DOCKETED

Docket Number:	18-AAER-04
Project Title:	Portable Air Conditioners
TN #:	224969
Document Title:	California Investor Owned Utilities Comments Statewide CASE Team Analysis of Standards Proposal for Portable Air Conditioners
Description:	N/A
Filer:	System
Organization:	California Investor Owned Utilities
Submitter Role:	Public
Submission Date:	10/12/2018 11:59:03 AM
Docketed Date:	10/12/2018

Comment Received From: California Investor Owned Utilities
Submitted On: 10/12/2018
Docket Number: 18-AAER-04

Statewide CASE Team Analysis of Standards Proposal for Portable Air Conditioners

Additional submitted attachment is included below.

Portable Air Conditioners

Codes and Standards Enhancement (CASE) Initiative
For PY 2018: Title 20 Standards Development

Analysis of Standards Proposal for
Portable Air Conditioners
Docket # 18-AAER-04

October 12, 2018

Prepared for:

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This report was prepared by the California Statewide Investor-Owned Utilities Codes and Standards Program and funded by the California utility customers under the auspices of the California Public Utilities Commission.
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1. Purpose

The Codes and Standards Enhancement (CASE) initiative presents recommendations to support the California Energy Commission's (Energy Commission) efforts to update California's Appliance Efficiency Regulations (Title 20) to include new requirements or to upgrade existing requirements for various technologies. The California Investor-Owned Utilities (IOUs) including Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE) sponsored this effort (herein referred to as the Statewide CASE Team). The program goal is to prepare and submit proposals that will result in cost-effective enhancements to improve the energy and water efficiency of various products sold in California. This report and the code change proposal presented herein are a part of the effort to develop technical and cost-effectiveness information for potential appliance standards. This CASE Report covers a standard proposal for portable air conditioners (ACs).

2. Product/Technology Description

Portable ACs are portable, self-contained, refrigeration-based products used to remove sensible and latent heat from the ambient air in a single enclosed space (Burke et al. 2014). They are similar to, but do not include, packaged terminal ACs, room ACs, and dehumidifiers. Unlike packaged terminal ACs or room ACs, portable ACs are freestanding and are not installed in a wall or window. Like other ACs, portable ACs contain a compressor, evaporator, condenser, fan, and refrigerant system. As shown in Figure 1**,** consumer portable ACs typically have one or two hoses, or ducts used for air intake and/or rejection. Ductless portable ACs that reject heat directly into the room being cooled do exist, but they are generally termed "spot coolers" and are most often used for non-consumer (i.e., commercial or industrial) applications. According to a Lawrence Berkeley National Laboratory (LBNL) study that monitored portable ACs, the devices "generally have plastic enclosures, weigh 50 to 90 pounds, are between 28 and 36 inches tall, and are mounted on wheels to provide mobility" (Burke et al. 2014). Ducted consumer portable ACs typically operate on 120-volt, single-phase electric power, with cooling capacities ranging from 8,000 to 16,000 British Thermal Units per hour (Btu/h). Alternatively, ductless spot coolers often offer higher cooling capacities in excess of 16,000 Btu/h, and some larger units operate on 480-volt, three-phase power. In addition to cooling, portable ACs may offer secondary modes, such as dehumidification or heating (either as electric resistance heating or as a heat pump). Compared to other AC products, portable ACs are attractive due to their portability, aesthetic appeal, low cost relative to central ACs, and ease of installation.

Figure 1: Single-duct portable AC (left), dual-duct portable AC (middle), and ductless spot cooler (right).

Source: Left – LG Electronics; Middle – Sylvane; Right – Dryco.

2.1 Types of Portable ACs

Portable ACs operate by drawing in warm, humid air from a room, cooling (and dehumidifying) the air and returning it to the room, and rejecting warm, moist air to an area outside the room. Consumer portable ACs are used in residential and light commercial applications and consist of one or two ducts that connect to a window using an adjustable window mounting bracket (i.e., window kit) to allow for air intake and heat rejection.

The United States Department of Energy (U.S. DOE) defines portable AC products as follows (U.S. DOE 2015):

- "Single-duct portable air conditioner" means a portable AC that draws all of the condenser inlet air from the conditioned space without the means of a duct, and discharges the condenser outlet air outside the conditioned space through a single duct.
- "Dual-duct portable air conditioner" means a portable AC that draws some or all of the condenser inlet air from outside the conditioned space through a duct, and may draw additional condenser inlet air from the conditioned space. The condenser outlet air is discharged outside the conditioned space by means of a separate duct.
- "Spot cooler" means a portable AC that draws condenser inlet air from and discharges condenser outlet air to the conditioned space, and draws evaporator inlet air from and discharges evaporator outlet air to a localized zone within the conditioned space.

Single-duct units (see Figure 2) draw air from a room into the unit and emit cooled air back into the room, while rejecting heat and moisture to the outside via an outlet duct. Rejecting exhaust air outside without replacing all the room air drawn into the unit creates negative pressure within the room being cooled. U.S DOE found that this negative pressure contributes to increased air infiltration into the room from the rest of the building or the outside environment. Due to this infiltration air, single-duct portable ACs are typically less efficient than dual-duct units, which do not create as much negative pressure.[1]

[1] U.S. DOE 2016b

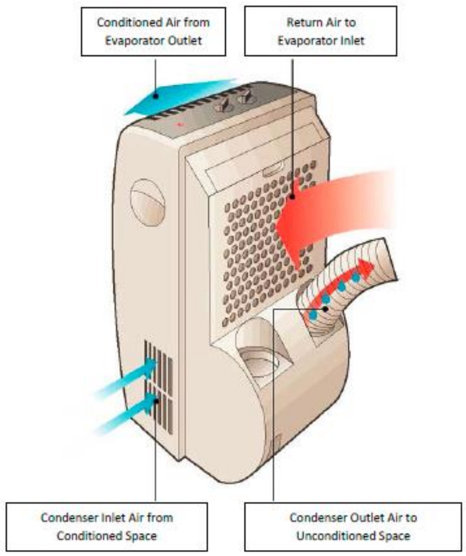

Figure 2: Single-duct portable AC operation.
Source: U.S. DOE 2016c, adapted from kingersons.com (Kingersons 2018).

In addition to the outlet duct for heat rejection, dual-duct portable AC units use another duct to draw outside air into the unit. The unit rejects heat to this outside air and then exhausts it using the outlet duct, allowing the air drawn into the unit from the room to be cooled and returned to the room without creating significant negative pressure. The additional air intake duct helps mitigate the negative pressure effect caused by single-duct portable ACs, making dual-duct units more efficient.

