 fins per inch for low- and medium-temperature unit coolers, respectively, are still appropriate to use in its

[34] See Table 5.3.5 of the TSD for the June 2014 ECS final rule. Docket EERE-2008-BT-STD-0015-0131.

[35] See Table 5.3.2 of the TSD for the July 2017 ECS final rule. Docket EERE-2015-BT-STD-0016-0099.

[36] Please see footnote 15.

engineering analysis given the number of certified models at each operating temperature that do not meet these specifications – and if not, which fin configuration(s) should DOE use for its analysis? DOE also requests information and data on the potential impact on defrost frequency and/or daily energy use contributions for low-temperature unit coolers with more than 4 fins per inch and for medium-temperature unit coolers with more than 6 fins per inch used in high-temperature freezer applications (i.e. freezers with an interior temperature range from 10 °F to 32 °F). Finally, DOE requests comment on whether the number of fins per inch would be different for medium-temperature unit coolers used for medium-temperature versus high-temperature freezer applications. If the number of fins per inch would differ, DOE seeks data to support a representative number of fins per inch for medium-temperature unit coolers used in high-temperature freezer applications.

b. Screening of Technology Options

Table II.14 summarizes the refrigeration system technology options that DOE did not include in its analysis in the June 2014 ECS final rule and July 2017 ECS final rule, and the applicable screening criteria.

Table II.14 Refrigeration Systems Technology Options Screened from the June 2014 ECS Final Rule and/or July 2017 ECS Final Rule

	EPCA Criteria				
Screened Technology Option	**Technological Feasibility**	**Practicability to Manufacture, Install, and Service**	**Adverse Impact on Product Utility**	**Adverse Impacts on Health and Safety**	**Other Reasons for not Considering the Technology**
Liquid suction heat exchangers					X*
Refrigeration system override					X*
Economizer cooling					X*
Automatic evaporator fan shut-off					X*
Energy storage systems	X				
High efficiency evaporator fan motor	X				
3-Phase motors			X		
Improved evaporator coil			X		
Variable-capacity compressors					X†
Adaptive defrost					X*
On-cycle variable-speed evaporator fans					X*
Hot gas defrost					X*

*DOE screened out these technology options because they do not affect energy consumption as measured by the current DOE test procedure. (Docket EERE-2008-BT-STD-0015-0131, Section 4.2 at pp. 4-3 through 4-4; EERE-2015-BT-STD-0016-0099, Section 4.2 at pp. 4-2 through 4-4)

† DOE screened out variable-capacity compressors (a subset of higher-efficiency compressors) because the current DOE test procedure does not include a method for assessing variable-capacity dedicated condensing units tested without a matched unit cooler (see 10 CFR 431.304). 82 FR 31808, 31839.

Issue 30: DOE requests feedback on what impact, if any, DOE's screening criteria (technological feasibility; practicability to manufacture, install, and service; adverse impacts on product utility or product availability; adverse impacts on health or safety; and unique-pathway proprietary technologies) would have on each of the technology options listed in Table II.12 or Table II.13 of this document. Similarly, DOE seeks information regarding how these same criteria would affect any other technology options not already identified in this document with respect to their potential use in walk-in refrigeration systems.

The current test procedure includes a method to address systems with adaptive defrost. Section 3.3.5 of appendix C to subpart R of 10 CFR part 431. As provided in the DOE test procedure, adaptive defrost is not included in the determination of AWEF to demonstrate compliance but a manufacturer may voluntarily account for a unit's improved performance with adaptive defrost activated in its market representations. *Id*. As discussed in the June 2021 TP RFI, an adaptive system with a long period (*i.e.,* when too much frost builds up on the coils) between defrosts may significantly affect the on-cycle performance of the refrigeration system; however, a system that defrosts frequently could increase defrost energy use. 86 FR 32332, 32348. DOE recognizes the potential efficiency advantage offered by adaptive defrost and is considering how best to incorporate adaptive defrost into its analysis.

In a future rulemaking, DOE may consider allowing walk-in refrigeration systems with adaptive defrost to continue to qualitatively represent improved efficiency performance solely for marketing purposes and not for demonstrating compliance with the current standards. Adaptive defrost could also be used to demonstrate compliance with energy conservation standards. DOE could also include adaptive defrost in its analysis for setting new energy conservation standards; however, DOE would need to determine whether adaptive defrost would be included in the engineering analysis for dedicated condensing unit or for unit coolers (since DOE's analysis is based on a single component).

Issue 31: DOE requests stakeholder feedback on how to address adaptive defrost in a future rulemaking. Specifically, DOE is interested in data that support whether DOE should continue to screen adaptive defrost from its engineering analysis, and if not, DOE is interested in understanding whether adaptive defrost functionality and cost burden should be included in its analysis of dedicated condensing units or in its analysis of unit coolers. DOE additionally requests comment on how the screening results summarized in Table II.14 may have changed for adaptive defrost, such that the approaches used in the prior rulemaking analyses may no longer be appropriate.

DOE removed hot gas defrost as a design option in its analysis for the July 2017 ECS final rule. 82 FR 31808, 31834. Instead, DOE assigned to hot gas defrost unit coolers the same default values for electric defrost heat and energy use calculations that the test procedure assigns to dedicated condensing units that are not matched with a unit cooler for testing (*i.e.,* tested alone). 81 FR 95758, 95774-95777, *see also* section 3.5 of appendix C to subpart R of 10 CFR part 431. In a test procedure final rule published on March 26, 2021 ("March 2021 TP final rule"), DOE updated the defrost energy use and thermal load equations for hot gas defrost unit coolers tested alone to provide a consistent performance evaluation between hot gas defrost and electric defrost unit coolers when tested alone. 86 FR 16027, 16030. However, this approach does not measure or account for actual hot gas defrost thermal load and energy use. 81 FR 95758, 95774-95777.