Spot coolers operate similarly to consumer portable ACs, but they usually feature tubes that can be directed to a particular location to provide cold, dry air to a small, targeted area. Heat is often rejected out of the unit directly back into the enclosed space being cooled, unless optional, custom ducting is used, thereby zeroing the net cooling effect within the room. Nevertheless, spot coolers effectively provide cooled air to a targeted area, which is especially useful in applications such as server rooms or industrial facilities where cooling may be needed for a specific machine or motor but isn't necessary for the whole space. Spot coolers are commonly available in capacities that exceed those used in consumer applications. According to U.S. DOE, "spot cooler shipments represent no more than approximately 1.5 percent of the total portable AC market in the United States, and…only about half of those shipments are for spot coolers with single-phase, 120-volt, and 60-hertz power supply requirements (the power supply appropriate for consumer products)" (U.S. DOE 2015).

2.2 Energy Use and Efficiency

2.2.1 Efficiency Definition

Portable AC manufacturers often report product energy efficiency ratio (EER) as a measure of product efficiency. The EER is the ratio of the product's cooling capacity (Btu/h) to its power input in watts (W). Higher EERs indicate that a product is more efficient. The Statewide CASE Team found a manufacturer-reported EER range of approximately 6.0 to 14.5 when reviewing commonly available portable ACs. Portable ACs are generally less efficient than other room ACs due to heat loss from the encasing or duct hoses, which are located within the conditioned space.

U.S. DOE has issued a test procedure for portable ACs (U.S. DOE 2016b) that measures product efficiency in terms of seasonally adjusted cooling capacity (SACC) and combined energy efficiency ratio (CEER). Like

EER, CEER compares a product's cooling capacity to its power input. However, instead of nominal cooling capacities reported by manufacturers, CEER uses the seasonally adjusted cooling capacity metric. The CEER metric represents the weighted average cooling capacity of a portable AC tested under standard test conditions: a high-temperature (95 °F dry-bulb and 75 °F wet-bulb) operating condition that represents peak usage and an expected average operating condition (83 °F dry-bulb and 67.5 °F wet-bulb) based on U.S. DOE's estimate of national average temperature during portable AC cooling hours. For the SACC calculation, the peak condition is weighted at 20 percent and the average condition is weighted at 80 percent, based on U.S. DOE analysis of the percentage of portable AC operating hours that would be associated with each rating condition using weather data from 44 representative states.

SACC is calculated in Equation 1 as follows (U.S. DOE 2016b):

Equation 1: Seasonally Adjusted Cooling Capacity (SACC) Calculation

$$SACC = (ACC_{95} \times 0.2) + (ACC_{83} \times 0.8)$$

Where:

- SACC is the seasonally adjusted cooling capacity, in Btu/h.
- ACC_{95} and ACC_{83} are the adjusted cooling capacities of the unit calculated at the 95 °F and 83 °F dry-bulb outdoor conditions, in Btu/h, respectively.
- 0.2 is the weighting factor for ACC_{95}.
- 0.8 is the weighting factor for ACC_{83}.

The CEER is calculated by dividing SACC by the portable AC unit power draw, assuming energy use is measured at standard test conditions and using standard hours of operation listed in Table 1:

Table 1: Standard Test Conditions and Hours of Operation for CEER Calculation

Operating mode	Annual operating hours
Cooling Mode, Dual-Duct 95 °F [a]	750
Cooling Mode, Dual-Duct 83 °F [a]	750
Cooling Mode, Single-Duct	750
Off-Cycle	880
Inactive or Off	1355

Source: U.S. DOE 2016b, Appendix CC.

[a] These operating mode hours are for the purposes of calculating annual energy consumption under different ambient conditions for dual-duct portable air conditioners and are not a division of the total cooling mode operating hours. The total dual-duct cooling mode operating hours are 750 hours.

The conditions at which energy use is measured for the CEER annual energy consumption calculation are in Table 2 (U.S. DOE 2016b).

Table 2: Evaporator (Indoor) and Condenser (Outdoor) Inlet Test Conditions

Test configuration	Evaporator inlet air, °F (°C)		Condenser inlet air, °F (°C)	
	Dry bulb	Wet bulb	Dry bulb	Wet bulb
3 (Dual-Duct, Condition A)	80 (26.7)	67 (19.4)	95 (35.0)	75 (23.9)
3 (Dual-Duct, Condition A)	80 (26.7)	67 (19.4)	83 (28.3)	67.5 (19.7)
5 (Single-Duct)	80 (26.7)	67 (19.4)	80 (26.7)	67 (19.4)

Source: U.S. DOE 2016b, Table 1.

The full calculation for CEER is shown in Equation 2 (U.S. DOE 2016b):

Equation 2: Combined Energy Efficiency Ratio (CEER) Calculation

$$CEER_{SD} = \left[\frac{(ACC_{95} \times 0.2 + ACC_{83} \times 0.8)}{\left(\frac{AEC_{SD} + AEC_{T}}{k \times t}\right)}\right]$$

$$CEER_{DD} = \left[\frac{ACC_{95}}{\left(\frac{AEC_{95} + AEC_{T}}{k \times t}\right)}\right] \times 0.2 + \left[\frac{ACC_{83}}{\left(\frac{AEC_{83} + AEC_{T}}{k \times t}\right)}\right] \times 0.8$$

Where:

- $CEER_{SD}$ and $CEER_{DD}$ = combined energy efficiency ratio for single-duct and dual-duct portable ACs, respectively, in Btu/Wh.
- ACC_{95} and ACC_{83} = adjusted cooling capacity, tested at the 95 °F and 83 °F dry-bulb outdoor conditions in Table 2, in Btu/h.
- AEC_{SD} = annual energy consumption in cooling mode for single-duct portable ACs, in kilowatt-hours per year (kWh/yr).
- AEC_{95} and AEC_{83} = annual energy consumption for the two cooling mode test conditions in Table 2 for dual-duct portable ACs, in kWh/yr.
- AEC_{T} = total annual energy consumption attributed to all modes except cooling, in kWh/yr.
- t = number of cooling mode hours per year (750 hours).
- k = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.
- 0.2 = weighting factor for the 95 °F dry-bulb outdoor condition test.
- 0.8 = weighting factor for the 83 °F dry-bulb outdoor condition test.