As discussed in the June 2021 TP RFI, defrost heat and energy values specific to hot gas defrost units are included in the most recent industry test method, "2020 Standard for Performance Rating of Walk-In Coolers and Freezers," ("AHRI 1250-2020"). 86 FR 32332, 32347. Similar to the current approach for adaptive defrost, DOE could allow walk-in refrigeration systems with hot gas defrost to qualitatively represent improved efficiency performance solely for marketing purposes and not for demonstrating compliance with the current standards. Hot gas defrost could also be used to demonstrate compliance with energy conservation standards. DOE could also include hot gas defrost as a design option in its analysis for setting new energy conservation standards.

Issue 32: DOE requests stakeholder feedback on how to address hot gas defrost in a future rulemaking. Specifically, DOE is interested in data that support whether DOE should continue to screen hot gas defrost from its engineering analysis, and if not, DOE is interested in understanding whether hot gas defrost functionality and cost burden should be included in its analysis of dedicated condensing units or in its analysis of unit coolers. DOE additionally requests comment on how the screening results presented in Table II.14 of this document have changed for hot gas defrost, such that the approaches used in the prior rulemaking analyses may no longer be appropriate.

c. Representative Units

In the June 2014 ECS final rule and July 2017 ECS final rule, DOE analyzed the representative refrigeration system capacities presented in Table II.15. 79 FR 32050, 37073 and 82 FR 31808, 31835. However, data retrieved from DOE's CCMS database[15] indicates that:

- For outdoor medium-temperature dedicated condensing units, 39 percent of certified units have a nominal capacity greater than 96,000 Btu/h and 19 percent of certified units have a capacity greater than 200,000 Btu/h;

- For low-temperature unit coolers, 48 percent of certified units have a rated capacity of greater than 40,000 Btu/h and 19 percent are rated at greater than 100,000 Btu/h;

- For medium-temperature unit coolers, 55 percent of certified units have a nominal capacity greater than 24,000 Btu/h, with 16 percent rated at greater than 100,000 Btu/h.

These data are based on a count of basic models submitted to the CCMS database and do not indicate the volume of shipments of each model.

Table II.15 Representative Refrigeration System Units Evaluated in the June 2014 and July 2017 ECS Final Rules

Equipment Class	Representative Unit Capacity (Btu/h)	Representative Unit Compressor Type	Associated Rulemaking
Dedicated Condensing, Medium, Indoor	6,000	Hermetic	June 2014 ECS final rule*
	6,000	Semi-hermetic	
	18,000	Hermetic	
	18,000	Scroll	
	18,000	Semi-hermetic	
	54,000	Scroll	
	54,000	Semi-hermetic	
	96,000	Scroll	
	96,000	Semi-hermetic	
Dedicated Condensing, Medium, Outdoor	6,000	Hermetic	
	6,000	Semi-hermetic	
	18,000	Hermetic	
	18,000	Scroll	
	18,000	Semi-hermetic	
	54,000	Scroll	
	54,000	Semi-hermetic	
	96,000	Scroll	
	96,000	Semi-hermetic	
Dedicated Condensing, Low, Indoor, <6,500 Btu/h	6,000	Scroll	July 2017 ECS final rule**
Dedicated Condensing, Low, Indoor, ≥6,500 Btu/h	9,000	Scroll	
	25,000	Scroll	
	25,000	Semi-hermetic	
	54,000	Semi-hermetic	
Dedicated Condensing, Low, Outdoor, <6,500 Btu/h	6,000	Scroll	
Dedicated Condensing, Low, Outdoor, ≥6,500 Btu/h	9,000	Scroll	
	25,000	Scroll	
	25,000	Semi-hermetic	
	54,000	Semi-hermetic	
	72,000	Semi-hermetic	
Unit Cooler, Medium	4,000	N/A	
	9,000	N/A	
	24,000	N/A	
Unit Cooler, Low, <15,500 Btu/h	4,000	N/A	
	9,000	N/A	
Unit Cooler, Low, ≥15,500 Btu/h	18,000	N/A	
	40,000	N/A	

* See section 5A.5 at pp. 5A-28 through 5A-45 of the TSD for the June 2014 ECS final rule, Docket EERE-2008-BT-STD-0015-0131.

** See section 5A.2 at pp. 5A-1 through 5A-18 of the TSD for the July 2017 ECS final rule, Docket EERE-2008-BT-STD-0015-0099.

Issue 33: DOE seeks comment on whether the representative minimum and maximum capacities listed in Table II.15 of this document are appropriate for walk-ins of 3,000 square feet or less. Specifically, DOE is interested in whether the highest capacities listed for each equipment class in Table II.15 of this document appropriately represent walk-ins within the scope of DOE's energy conservation standards (and/or sufficiently representative of models up to the largest capacities). If the highest capacities listed for each equipment class in Table II.15 of this document are not representative, DOE requests data and supporting information as to why they are not representative, and what appropriate maximum capacities for each equipment class would be.

Issue 34: DOE seeks comment on the appropriateness of the compressor types associated with each representative unit. Specifically, DOE seeks data on the respective ranges of refrigeration system capacities for which each compressor type (scroll, hermetic, and semi-hermetic) may realistically be used. Further, DOE seeks comment on if there are refrigeration system capacity ranges for which multiple types of compressors may be used.

DOE's initial research into single-package refrigeration systems indicates that capacities range between 1,900 Btu/h and 29,000 Btu/h, with most units less than 17,000 Btu/h. In order to conduct an engineering analysis for single-package refrigeration systems, DOE seeks information on the capacities of the most representative units on the market.

Issue 35: DOE requests comment on appropriate representative capacities for single-package refrigeration systems. Specifically, DOE requests data on the availability and prevalence of single-package units sized between 17,000 Btu/h and 29,000 Btu/h, and whether DOE should consider including a representative single-packaged refrigeration system with capacity in this range.

To conduct an engineering analysis for wine cellar refrigeration systems, DOE seeks information on the size and capacities of the most representative units on the market. DOE's initial research into wine cellar refrigeration systems indicates that the capacity for most single-package and matched-pair units ranges from 1,000 Btu/h to 18,000 Btu/h, with very few units between 13,000 Btu/h and 18,000 Btu/hr. Additionally, DOE received information from AHRI in 2019 listing capacity, AWEF, condenser fan power, and compressor type for wine cellar refrigeration systems.[37]

Issue 36: DOE requests comment on if the capacity, AWEF, condenser fan power, and compressor types provided by AHRI are representative of the market for single-package and matched-pair wine cellar refrigeration systems. DOE also seeks information on the availability and prevalence of wine cellar refrigeration systems between 13,000 and 18,000 Btu/h for walk-in wine cellars with a square footage of 3,000 square feet or less.

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[37] The AHRI Wine Cellar AWEF Technical Justification document containing the performance data of wine cellar refrigeration systems can be found at *www.regulations.gov* Docket No. EERE-2017-BT-STD-0009-0011.

D. Significant Savings of Energy

In determining whether a proposed energy conservation standard is economically justified, DOE analyzes, among other things, the potential economic impact on consumers, manufacturers, and the Nation. DOE seeks comment on whether there are economic barriers to the adoption of more stringent energy conservation standards. DOE also seeks comment and data on any other aspects of its economic justification analysis from the June 2014 ECS final rule and July 2017 ECS final rule that may indicate whether a more stringent energy conservation standard would be economically justified or cost effective.

While DOE is particularly interested in comment, information, and data on the following issues, this request for information is not strictly limited to them.

1. Markups Analysis—Distribution Channels

DOE derives customer prices based on manufacturer markups, retailer markups, distributor markups, contractor markups (where appropriate), and sales taxes. In deriving these markups, DOE determines the major distribution channels for product sales, the markup associated with each party in each distribution channel, and the existence and magnitude of differences between markups for baseline products ("baseline markups") and higher-efficiency products ("incremental markups"). The identified distribution channels (*i.e.*, how the products are distributed from the manufacturer to the consumer) and estimated relative sales volumes through each channel are used in generating end-user price inputs for the life-cycle cost ("LCC") analysis and national impact analysis ("NIA").

In the June 2014 ECS final rule and July 2017 ECS final rule, DOE defined the distribution channels for WICFs and estimated their respective shares of shipments as: (1) direct to customer sales, through national accounts or contractors; (2) refrigeration wholesalers to consumers; (3) Original Equipment Manufacturers ("OEM") to consumers—the OEM distribution channel primarily represents manufacturers of WICF refrigeration systems who may also install and sell entire WICF refrigeration units; (4) contractors who primarily install WICF envelope components (panels and doors); and (5) refrigeration equipment distributors of panels and non-display doors. WICF distribution channels evaluated in DOE's previous rulemakings are summarized in Table II.16.

Table II.16: Distribution Channels

Distribution Channel		Equipment Type			
		Dedicated Condensing Equipment	Unit Coolers	Panels and Non-display Doors	Display Doors
1	Direct (National Accounts)	3%	45%	49%	30%
2	Refrigeration Wholesalers	42%	45%		
3	OEM	55%	10%		70%
4	General Contractor			8%	
5	Equipment Distributor			43%	
	Total	100%	100%	100%	100%

Issue 37: DOE seeks comment on whether the distribution channels used in the June 2014 ECS final rule and July 2017 ECS final rule (as depicted in Table II.16) remain relevant today, and if not, DOE requests information on these channels as well as the existence of any additional channels that are used to distribute walk-in components into the market. Additionally, DOE requests comment on the appropriateness of these channels, and their respective fractions for the following equipment: display-panels, high-temperature freezers, single-package refrigeration systems, and wine cellars as described in sections II.A.1 through II.A.4 of this document.

2. Lifetime Analysis

The equipment lifetime is the age at which the equipment is retired from service. To reflect the uncertainty of equipment lifetimes the LCC analysis uses Weibull probability distributions for each equipment class. For the June 2014 ECS final rule and July 2017 ECS final rule DOE developed separate lifetime distributions for WICF envelope components and refrigeration system components. 79 FR 32050, 32086 and 82 FR 31808, 31846. The average values of these distributions are shown in Table II.17.

Table II.17 Estimated Average WICF Equipment Lifetimes (years)

Component	Average Lifetime (years)
Refrigeration Systems (condensing systems and unit coolers)	10.5
Non-display Doors (freight and passage doors)	6
Display Doors	12
Panels	12

Issue 38: DOE seeks comment on its estimated equipment lifetime for WICF refrigeration system and envelope components. Specifically, DOE requests data on appropriate average lifetimes that DOE's analyses should use for: display-panels, high-temperature freezers, single-package refrigeration systems, and wine cellars as described in sections II.A.1 through II.A.4 of this document.

3. Shipments Analysis

DOE develops shipments forecasts of walk-ins to calculate the national impacts of potential amended energy conservation standards on energy consumption, net present value ("NPV"), and future manufacturer cash flows.[38] DOE's shipments projections are based on available data broken out by equipment class, capacity, and efficiency. Current sales estimates allow for a more accurate model that captures recent trends in the market.

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[38] DOE uses data on manufacturer shipments as a proxy for national sales, as aggregate data on sales are not readily available for DOE to examine. In general, one would expect a close correspondence between shipments and sales in light of their direct relationship with each other.