2.2.2 Relative Energy Use

U.S. DOE has established efficiency levels (ELs) categorizing portable AC average annual energy usage. These ELs and their corresponding average SACC, EER, CEER, and annual energy usage values are summarized in Table 3. These levels exemplify the expected relationship between SACC, EER, CEER and portable AC energy use, and they also demonstrate the potential range of performance for portable ACs. The table also includes Performance Ratio (PR) values for each EL calculated by U.S. DOE based on product testing. The PR is the ratio of the measured CEER of a unit to the nominal CEER for a given SACC that is determined by an empirical equation developed by U.S. DOE. The nominal CEER represents the generally expected CEER for a portable AC unit based on its SACC, as determined by U.S. DOE's comparison of performance across all portable ACs in its test sample. In the U.S. DOE framework, EL 0 represents the minimum PR observed in the test sample. EL 2 is the PR that corresponds to the maximum efficiency at which units were available across the full capacity range of portable ACs. EL 1 is an intermediate PR between EL 0 and EL 2. EL 3 is the PR for the single highest efficiency unit tested, and EL 4 is the theoretical maximum-achievable efficiency for all units modeled by U.S. DOE, assuming that they contain a number of efficiency improvements including: a 20 percent increase in heat exchanger area, more efficient blower motors, a high-EER variable-speed compressor, and low-standby-power electronic controls.

Table 3: Portable AC Characteristics and Annual Energy Use (AEU) by EL

EL	**PR**	**Avg. SACC** (Btu/h)	**Avg. EER** (Btu/Wh)	**Avg. CEER** (Btu/Wh)	**Residential AEU** (kWh)	**Commercial AEU** (kWh)	**Total AEU** [a] (kWh)
0	0.67	6,706	5.35	5.08	804	2015	964
1	0.85	6,764	6.05	5.94	719	1801	862
2	1.04	6,848	7.15	7.13	618	1547	741
3	1.18	6,888	8.48	8.46	523	1312	627
4	1.62	6,980	10.75	10.73	422	1055	505

Source: U.S. DOE 2016a,U.S. DOE 2016d

[a] Assumes that 87 % of installations are in residential settings, and 13 % are in commercial settings.

In 2016, U.S. DOE proposed but did not finalize energy conservation standards for portable ACs that would have required products to meet a minimum CEER corresponding to EL 2 in Table 3. The allowable CEER varies based on the SACC of the portable AC unit, and in general, lower-capacity units have a lower CEER requirement than larger-capacity units do because higher-capacity units typically achieve higher efficiencies. The formula by which U.S. DOE calculates the allowable minimum CEER for a portable AC unit of a given SACC is as follows (U.S. DOE 2016a):

Equation 3: Minimum Allowable CEER Calculation

$$\text{Minimum CEER (Btu/Wh)} = PR \times \frac{SACC}{3.7117 \times SACC^{0.6384}}$$

Where:

- SACC is the seasonally adjusted cooling capacity, in Btu/h.
- PR = 1.04, the PR corresponding to U.S. DOE EL 2.

Although U.S. DOE uses a PR of 1.04 in Equation 3 to correspond to products that meet EL 2, the equation can be used to define minimum allowable CEER requirements based on any PR in the range shown in Table 3.

3. Standards Proposal Overview

The analysis in this CASE Report draws from U.S. DOE rulemakings regarding portable AC test procedures and energy conservation standards, on which activity occurred between 2013 and 2016. The Statewide CASE Team proposes minimum allowable combined energy efficiency ratio (CEER) standards for single- and dual-duct portable ACs corresponding to EL 3, based on the U.S. DOE framework in Table 3. The Statewide CASE Team does not propose efficiency standards for spot coolers at this time but proposes that spot coolers continue to be tested and listed per the test procedure found in Title 20, Section 1604. Spot coolers were included in the U.S. DOE rulemaking, but neither a test procedure nor energy conservation standards for spot coolers were proposed in the rulemaking due to the low market share of these products. The Statewide CASE Team proposal is summarized in Table 4.

Table 4: Summary of Proposal

Topic	Description
Description of Standards Proposal/Framework of Roadmap	The Statewide CASE Team proposes requiring that single- and dual-duct portable ACs are tested using the test procedure in Section 4.3.2, and that they meet a minimum CEER corresponding to U.S. DOE's EL 3 (PR 1.18). The CEER is calculated based on product testing according to Equation 2. The minimum allowable CEER for a product of a given SACC is determined by Equation 3, where the PR equals 1.18.
Technical Feasibility	Product efficiency opportunities are described in Section 5.2. U.S. DOE found that the following options were most likely to be implemented to improve portable AC efficiency: increased heat exchange area, improved compressor efficiency, improved blower efficiency, and low standby power electronic controls. In their analysis, U.S. DOE identified at least one portable AC model that meets EL 3, and they determined that EL 2 could be met by existing portable AC models across a range of capacities.
Energy Savings and Demand Reduction	This proposal will yield 367 GWh/yr of energy savings and 510 MW of demand reduction after stock turnover in 2029.
Environmental Impacts and Benefits	This proposal will yield annual savings of about 7,340 metric tons of carbon dioxide equivalent ($MTCO_2e$) and approximately 71,270 $MTCO_2e$ after stock turnover in 2029.
Economic Analysis	This proposal will lead to significant cost savings for consumers with $55 million in first-year savings and a net present value (NPV) of $484 million after stock turnover in 2029.
Consumer Acceptance	From the consumer perspective, there is no notable difference in the utility of non-qualifying products and qualifying ducted portable ACs. Qualifying products have the same form factor and offer the same features as lower efficiency non-qualifying products.
Other Regulatory Considerations	This energy conservation standard, testing, and reporting requirement will not interfere with other local, state, or federal regulations. Spot coolers are already subject to a test and list requirement under Title 20.

Source: Statewide CASE Team.

4. Proposed Standards and Recommendations

4.1 Proposal Description

Portable ACs fulfill a useful niche for consumers in situations not well suited for other types of ACs. For example, they are useful in locations without adequate window or wall space for a room AC, in scenarios where cooling is only needed temporarily or on a seasonal basis, or where consumers plan to use the product in more than one location in the residence or facility over the lifetime of the product. However, due to inefficiencies in this product class—such as heat loss from the encasing or ducts directly into the enclosed space—a standard for portable ACs is needed to improve their efficiency.

Portable AC efficiency is a function of product capacity. Higher capacity units are generally more efficient, and this same relationship is true across all product classes. Therefore, the proposed efficiency standard level for a particular product depends on the capacity of the product. In their final rule on energy conservation standards for portable ACs, U.S. DOE proposed minimum CEER standard for portable ACs corresponding to EL 2 and a performance ratio of 1.04. U.S. DOE found that EL 3 was not cost-effective, primarily due to the increased burden on manufacturers and limited availability of qualified products across all capacities. Given California-specific market considerations, the Statewide CASE Team believes that U.S. DOE estimates were overly conservative in estimating what efficiency improvements could be applied to portable ACs. For example, due to lack of data on products currently utilizing alternative refrigerants, U.S. DOE did not consider potential efficiency improvements from switching from R-410A to R-32 or other alternative refrigerants. As noted in Section 5.6.2, this assumption is not necessarily realistic for California, and the use of alternative refrigerants could be a feasible (and likely) technical pathway for efficiency improvements in the California market. Additionally, although at the time of the U.S. DOE rulemaking, components such as high-efficiency compressors may not have been available across the full range of portable AC capacities, recent energy conservation standards for related products, such as standalone dehumidifiers and room ACs, may drive the increased production of these high-efficiency components across a wide range of capacities, making them available for portable AC manufacturing in the near future. During the U.S. DOE rulemaking, the Statewide CASE Team and other efficiency advocates highlighted additional considerations supporting the improvement of portable AC efficiencies to EL 3, and comment letters outlining these arguments can be found in Appendix C: California IOU Team Comment Letter from U.S. DOE Rulemaking and Appendix D: Efficiency Advocate Comment Letter from U.S. DOE Rulemaking. The Statewide CASE Team therefore proposes a Title 20 standard at EL 3 to maximize cost-effective energy and demand savings to California consumers. Single- and dual-duct portable ACs have not been subject to energy conservation standards in the past, necessitating a new section for this Title 20 standard. At this time, the Statewide CASE Team does not propose new standards for spot coolers, which are currently required to test-and-list performance under Title 20.

4.2 Proposal History

There are currently no state or federal standards in effect for portable ACs. As noted in Section 4.1, between 2013 and 2016, U.S. DOE rulemakings addressed a test procedure and energy conservation standards for portable ACs. U.S. DOE began collecting data for a test procedure for portable ACs in early 2014, and on June 1, 2016, a final test procedure for portable ACs was published in the Federal Register, making it the applicable test procedure for all single- and dual-duct portable AC testing in the future. In April 2016, U.S. DOE issued a final determination of coverage finding portable ACs as a covered consumer product under the Energy Policy and Conservation Act, making them subject to potential energy conservation standards. In June 2016, a notice of proposed rulemaking (NOPR) was issued that outlined

U.S. DOE's proposed product standard. After a comment period, the pre-publication final rule for portable ACs was issued in December 2016, but this rule was not published in the Federal Register.

Standards for single- and dual-duct portable ACs are not currently included in Title 20; however, Title 20 does contain a definition and test procedure for spot ACs.

4.3 Proposed Changes to the Title 20 Code Language

The proposed changes to the Title 20 standards are provided in Section 4.3.1. Changes to the 2017 standards are marked with underlining (new language) and ~~strikethroughs~~ (deletions).

4.3.1 Proposed Definitions

The Statewide CASE Team proposes that the Energy Commission use the definitions contained within the Code of Federal Regulations (10 C.F.R. §430.2):

Section 1601. Scope.

…

(   ) Single-duct portable air conditioners and dual-duct portable air conditioners.

…

Section 1602. Definitions.

…

(   ) "ANSI/AHAM PAC–1–2015" means the test standard published by the Association of Home Appliance Manufacturers, titled "Portable Air Conditioners," ANSI/AHAM PAC–1–2015.

(   ) "Combined energy efficiency ratio (CEER)" means a metric for representing the overall energy efficiency of single-duct and dual-duct portable air conditioners. CEER is a measure of the seasonally adjusted cooling capacity of a portable air conditioner divided by the weighted average annual energy consumption of the unit allocated over the unit's annual cooling mode hours, expressed in Btu/Wh, as determined using the applicable test method Section in 1604( ).

(   ) "Cooling mode" means a mode in which a portable air conditioner has activated the main cooling function according to the thermostat or temperature sensor signal, including activating the refrigeration system, or activating the fan or blower without activation of the refrigeration system.

(   ) "Dual-duct portable air conditioner" means a portable air conditioner that draws some or all of the condenser inlet air from outside the conditioned space through a duct attached to an adjustable window bracket, may draw additional condenser inlet air from the conditioned space, and discharges the condenser outlet air outside the conditioned space by means of a separate duct attached to an adjustable window bracket.

(   ) "Inactive mode" means a standby mode that facilitates the activation of an active mode or off-cycle mode by remote switch (including remote control), internal sensor, or timer, or that provides continuous status display.

(   ) "Off-cycle mode" means a mode in which a portable air conditioner: (1) Has cycled off its main cooling or heating function by thermostat or temperature sensor signal; (2) May or may not operate its fan or blower; and (3) Will reactivate the main function according to the thermostat or temperature sensor signal.

( ) "Off mode" means a mode in which a portable air conditioner is connected to a mains power source and is not providing any active mode, off-cycle mode, or standby mode function, and where the mode may persist for an indefinite time. An indicator that only shows the user that the portable air conditioner is in the off position is included within the classification of an off mode.

( ) "Portable air conditioner" means a portable encased assembly, other than a "packaged terminal air conditioner," "room air conditioner," or "dehumidifier," that delivers cooled, conditioned air to an enclosed space, and is powered by single-phase electric power. It includes a source of refrigeration and may include additional means for air circulation, dehumidification, and heating. A portable air conditioner may be mounted on wheels for moving from place to place within a building or structure.

( ) "Seasonally adjusted cooling capacity (SACC)" means the temperature-weighted measure of the ability of a portable air conditioner to remove heat from an enclosed space corrected for duct heat transfer and infiltration air heat transfer, expressed in Btu/h, as determined using the applicable test method in Section 1604( ).

( ) "Single-duct portable air conditioner" means a portable air conditioner that draws all of the condenser inlet air from the conditioned space without the means of a duct, and discharges the condenser outlet air outside the conditioned space through a single duct attached to an adjustable window bracket.

( ) "Spot air conditioner" means a non-ducted portable air conditioner that delivers cooled air into a space and discharges the condenser outlet air back into another area within that same space,

( ) "Standby mode means any mode where a portable air conditioner is connected to a mains power source and offers one or more of the following user-oriented or protective functions, which may persist for an indefinite time: (1) To facilitate the activation of other modes (including activation or deactivation of cooling mode) by remote switch (including remote control), internal sensor, or timer; or (2) Continuous functions, including information or status displays (including clocks) or sensor-based functions. A timer is a continuous clock function (which may or may not be associated with a display) that provides regular scheduled tasks (e.g., switching) and that operates on a continuous basis.

…

Section 1604. Test Methods for Specific Appliances.

…

( ) Single-Duct Portable Air Conditioners and Dual-Duct Portable Air Conditioners.

( ) The test method for single-duct portable air conditioners and dual-duct portable air conditioners is 10 C.F.R. section 430.23(dd) and 10 C.F.R. Appendix CC to Subpart B of Part 430 – "Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners."