The envelope component shipments model for panels and doors, and the refrigeration system shipments model for dedicated condensing systems and unit coolers, take an accounting approach, tracking market shares of each equipment class and the vintage of units in the existing stock over time. Stock accounting uses equipment shipments as inputs to estimate the age distribution of in-service equipment stocks for all the years covered under a potential revised standard. The age distribution of in-service equipment stocks is a key input to calculations of both the National Energy Savings ("NES") and NPV of a potential new standard because operating costs for any year depend on the age distribution of the stock.

DOE's shipments model of walk-in refrigeration systems and envelope components are driven by new purchases and stock replacements due to failures. Equipment failure rates are related to equipment lifetimes (see section II.D.2 of this document). In the analyses done for the June 2014 ECS final rule and July 2017 ECS final rule, DOE modeled projections for new equipment using the commercial building floor space growth rates of buildings classified as "*food sales*," "*food service*," and "*other*" from the Energy Information Administration's Annual Energy Outlook.[39] In both the June 2014 ECS final rule and July 2017 ECS final rule DOE assumed that the share

[39] See chapter 9, section 9.2 of the June 2014 ECS final rule TSD, available at: *www.regulations.gov/document/EERE-2008-BT-STD-0015-0131.* See chapter 9, section 9.3 of the July 2017 ECS final rule TSD, available at: *www.regulations.gov/document/EERE-2015-BT-STD-0016-0099.* For more information see: *www.eia.gov/outlooks/aeo/*.

of shipments for each equipment class and capacity would remain constant over time.[40] 82 FR 31808, 31847.

Previously, complete historical shipments data for walk-ins could not be obtained from any single source. Therefore, in the June 2014 ECS final rule DOE used data from multiple sources to estimate historical shipments. 79 FR 32050, 32088. For the July 2017 ECS final rule, DOE continued with the same sources of shipments described in the NOPR published on September 13, 2016. 81 FR 62980, 63012

Issue 39: DOE requests comment on its assumption that the market share of shipments for each equipment class would remain constant over time.

a. Dedicated Condensing Systems and Unit Coolers

For the July 2017 ECS final rule, DOE initialized its stock and shipments model for low-temperature dedicated condensing equipment and unit coolers based on shipments data provided by stakeholders.[41] 82 FR 31808, 31847. These data did not explicitly state the share of medium-temperature dedicated condensing units and were inferred from both the fraction of low-temperature dedicated condensing equipment for

[40] The assumption that shipments for each capacity of each equipment class would remain constant over time were not explicitly stated in either the Notice or the TSD of the June 2014 ECS final rule. However, the results for the shipments analysis, where this assumption is applied, can be reviewed in the final rule National Impacts Analyses (NIA) models for both refrigeration systems, panels, and doors.
For refrigeration systems: *www.regulations.gov/document/EERE-2008-BT-STD-0015-0135.* For panels and doors: *www.regulations.gov/document/EERE-2008-BT-STD-0015-0134*.

[41] *www.regulations.gov/document?D=EERE-2015-BT-STD-0016-0029*, WICF Refrigeration Equipment Shipment Data - 10212015

various applications, and from medium-temperature unit cooler shipments. Walk-in shipments data used in the July 2017 ECS final rule analysis are summarized in Table II.18.

Table II.18: Estimated Condensing System and Unit Cooler Shipments, 2020 (units)

	Equipment Class					
	DC.L.I	**DC.L.O**	**UC.L**	**DC.M.I**	**DC.M.O**	**UC.M**
Dedicated Condensing Unit Only	3,202	4,075		6,459	11,481	
Field Paired (Dedicated Condensing Systems and Unit Coolers)	14,943	19,019		30,141	53,586	
Unit Coolers Only (connected to Dedicated Condensing Units)			7,277			17,941
Unit Coolers Only (connected to Multiplexing Condensing Units)			11,635			20,459

These data showed that:

- 4 percent of shipments were manufacturer-matched dedicated condensing units and unit coolers (manufacturer matched-paired), and the remaining 96 percent were sold as individual dedicated condensing units or unit coolers that installers matched in the field (stand-alone, and field-paired);

- 82 percent of low-temperature unit coolers were paired with dedicated condensing systems, and the remaining 18 percent were paired with multiplex systems. With respect to medium-temperature unit coolers, 85 percent of these were paired with dedicated condensing systems while the remaining 15 percent were paired with multiplex systems; and

- 46 percent of low-temperature dedicated condensing systems were installed indoors with the remaining 54 percent installed outdoors. Among medium-temperature dedicated condensing systems, 36 percent of these were installed indoors with the remaining 64 percent installed outdoors.[42]

These shipments estimates are exclusive of single-package refrigeration systems, high-temperature freezers, and wine cellar refrigeration systems described in sections II.A.2 through II.A.4 of this document.

Issue 40: DOE seeks input from stakeholders on whether the shipments shown for low-temperature dedicated condensing equipment and unit coolers are still relevant. Further, DOE seeks data on the annual shipments of low-temperature single-package refrigeration systems (see section II.A.3 of this document) and the distribution of rated capacities as shown in Table II.15 of this document.

Issue 41: DOE seeks input from stakeholders on whether the shipments shown for medium-temperature condensing equipment and unit coolers reflect the state of the current market.

[42] See Chapter 9 of the TSD for the July 2017 ECS final rule. Docket EERE-2015-BT-STD-0016-0099.