…

Section 1605.3. State Standards for Non-Federally-Regulated Appliances.

…

( ) Single-Duct Portable Air Conditioners and Dual-Duct Portable Air Conditioners.

( ) The combined energy efficiency ratio (CEER) of single-duct and dual-duct portable air conditioners manufactured on or after January 1, 2020, shall not be less than the minimum CEER value resulting from the following equation, where SACC is the seasonally adjusted cooling capacity as determined using the applicable test method in Section 1604( ).

$$\text{Minimum CEER (BTU/Wh)} = 1.18 \times \frac{SACC}{3.7117 \times SACC^{0.6384}}$$

( ) Portable Air Conditioners. If a model of portable air conditioner sold or offered for sale in California has both single-duct and dual-duct configuration options, both configurations must meet the applicable standard in section 1605.3. If a model of portable air conditioner sold or offered for sale in California has a dehumidification option, the model must meet the applicable dehumidifier standard in Section 1605.1 per 1605(f).

…

Section 1606. Filing by Manufacturers; Listing of Appliances in Database.

…

Table X

Data Submittal Requirements

	Appliance	Required Information	Permissible Answers
( )	Single-Duct Portable Air Conditioners and Dual-Duct Portable Air Conditioners	Duct Configuration.	Single-duct, dual-duct
		Ability to operate in both single-duct and dual-duct configurations.	True, False
		Heating Function Present.	True, False
		Dehumidification Mode Available.	True, False
		Primary Condensate Removal Feature.	Auto-evaporation, gravity drain, removable internal collection bucket, condensate pump
		Nominal Cooling Capacity, in Btu/h.	
		Seasonally Adjusted Cooling Capacity, in Btu/h.	

		Combined Energy Efficiency Ratio, in Btu/Wh.	
		Refrigerant Type.	
		Annual energy consumption in off-cycle mode, in kWh/yr (AEC_{OC}), calculated using the applicable test procedure.	
		Annual energy consumption in inactive or off mode, in kWh/yr ($AEC_{IM/OM}$), calculated using the applicable test procedure.	
		Adjusted cooling capacity tested at the 83 °F dry-bulb outdoor temperature test condition in the applicable test procedure (ACC_{83}).	
		Adjusted cooling capacity tested at the 95 °F dry-bulb outdoor temperature test condition in the applicable test procedure (ACC_{95}).	
	Dual-Duct Portable Air Conditioners	Annual energy consumption in cooling mode for the 83 °F dry-bulb outdoor temperature test condition, in kWh/yr (AEC_{83}), calculated using the applicable test procedure.	
		Annual energy consumption in cooling mode for the 95 °F dry-bulb outdoor temperature test condition, in kWh/yr (AEC_{95}), calculated using the applicable test procedure.	
	Single-Duct Portable Air Conditioners	Annual energy consumption in cooling mode, in kWh/yr (AEC_{SD}), calculated using the applicable test procedure.	

…

Section 1607. Marking of Appliances.

…

(   ) Single-Duct Portable Air Conditioners and Dual-Duct Portable Air Conditioners.

( ) Each single-duct and dual-duct portable air conditioner unit manufactured on or after January 1, 2020, and each package containing a unit shall be labeled, permanently and legibly on an accessible and conspicuous place on the unit, in characters no less than 1/8" on the unit, and 1/4" on the packaging, with the following energy performance information: nominal cooling capacity, seasonally adjusted cooling capacity, and combined energy efficiency ratio, and with the following statement "UNIT TO BE USED WITH DUCTS – PORTABLE AIR CONDITIONER IS NON-COMPLIANT IF IT IS USED WITHOUT DUCTS."

…

4.3.2 Proposed Test Procedure

The Statewide CASE Team proposes that the Energy Commission adopt the U.S DOE portable ACs test procedure contained within the Code of Federal Regulations (10 C.F.R. § 430.23) and Appendix CC to Subpart B of Part 430 – "Uniform Test Method for Measuring the Energy Consumption of Portable Air

Conditioners." The U.S. DOE test procedure incorporates by reference ANSI/AHAM PAC–1–2015, "Portable Air Conditioners" (June 19, 2015).

4.3.3 Proposed Standard Metrics

The Statewide CASE Team proposes that the standard metric be a minimum CEER requirement that varies based on SACC. As discussed in Section 2.2.1, CEER compares a product's seasonally adjusted cooling capacity to its energy usage. As discussed in Section 2.2.2, U.S. DOE tested products to develop a relationship between cooling mode power and SACC to determine a nominal CEER equation for a given SACC, shown in Equation 4.

Equation 4: Nominal CEER Relationship

$$\text{Nominal CEER (Btu/Wh)} = \frac{SACC}{3.7117 \times SACC^{0.6384}}$$

U.S. DOE's reported performance ratios, listed in Table 3 can be used to scale the nominal CEER to a minimum CEER for the energy efficiency levels in Table 3. For the proposed standard, which aligns with U.S. DOE's EL 3, the minimum CEER equation would then be:

Equation 5: Minimum Allowable CEER Formula for Proposed Title 20 Standard

$$\text{Minimum CEER (Btu/Wh)} = 1.18 \times \frac{SACC}{3.7117 \times SACC^{0.6384}}$$

4.3.4 Proposed Reporting Requirements

The Statewide CASE Team proposes the following information be reported for each portable AC model listed in the Energy Commission Modernized Appliance Efficiency Database System (MAEDBS):

- Manufacturer name;
- Brand name or trademark;
- Model number;
- Add date;
- Type (single-duct or dual-duct);
- Ability to operate in both single-duct and dual-duct configurations;
- Presence of a heating function;
- Presence of a dehumidification mode;
- Primary condensate removal feature;
- Nominal cooling capacity, in Btu/h;
- Seasonally adjusted cooling capacity, in Btu/h;
- Combined energy efficiency ratio, in Btu/Wh;

- Refrigerant type;
- Annual energy consumption in off-cycle mode, in kWh/yr (AEC_{OC}), calculated using the applicable test procedure;
- Annual energy consumption in inactive or off mode, in kWh/yr ($AEC_{IM/OM}$), calculated using the applicable test procedure;
- Adjusted cooling capacity tested at the 83 °F dry-bulb outdoor temperature test condition in the applicable test procedure (ACC_{83});
- Adjusted cooling capacity tested at the 95 °F dry-bulb outdoor temperature test condition in the applicable test procedure (ACC_{95});
- For dual-duct portable ACs, annual energy consumption in cooling mode for the 83 °F dry-bulb outdoor temperature test condition, in kWh/yr (AEC_{83}), calculated using the applicable test procedure;
- For dual-duct portable ACs, annual energy consumption in cooling mode for the 95 °F dry-bulb outdoor temperature test condition, in kWh/yr (AEC_{95}), calculated using the applicable test procedure; and
- For single-duct portable ACs, annual energy consumption in cooling mode, in kWh/yr (AEC_{SD}), calculated using the applicable test procedure.