Issue 42: DOE seeks data on the annual shipments of medium-temperature single-package refrigeration systems (see section II.A.3 of this document), high-temperature freezers (see section II.A.2 of this document) and wine cellar refrigeration systems (see section II.A.4 of this document) and the distribution of rated capacities of each (Btu/h). DOE also seeks data on the fraction of high-temperature freezers and wine cellar refrigeration systems that are sold as single-package, manufacturer matched-pair or split systems. Additionally, DOE requests data on the relative market size of refrigeration systems used in high temperature freezers compared to the refrigeration system market sizes for cooler applications (i.e., temperature greater than 32 ºF) and low-temperature (e.g., less than or equal to -10 °F) freezer applications.

b. Doors and Panels

For the July 2014 ECS final rule, DOE initialized its stock and shipments model for panels and doors based on the number of complete WICF units per unit of floor space area, per building of a given type and size having any WICF unit. These data were derived from the Commercial Buildings Energy Consumption Survey ("CBECS") 1999[43] and CBECS 2003.[44, 45]

These data show that 70 percent of panel shipments are medium-temperature, 23 percent are low-temperature wall panels, and the remaining 7 percent are low-temperature floor panels (in terms of ft^2 shipped). DOE's forecasted shipments for WICF panels in 2020 are shown in Table II.19 of this document. For the June 2014 ECS final rule, DOE did not include panels and non-display doors that were installed outdoors its analysis.

Table II.19: Estimated Panel Shipments, 2020 (million ft^2)

Utility	Temperature	Shipments (million ft^2)
Wall Panels	Medium	74
Wall Panels	Low	27
Floor Panels	Low	8

For display and non-display (freight and passage) doors, the CBECS data show that:

[43] U.S. Department of Energy–Energy Information Administration. Commercial Buildings Energy Consumption Survey 1999. Washington, DC

[44] U.S. Department of Energy–Energy Information Administration. Commercial Buildings Energy Consumption Survey 2003. Washington, DC

[45] See Chapter 9 TSD for the June 2014 ECS final rule. Docket EERE-2008-BT-STD-0015-0131.

- 92 percent of display doors shipments were medium-temperature with low-temperature making up the remaining 8 percent;

- 67 percent of passage doors shipments were medium-temperature and 33 percent were low-temperature; and

- 65 percent of freight doors shipments were medium-temperature and 35 percent were low-temperature.

DOE's forecasted shipments for WICF doors in 2020 are shown in Table II.20. For the June 2014 ECS final rule DOE assumed that all doors were installed indoors.

Table II.20: Estimated Door Shipments, 2020 (units)

Utility	Temperature	Shipments (units)
Display Door	Medium	325,869
Display Door	Low	26,751
Passage Door	Medium	328,103
Passage Door	Low	161,848
Freight Door	Medium	19,477
Freight Door	Low	10,529

These shipments estimates are exclusive of display panels described in section II.A.1 of this document.

Issue 43: DOE requests data on the fraction of low-temperature and medium-temperature panels that are installed outdoors versus indoors. Additionally, DOE requests data on the fraction of low-temperature and medium-temperature freight and passage doors that are installed outdoors versus indoors.

Issue 44: DOE seeks input from stakeholders on whether the shipments shown for panels and doors reflect the state of the current market. Further, DOE seeks data on the annual shipments, in terms of units shipped, of low-temperature and medium-temperature display panels described in section II.A.1 of this document.

Issue 45: DOE also requests specific information on high-humidity medium-temperature display door shipments (see section II.C.1.a of this document) and their fraction of annual display door shipments.

III. Submission of Comments

DOE invites all interested parties to submit in writing by the date under the **DATES** heading, comments and information on matters addressed in this notification and on other matters relevant to DOE's early assessment of whether more-stringent energy conservation standards are warranted for walk-in coolers and freezers.

Submitting comments via www.regulations.gov. The *www.regulations.gov* webpage requires you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. If this instruction is followed, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information ("CBI")). Comments submitted through *www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email. Comments and documents submitted via email also will be posted to *www.regulations.gov*. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. Faxes will not be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, written in English, and free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked "confidential" including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

DOE considers public participation to be a very important part of the process for developing test procedures and energy conservation standards. DOE actively encourages the participation and interaction of the public during the comment period in each stage of this process. Interactions with and between members of the public provide a balanced discussion of the issues and assist DOE in the process. Anyone who wishes to be added to the DOE mailing list to receive future notices and information about this process should contact Appliance and Equipment Standards Program staff at (202) 287-1445 or via e-mail at *ApplianceStandardsQuestions@ee.doe.gov*.

IV. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

Issue 1: DOE seeks information regarding the thermal transmission through display panels and design characteristics which would affect the thermal transmission, specifically, "glass pack" design and frame design. DOE also seeks information regarding the amount of direct electrical energy consumption of electricity-consuming devices sited on or within display panels, including the amount of anti-sweat heat required, if any. DOE additionally requests information on any specific design or use characteristics differentiating display panels from display doors.

Issue 2: DOE requests comment on (1) whether there are medium-temperature refrigeration system models that are used exclusively in high temperature freezers, and (2) if a medium-temperature refrigeration system is efficient for cooler applications, will it also be efficient for use in high-temperature freezer applications. To the extent available, DOE requests data on dedicated condensing unit energy efficiency ratio ("EER") at both high-temperature freezer and medium-temperature refrigeration operation.

Issue 3: DOE requests data and information on the impact of single-package system design limitations on efficiency and how single-package systems differ from split systems. DOE additionally requests information showing the trend of efficiency as a function of capacity for single-package refrigeration systems.

Issue 4: DOE seeks information on how trends in wine cellar installations (*e.g.,* commercial vs. residential, square footage, etc.) are expected to impact the type of refrigeration system (*i.e.,* single-package, matched-pair, dedicated condensing unit, or unit cooler system) used in wine cellars over the next 5 to 10 years. Additionally, DOE requests information and data on the extent to which capacity may impact the efficiency of wine cellar refrigeration systems.