4.3.5 Proposed Marking and Labeling Requirements

The Statewide CASE Team recommends that the date of product manufacture be labeled clearly on the product to ensure product compliance with the standard after the standard effective date. The Statewide CASE Team also proposes labeling product nominal cooling capacity, SACC, and CEER on the unit and in product literature to facilitate review of products for compliance. Additionally, the Statewide CASE Team recommends that product packaging clearly indicate that portable AC units are meant to be used with ducting, and that product literature includes clear instructions on proper product ducting use.

5. Analysis of Proposal

5.1 Scope/Framework

Similar to the U.S. DOE energy conservation standards, this proposal addresses single- and dual-duct consumer portable ACs. This proposal does not consider standards for spot ACs, which are currently subject to test-and-list requirements under Title 20. U.S. DOE did not issue a test procedure or energy conservation standards for spot ACs because "manufacturers indicated that spot cooler shipments represent no more than approximately 1.5 percent of the total portable AC market in the United States, and…only about half of those shipments are for spot coolers with single-phase, 120-volt, and 60-hertz power supply requirements (the power supply appropriate for consumer products)" (U.S. DOE 2015). This proposal also does not address products explicitly excluded from the definition of portable ACs in U.S. DOE's Final Determination including: packaged terminal ACs, room ACs, or stand-alone dehumidifiers, and it also does not address portable evaporative coolers.

5.2 Product Efficiency Opportunities

Portable AC efficiency is defined by the amount of space cooling and dehumidification that can be provided for a given amount of input power. More efficient portable ACs can provide space cooling at reduced power draw, resulting in a higher CEER value, as discussed in Section 2.2.1.

U.S. DOE has identified technological pathways that could improve the efficiency of portable ACs. These include the following (U.S. DOE 2016c):

- Increased Heat-Transfer Surface Area: Increasing the heat-transfer surface area of the condenser and evaporator coils by increasing cross-sectional area, heat exchanger depth, and/or fin density would allow the coils to transfer the same amount of heat while decreasing the temperature difference between the evaporator and condenser refrigerant temperature. This would decrease the pressure difference between the coils, lowering the needed compressor input power. However, these changes could limit the ability of the unit to dehumidify air or could add to the size and weight of the unit, decreasing portability and increasing cost.
- Increased Heat-Transfer Coefficients: Modifying the design of refrigerant fins or tubes, or spraying condensate over the condensers could increase the heat-transfer coefficients of a portable AC; however, fabricating these components would likely increase the cost of the portable AC unit.
- Component Improvements: Improving the efficiency of individual components within the portable AC unit would increase the efficiency of the unit.
    - Improved compressor efficiency could be achieved by using inertia compressors or scroll compressors instead of the rotary compressors typically used in portable ACs; however, these higher efficiency compressors are larger, heavier, and more expensive than those currently used in portable ACs.
    - Improved fan or blower efficiency could be achieved by more advanced fan and blower design, which could be a costly improvement.
    - Low standby power electronic controls could reduce the power draw of the unit while not operating in cooling mode.
    - Ducting insulation could improve heat loss via the ducts, but it could result in shipping and installation difficulties due to the flexible nature of the ducts.
    - Improved duct connections at the window mounting bracket could reduce air leakage from outdoors to the conditioned space.
    - External case insulation could limit heat transfer from within the portable AC unit to the conditioned space; however, the performance and reliability effects of this modification are not fully known.
- Part-Load Technology Improvements: Variable speed compressors would better match the compressor power to the load, increasing compression efficiency and saving energy at part-load conditions. Additionally, using higher cost, variable thermostatic expansion valves or electronic expansion valves instead of static capillary tubes for flow control could help optimize efficiency under varying conditions.

- Alternative Refrigerants: Most portable ACs in the U.S. market use R-410A refrigerant, but using alternative refrigerants, such as propane (R-290) and R-32 could increase operational efficiency and reduce cost.
- Reduced Infiltration Air: Optimizing airflow and reducing infiltration air may improve portable AC efficiency.

5.3 Technical Feasibility

With input from manufacturers, trade organizations, and energy efficiency advocates, U.S. DOE analyzed the technical feasibility of the technology options in Section 5.2 to improve unit efficiency (U.S. DOE 2016c).

Of the above options, U.S. DOE determined that ducting insulation and the use of propane refrigerant are impractical technology options. In the case of ducting insulation, portable AC ducting is typically uninsulated and collapsed for shipping, and collapsible insulated ducting was not found to be available on the market. Additionally, shipping insulated ducting in its fully expanded configuration would result in an impractical increase to packaging size. Propane refrigerant was screened out of consideration because the amount of propane refrigerant that would be required to provide the minimum necessary cooling capacity would exceed the Underwriter's Laboratory safety limits for the amount of flammable refrigerant that can be used in portable ACs.

All other technology options were deemed to be technologically feasible. According to U.S. DOE, the following options are most likely to be implemented to improve portable AC efficiency:

- Increased heat exchange area: U.S. DOE found that the average trend of heat exchanger areas for units tested ranged +/- 20 percent; thus, portable AC heat exchange area could be increased by up to 20 percent to improve efficiency. This increased heat exchange area would increase unit weight by approximately six percent; consumer utility would not be significantly affected by this weight increase.
- Improved compressor efficiency: Many portable AC compressors fall short of the maximum efficiency available for single-speed rotary R-410A compressors. Using more efficient compressors is a feasible pathway for improving the efficiency of portable ACs.
- Improved blower efficiency: Portable ACs tested by U.S. DOE used permanent split capacitor fan motors; however, more efficient permanent magnet or electronically commutated motors would slightly increase unit efficiency.
- Low-standby-power electronic controls: Controls that use minimal energy while in standby mode are a viable pathway for portable AC units.

Other design options were potentially feasible but were not considered by U.S. DOE due to lack of information regarding real-world applicability, including: increased heat-transfer coefficients, improved duct connections, improved product case insulation, part-load technology improvements, and the use of R-32 refrigerant. However, the Statewide CASE Team and other efficiency advocates believe many of these other design options are feasible and should also be considered, as noted in Appendix C and Appendix D.

U.S. DOE estimates that qualifying products (those that meet EL 3) currently have a two percent market share, while products that meet EL 2 or above have a market share of 15 percent. The U.S. DOE efficiency distribution is discussed in more detail in Section 5.4.1.

5.3.1 Future Market Adoption of Qualifying Products

The Statewide CASE Team assumed that the naturally occurring market adoption of qualifying products would be constant over the period of analysis. It is possible that the market might naturally shift, but it is unlikely that the qualifying product market share would change significantly in the absence of a new standard. In the no-new-standard scenario, the U.S. DOE assumed the period between 2020 and 2030 would see a small change in the average energy consumption of non-qualifying products, but they assumed no change in the market share of qualifying products (U.S. DOE 2016d). This offers support for the Statewide CASE Team's assumption of constant market share for qualifying products over time.

5.4 Statewide Energy Savings

5.4.1 Per-Unit Energy Savings Methodology

This section describes the methodology the Statewide CASE Team used to estimate energy and environmental impacts. The Statewide CASE Team calculated the impacts of the proposed code change by comparing average unit energy consumption of non-qualifying products to that of qualifying products. In calculating average per-unit energy consumption, the Statewide CASE Team made the following assumptions based on U.S. DOE findings:

- Residential units make up 87 percent of sales; the remaining 13 percent are commercial sector sales (U.S. DOE 2016c).
- The average unit energy consumption by sector and efficiency level correspond to the U.S. DOE’s 2016 findings, summarized in Table 5:

Table 5: Annual Per-Unit Energy Use by Sector and EL

EL	Avg. annual residential electricity use (kWh/yr)	Avg. annual commercial electricity use (kWh/yr)
0	804	2015
1	719	1801
2	618	1547
3	523	1312
4	422	1055

Source: U.S. DOE 2016c, 7-10.

- The California market share by EL in Table 6 is assumed to be the same across both sectors, matching the efficiency distribution determined by the U.S. DOE.

Table 6: California Market Share by EL

EL	Market share
0	37%
1	48%
2	13%
3	2%
4	0%

Source: U.S. DOE 2016c, 8-29.

5.4.1.1 Annual Per-Unit Energy Use Methodology

The annual per-unit energy consumption is taken from U.S. DOE's 2016 analysis. U.S. DOE calculated annual per-unit energy consumption by multiplying the annual total operating hours in all modes by the average power usage, weighted by percent of time spent in each mode. U.S. DOE separately considered cooling mode, fan mode, and standby mode. To determine annual operating hours for the residential sector, U.S. DOE relied on room AC data from the United States Energy Information Administration (U.S. EIA) 2009 Residential Energy Consumption Survey (RECS). To determine annual operating hours for the commercial sector, the U.S. DOE used data from the U.S. EIA 2012 Commercial Building Energy Consumption Survey.

5.4.1.2 Peak Demand Methodology

Peak demand was calculated by multiplying daily electricity use by an assumed load factor. A load factor is the ratio of average annual load to coincident peak load. The Statewide CASE Team obtained end-use load factor estimates through consultations with the Energy Commission. The load factors used in this report were developed by the Energy Commission using an Hourly Energy and Load Model (Brown and Koomey 2002) on 2013 utility-level energy demand data. A complete table of updated values for several end uses is included in Appendix B: Load Factors.

For the purposes of this report, the Statewide CASE Team used load factors of 0.06 and 0.23 for residential and commercial portable ACs, respectively. The load factors for both sectors were assumed to equal the sectors' overall AC load factors, which the Statewide CASE Team believes to best resemble portable AC usage.

5.4.2 Summary of Per-Unit Energy Use Impacts

Annual per-unit energy impacts are presented in Table 7. As previously described, non-qualifying products are products that do not meet the minimum CEER corresponding to the EL, while qualifying products are products that do meet the EL. The methodology used to calculate these estimates is presented in Section 5.4.1. Results are shown for both EL 2 (U.S. DOE's selected standard level) and EL 3 (the Statewide CASE Team's proposed standard level).

Table 7: Annual Per-Unit Energy Use and Potential Savings from Qualifying Products

EL		Electricity use (kWh/yr)	Peak demand (W)
2	Non-qualifying PACs (PR < 1.04)	904	1,257
	Qualifying PACs (PR ≥ 1.04)	736	1,024
	Savings	168	233
3	Non-qualifying PACs (PR < 1.18)	882	1,226
	Qualifying PACs (PR ≥ 1.18)	625	870
	Savings	257	356

Source: Statewide CASE Team analysis 2018; U.S. DOE 2016c.

5.4.3 Stock

The stock was calculated by multiplying the average unit lifetime by the annual shipments. The value of 10.47 years for the average lifetime was taken from the U.S. DOE's 2016 Final Rule Technical Support Document (TSD) (U.S. DOE 2016c). The methodology used to calculate the annual shipments is presented in Section 5.4.4.1. According to these calculations, the Statewide CASE Team estimates the existing stock installed in California as approximately 1,467,000 units as of 2018.

5.4.4 Shipments

Shipments – the number of products shipped by manufacturers – was used as a proxy for the number of units purchased by consumers in a given year.

5.4.4.1 Current and Future Shipments

Current and future shipments were calculated by adjusting national shipment forecasts from the U.S. DOE's 2016 TSD according to the number of housing units in California. The U.S. DOE forecasted shipments from 2017 to 2040 under various scenarios; the Statewide CASE Team elected to use U.S. DOE's forecasted shipments for the "no-new-standards" scenario.

To adjust the national shipments for California, the Statewide CASE Team multiplied the national shipments by the percentage of U.S. households that are in California (10.3 percent) as estimated by the U.S. Census Bureau's American Community Survey for 2016 (U.S. Census Bureau 2016). The results are shown in Table 8.

Table 8: California Shipments and Stock

Year	Annual shipments	Stock
2020	142,200	1,489,000
2021	143,200	1,499,000
2022	144,000	1,508,000
2023	144,800	1,516,000
2024	145,500	1,524,000
2025	146,300	1,532,000
2026	147,400	1,543,000
2027	148,400	1,554,000
2028	149,400	1,565,000
2029	150,500	1,575,000

Source: Statewide CASE Team analysis 2018.

5.4.5 Statewide Energy Savings - Methodology

Statewide savings estimates were first calculated by applying the per-unit energy savings to the statewide shipments forecast presented in Section 5.4.4.1 of the report. Savings were then reduced by subtracting the fraction of the market expected to already meet the standard (two percent, which is the U.S. DOE's current estimate of national market penetration for EL 3). Demand reduction was calculated by dividing statewide electricity savings by the statewide sector-weighted load factor, derived as described in Section 5.4.1.2.

5.4.6 Statewide Energy Use – Non-Standards and Standards Case

Statewide electricity consumption and peak demand are based on multiplying shipments or stock by the average per-unit electricity consumption and demand. Savings are calculated assuming a market shift from the weighted average of non-qualifying and qualifying products to all qualifying products, beginning in the effective year, 2020.