Issue 5: DOE seeks input and data as to the daily run-time hours, sizing practice, and ambient conditions for the following: single-package refrigeration systems, high-temperature freezers, and wine cellars described in sections II.A.2 through II.A.4 of this document. DOE also requests information and data regarding any other aspects of the operation of such equipment that would influence run-time hours.

Issue 6: DOE seeks input and data on the appropriate PTO values for display doors that would be exposed to higher levels of humidity. Specifically, DOE requests information on high-humidity walk-in cooler doors, including the range of typical installation conditions (e.g., relative humidity throughout the year in store). DOE also requests data on the average amount of time per day or per year that anti-sweat heaters with timers, control systems, or demand-based controls are operating at their full power and partial power (if applicable) for walk-in cooler display doors marketed for high-humidity applications.

Issue 7: DOE seeks input on whether the combined safety and capacity mismatch oversizing factors for adjusting daily nominal run-time hours relied on in the June 2014 ECS final rule and the July 2017 ECS final rule are appropriate for single-package refrigeration systems, high-temperature freezers, and wine cellars as described in sections II.A.2 through II.A.4 of this document. If different factors would be appropriate for such equipment, DOE requests data in support of alternate assumptions.

Issue 8: DOE seeks data and information regarding the current, and projected future market shares of WICF equipment by efficiency level (e.g., expressed in terms of increments of 10 percent improvement in AWEF, R-values, and kWh/day for refrigeration systems, panels, and doors, respectively, above or below the existing standards in 10 CFR 431.306) to establish market trends in equipment efficiency over time. DOE also seeks information on how the current regulatory environment has affected the market share of WICF equipment by efficiency rating.

Issue 9: DOE seeks information on how the physical construction of a display door, including the glass pack and the frame, impact the amount of anti-sweat heater wire power needed to prevent condensation accumulating on any part of the door. Specifically, DOE seeks quantitative data, if available, on the change in anti-sweat heater power (1) with a specific change in door frame design but no change in glass pack design, (2) with a specific change in glass pack design but no change in door frame design, and/or (3) with specific changes to the entire assembly. If there are specific design choices which are more costly but result in less or no anti-sweat heat, DOE requests cost data based on the capability of the door to prevent condensation from forming and the respective design options chosen. DOE also requests comment on any other considerations which may impact the use and power of anti-sweat heaters.

Issue 10: DOE seeks specific data and information on the correlation between relative humidity conditions at installation and the anti-sweat heater power needed to prevent condensation from accumulating on a walk-in door.

Issue 11: DOE requests comment on the differences in design, typical conditions, and usage of a walk-in display door as compared to a display door for commercial refrigeration equipment which result in commercial refrigeration equipment door designs with no anti-sweat heaters.

Issue 12: DOE seeks specific data and information on how the physical construction of both passage and freight doors impact the amount of anti-sweat heater wire power needed to prevent condensation accumulation on any part of the door. DOE requests specific comment on any technologies that may reduce or eliminate the need for anti-sweat heat on passage or freight doors. DOE also requests door design information and data that explain why many passage and freight doors are able to perform without any anti-sweat heater power in the field but some doors, specifically low-temperature passage and freight doors, still require anti-sweat power that is greater than that required for display doors to prevent condensation accumulation.

Issue 13: DOE requests comment on the prevalence of vacuum-insulated glass for walk-in doors and whether other manufacturers are considering adopting this technology. DOE requests specific feedback on any obstacles or concerns (e.g., patents, proprietary use, durability, practicability to manufacture, etc.) which would prevent manufacturers from using vacuum-insulated glass in walk-in doors. DOE also requests cost data for implementing vacuum-insulated glass in walk-in display doors.

Issue 14: DOE requests feedback on what impact, if any, DOE's screening criteria (technological feasibility; practicability to manufacture, install, and service; adverse impacts on product utility or product availability; adverse impacts on health or safety; and unique-pathway proprietary technologies) would have on each of the technology options listed in Table II.6, Table II.7, and Table II.8 of this document. DOE also seeks information regarding how these same criteria would affect any other technology options not already identified in this document with respect to their potential use in walk-in doors and panels.

Issue 15: DOE requests comment on whether 6 inches is an appropriate upper limit for screening out insulation thickness for panels and doors. For manufacturers that produce and certify panels with insulation thicknesses exceeding 6 inches, DOE requests feedback on what manufacturing investments have been made to do so. For manufacturers that do not produce panels with insulation thicknesses exceeding 6 inches, DOE requests feedback on the obstacles preventing them from increasing panel thickness.

Issue 16: DOE requests feedback on the representative units for display doors used for the 2014 ECS final rule engineering analysis and whether multi-door configurations should be included as representative units. If so, DOE seeks comment on panel size and the number of panels that would be most representative for multi-door configurations. Additionally, DOE seeks specific data on the appropriate number of door openings and door sizes to consider and the additional electrical component power (e.g., anti-sweat heater power, lighting, etc.) required for each additional door opening. DOE is also interested in any other differences between single-door and multi-door configurations that would impact energy use.

Issue 17: DOE seeks comment on the appropriateness of the representative units chosen for the previous analysis of passage and freight doors. DOE requests specific feedback on what the minimum and maximum sizes of both passage and freight doors are and if there are other attributes besides size which differentiate passage doors from freight doors and vice versa.

Issue 18: DOE seeks comment on the prevalence of motorized door openers for both display and non-display doors. DOE requests specific feedback on the prevalence of motorized door openers by equipment class, the minimum door size that might have a motorized door opener, the percentage of doors sold which typically include a motorized door opener, and any data relating power of a motorized door opener to door size.

Issue 19: DOE requests comment on whether there are technology options or other design features that would be unique to high-temperature freezer refrigeration systems (i.e., medium-temperature systems operating at a temperature between 10°F to 32°F) as compared to technology options or design features for medium-temperature refrigeration systems operating at above-freezing (cooler) temperatures. If high-temperature freezer refrigeration systems have certain unique features, DOE seeks information on those features and how they impact refrigeration system performance.

Issue 20: DOE requests comment on which of the technology options listed in Table II.12 and Table II.13 of this document are available and used in single-package refrigeration systems. DOE also requests comment on whether there are other technologies that apply to single-package refrigeration systems not mentioned in Table II.12 or Table II.13 of this document. Additionally, DOE requests comment on which technology options are feasible for dedicated condensing systems and unit coolers but may not be feasible for single-packaged refrigeration systems due to structural design constraints.

Issue 21: DOE requests comment on which of the technology options listed in Table II.12 and Table II.13 of this document are available and used in wine cellar refrigeration systems. DOE also seeks information on whether there are additional technologies that apply to wine cellar refrigeration systems that are not mentioned in Table II.12 or Table II.13 of this document. Additionally, DOE requests comment on the specific design constraints for wine cellar refrigeration systems and how these constraints may impact the use of certain technology options.

Issue 22: DOE seeks information on the availability of multiple-capacity or variable-capacity compressors in the current market. DOE is also interested in any end-user requirements that may restrict the use of, or reduce the potential benefits of, multi- or variable-capacity compressors in the field.

Issue 23: DOE requests comment on the relative efficiency difference between scroll and semi-hermetic compressors in the range of capacities in which both are available. DOE also requests comment on other design parameters that would lead a manufacturer to select a certain compressor design over another and would represent potential utility differences of different compressor designs, specifically, (1) compressor weight relative to the final equipment weight and its impact on equipment shipping, installation, and end-use; (2) compressor durability, equipment warranty, and equipment lifetime; and (3) any other relevant differences.

Issue 24: DOE seeks information on the availability and efficiencies of single-speed compressors (*e.g.*, scroll compressors, rotary compressors, semi-hermetic compressors) that were not available or were not considered in the analysis during the rulemaking finalized in 2017. Additionally, DOE is interested in understanding the availability of rotary compressors for use in single-package and wine cellar refrigeration systems.

Issue 25: DOE seeks comment on the prevalence of the use of crankcase heater controls for walk-in refrigeration systems. Additionally, DOE requests information on what type of crankcase heater controls are considered viable, and what application circumstances would make certain control approaches inappropriate *e.g.*, by unacceptably increasing the chance of compressor failure.

Issue 26: DOE seeks information on the potential for improved thermal insulation and sealing of air leaks to improve the efficiency of single-package refrigeration systems. Specifically, DOE is interested in data on the range of typical insulation thickness used in single-package systems to insulate the indoor portion, in addition to the insulation materials that are typically used. Additionally, DOE requests information on the processes and materials that manufacturers utilize to ensure airtight enclosures. DOE is also interested in understanding the quality control processes manufacturers have in place to ensure that airtight units are released to the market.

Issue 27: DOE requests comment and data to support whether it should include refrigerant as a design option in its engineering analysis for walk-in refrigeration systems. DOE also requests information on the availability and relative utility of R-452A, R-407C, and R-407F compared to R-407A and R-448A/R-449A for use in walk-in dedicated condensing units and single-package systems. Additionally, DOE is interested in understanding the availability and relative utility of R-450A, R-513A/R-513B, and R-515A compared to R-134A for wine cellar walk-in refrigeration systems. DOE is also interested in understanding what domestic and international activities may be driving trends in the market adoption of low GWP refrigerants.

Issue 28: DOE requests information on the availability of specific non-traditional (e.g. hydrocarbon) refrigerants for use in dedicated condensing unit, unit cooler, single-package, and wine cellar walk-in refrigeration systems. DOE is interested in understanding what domestic and international activities may be driving trends in market adoption of non-traditional (e.g. hydrocarbon) refrigerants. DOE also seeks comment on whether and how the availability of higher-efficiency compressors might be impacted by the use of non-traditional (e.g. hydrocarbon) refrigerants. DOE requests information on whether charge limits or safety standards (*e.g.,* standards issued by Underwriter's Laboratory) would restrict the use of non-traditional (e.g. hydrocarbon) refrigerants in walk-in refrigeration systems. Finally, DOE requests comment on any additional design changes or safety measures that may be necessary for WICFs to incorporate non-traditional (e.g. hydrocarbon) refrigerants.

Issue 29: DOE seeks comment on if 4 fins per inch and 6 fins per inch for low- and medium-temperature unit coolers, respectively, are still appropriate to use in its engineering analysis given the number of certified models at each operating temperature that do not meet these specifications – and if not, which fin configuration(s) should DOE use for its analysis? DOE also requests information and data on the potential impact on defrost frequency and/or daily energy use contributions for low-temperature unit coolers with more than 4 fins per inch and for medium-temperature unit coolers with more than 6 fins per inch used in high-temperature freezer applications (i.e. freezers with an interior temperature range from 10 °F to 32 °F). Finally, DOE requests comment on whether the number of fins per inch would be different for medium-temperature unit coolers used for medium-temperature versus high-temperature freezer applications. If the number of fins per inch would differ, DOE seeks data to support a representative number of fins per inch for medium-temperature unit coolers used in high-temperature freezer applications.

Issue 30: DOE requests feedback on what impact, if any, DOE's screening criteria (technological feasibility; practicability to manufacture, install, and service; adverse impacts on product utility or product availability; adverse impacts on health or safety; and unique-pathway proprietary technologies) would have on each of the technology options listed in Table II.12 or Table II.13 of this document. Similarly, DOE seeks information regarding how these same criteria would affect any other technology options not already identified in this document with respect to their potential use in walk-in refrigeration systems.

Issue 31: DOE requests stakeholder feedback on how to address adaptive defrost in a future rulemaking. Specifically, DOE is interested in data that support whether DOE should continue to screen adaptive defrost from its engineering analysis, and if not, DOE is interested in understanding whether adaptive defrost functionality and cost burden should be included in its analysis of dedicated condensing units or in its analysis of unit coolers. DOE additionally requests comment on how the screening results summarized in Table II.14 may have changed for adaptive defrost, such that the approaches used in the prior rulemaking analyses may no longer be appropriate.

Issue 32: DOE requests stakeholder feedback on how to address hot gas defrost in a future rulemaking. Specifically, DOE is interested in data that support whether DOE should continue to screen hot gas defrost from its engineering analysis, and if not, DOE is interested in understanding whether hot gas defrost functionality and cost burden should be included in its analysis of dedicated condensing units or in its analysis of unit coolers. DOE additionally requests comment on how the screening results presented in Table II.14 of this document have changed for hot gas defrost, such that the approaches used in the prior rulemaking analyses may no longer be appropriate.

Issue 33: DOE seeks comment on whether the representative minimum and maximum capacities listed in Table II.15 of this document are appropriate for walk-ins of 3,000 square feet or less. Specifically, DOE is interested in whether the highest capacities listed for each equipment class in Table II.15 of this document appropriately represent walk-ins within the scope of DOE's energy conservation standards (and/or sufficiently representative of models up to the largest capacities). If the highest capacities listed for each equipment class in Table II.15 of this document are not representative, DOE requests data and supporting information as to why they are not representative, and what appropriate maximum capacities for each equipment class would be.

Issue 34: DOE seeks comment on the appropriateness of the compressor types associated with each representative unit. Specifically, DOE seeks data on the respective ranges of refrigeration system capacities for which each compressor type (scroll, hermetic, and semi-hermetic) may realistically be used. Further, DOE seeks comment on if there are refrigeration system capacity ranges for which multiple types of compressors may be used.

Issue 35: DOE requests comment on appropriate representative capacities for single-package refrigeration systems. Specifically, DOE requests data on the availability and prevalence of single-package units sized between 17,000 Btu/h and 29,000 Btu/h, and whether DOE should consider including a representative single-packaged refrigeration system with capacity in this range.

Issue 36: DOE requests comment on if the capacity, AWEF, condenser fan power, and compressor types provided by AHRI are representative of the market for single-package and matched-pair wine cellar refrigeration systems. DOE also seeks information on the availability and prevalence of wine cellar refrigeration systems between 13,000 and 18,000 Btu/h for walk-in wine cellars with a square footage of 3,000 square feet or less.

Issue 37: DOE seeks comment on whether the distribution channels used in the June 2014 ECS final rule and July 2017 ECS final rule (as depicted in Table II.16) remain relevant today, and if not, DOE requests information on these channels as well as the existence of any additional channels that are used to distribute walk-in components into the market. Additionally, DOE requests comment on the appropriateness of these channels, and their respective fractions for the following equipment: display-panels, high-temperature freezers, single-package refrigeration systems, and wine cellars as described in sections II.A.1 through II.A.4 of this document.

Issue 38: DOE seeks comment on its estimated equipment lifetime for WICF refrigeration system and envelope components. Specifically, DOE requests data on appropriate average lifetimes that DOE's analyses should use for: display-panels, high-temperature freezers, single-package refrigeration systems, and wine cellars as described in sections II.A.1 through II.A.4 of this document.

Issue 39: DOE requests comment on its assumption that the market share of shipments for each equipment class would remain constant over time.

Issue 40: DOE seeks input from stakeholders on whether the shipments shown for low-temperature dedicated condensing equipment and unit coolers are still relevant. Further, DOE seeks data on the annual shipments of low-temperature single-package refrigeration systems (see section II.A.3 of this document) and the distribution of rated capacities as shown in Table II.15 of this document.

Issue 41: DOE seeks input from stakeholders on whether the shipments shown for medium-temperature condensing equipment and unit coolers reflect the state of the current market.

Issue 42: DOE seeks data on the annual shipments of medium-temperature single-package refrigeration systems (see section II.A.3 of this document), high-temperature freezers (see section II.A.2 of this document) and wine cellar refrigeration systems (see section II.A.4 of this document) and the distribution of rated capacities of each (Btu/h). DOE also seeks data on the fraction of high-temperature freezers and wine cellar refrigeration systems that are sold as single-package, manufacturer matched-pair or split systems. Additionally, DOE requests data on the relative market size of refrigeration systems used in high temperature freezers compared to the refrigeration system market sizes for cooler applications (i.e., temperature greater than 32 ºF) and low-temperature (e.g., less than or equal to -10 °F) freezer applications.

Issue 43: DOE requests data on the fraction of low-temperature and medium-temperature panels that are installed outdoors versus indoors. Additionally, DOE requests data on the fraction of low-temperature and medium-temperature freight and passage doors that are installed outdoors versus indoors.

Issue 44: DOE seeks input from stakeholders on whether the shipments shown for panels and doors reflect the state of the current market. Further, DOE seeks data on the annual shipments, in terms of units shipped, of low-temperature and medium-temperature display panels described in section II.A.1 of this document.

Issue 45: DOE also requests specific information on high-humidity medium-temperature display door shipments (see section II.C.1.a of this document) and their fraction of annual display door shipments.

Signing Authority

This document of the Department of Energy was signed on July 7, 2021, by Kelly Speakes-Backman, Principal Deputy Assistant Secretary and Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the

Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, D.C., on July 7, 2021.

X Kelly Speakes-Backman

Digitally signed by Kelly Speakes-Backman
Date: 2021.07.07 20:55:55 -04'00'

Kelly Speakes-Backman
Principal Deputy Assistant Secretary and
Acting Assistant Secretary
Energy Efficiency and Renewable Energy