The annual shipments values represent the energy use (or savings) and demand associated with products sold during a given year. The stock values represent the energy use (or savings) and demand associated with all products that are installed/operational during a given year.

Table 9 (Non-Standards Case) shows the estimated statewide energy consumption in gigawatt-hours (GWh) per year (GWh/yr) and demand in megawatts (MW) if the proposed changes were *not* adopted. Table 10 (Standards Case) shows the estimated statewide energy consumption and demand if the proposed changes are adopted. Table 11 (Standards Case) shows the estimated statewide energy savings and demand reduction if the proposed changes are adopted relative to the non-standards case.

Table 9: California Statewide Energy Use – Non-Standards Case (After Effective Date)

Year	Annual shipments		Stock	
	Electricity use (GWh/yr)	Electricity demand (MW)[a]	Electricity use (GWh/yr)	Electricity demand (MW)
2020 (first-year standard is in effect)	125	173	1,288	1,791
2029 (after stock turns over)	132	183	1,405	1,953

Source: Statewide CASE Team analysis 2018.

Table 10: California Statewide Energy Use – Standards Case (After Effective Date)

EL	Year	Annual shipments		Stock	
		Electricity use (GWh/yr)	Electricity demand (MW)[a]	Electricity use (GWh/yr)	Electricity demand (MW)
2	2020 (first year standard is in effect)	105	146	1,269	1,764
	2029 (after stock turns over)	111	154	1,200	1,669
3	2020 (first year standard is in effect)	89	124	1,253	1,742
	2029 (after stock turns over)	94	131	1,038	1,443

Source: Statewide CASE Team analysis 2018.

Table 11: California Statewide Energy Savings – Standards Case (After Effective Date) [a]

EL	Year	Annual shipments		Stock	
		Electricity use (GWh/yr)	Electricity demand (MW)[a]	Electricity use (GWh/yr)	Electricity demand (MW) [b]
2	2020 (first year standard is in effect)	20	28	20	27
	2029 (after stock turns over)	21	29	205	284
3	2020 (first year standard is in effect)	36	50	36	50
	2029 (after stock turns over)	38	52	367	510

Source: Statewide CASE Team analysis 2018.

[a] Rounded values are shown.

[b] Statewide demand (and demand reduction) is quantified as coincident peak load (and coincident peak load reduction), the simultaneous peak load for all end users, as defined by Brown and Koomey (2002).

5.5 Cost-Effectiveness

This section describes the methodology and approach the Statewide CASE Team used to analyze the economic impacts of the proposed standard.

5.5.1 Incremental Cost

To determine average retail cost of a portable AC, the Statewide CASE Team collected price data on 165 portable AC models offered online by a major retailer. The average listed price of these models was $393.30, and only one model in the sample had a retail price higher than $600.

Because CEER and SACC are typically not recorded by retailers or manufacturers, the Statewide CASE Team could not precisely categorize models in the online listings as qualifying or non-qualifying.

Consequently, the non-qualifying product cost was assumed to be the average cost of *all* models in the sample, and the incremental cost was calculated by applying the *percent* incremental cost as determined by the U.S. DOE (2016). This is a conservative method – any qualifying models in the sample will tend to increase the calculated non-qualifying product cost (because they increase the average cost), and since the incremental cost is calculated by applying a percentage to the average non-qualifying product cost, the higher non-qualifying product cost results in a higher incremental cost as well. Therefore, using the average costs of all products in the incremental cost calculation is a conservative approach. Also, including the full market distribution of prices aligns with the energy savings methodology, which calculates the non-qualifying product energy consumption as a market-weighted average of the non-qualifying efficiency levels.

The U.S. DOE's bottom-up cost analysis estimated an average *non-qualifying* product cost higher than 95 percent of prices for the sample of 165 models sold online; therefore, the Statewide CASE Team chose to use the U.S. DOE's percent incremental cost, rather than the absolute incremental cost. For EL 2, this was a 10.4 percent increase on the non-qualifying product cost. For EL 3, this was a 20.0 percent increase.

This method gave a qualifying product cost of $434.08 for EL 2 and $472.01 for EL 3. Given the non-qualifying product cost of $393.30, this resulted in a per-unit incremental cost of $40.78 for EL 2 and $78.71 for EL 3.

5.5.2 Design Life

The Statewide CASE Team recommends using 10.47 years (U.S. DOE 2016c) as the product lifetime for portable ACs at all ELs. This value is derived from data on average room AC lifetimes. While room and portable ACs may differ in *technical* product life, U.S. DOE assessed that their *useful* life is likely similar.

5.5.3 Lifecycle Cost/Net Benefit

The per-unit, present value (PV), total lifecycle costs and benefits of the proposed standard are presented in Table 12. Accounting for the incremental cost and lifetime electricity savings, the NPV per-unit is $267.26 for EL 2 and $392.24 for EL 3, and the benefit-to-cost (B/C) ratio is 7.6 for EL 2 and 6.0 for EL 3. The expected payback period is 1.4 years for EL 2 and 1.7 years for EL 3.

Table 12: Costs and Benefits Per-Unit for Qualifying Products [a]

Product class	Product life (years)	Per-unit lifecycle costs (PV $) [b]		Per-unit lifecycle benefits (PV $)		Per-unit NPV ($)
		Incremental Cost [c]	Total PV Costs	Electricity Savings	Total PV Benefits	
Portable ACs, EL 2	10.47	$40.78	$40.78	$308.04	$308.04	$267.26
Portable ACs, EL 3	10.47	$78.71	$78.71	$470.95	$470.95	$392.24

Source: Calculations from the Statewide CASE Team analysis 2018; U.S. DOE's 2016c and online retail data.

[a] Cost savings will be realized through lower electricity bills. Average annual electricity was used, starting in the effective year.

[b] Calculated using the Energy Commission's average statewide PV statewide energy rates, assuming a three % discount rate (CEC 2017).

[c] Incremental cost is the cost difference between the baseline non-qualifying product and the qualifying product.

5.6 Environmental Impacts/Benefits

5.6.1 Greenhouse Gas

Table 13 presents the annual and stock greenhouse gas (GHG) savings for the first year the standard takes effect (2020) and the year of full stock turnover (2029). The Statewide CASE Team calculated the avoided GHG emissions due to the adoption of the standard, assuming annual emissions factors varying over the duration of the measure, from 195 to 220 $MTCO_2e$ per GWh of electricity savings (CARB 2017).

As shown in Table 13, for EL 3, the estimated statewide GHG savings for annual shipments is approximately 7,860 $MTCO_2e$ the first year the standard is in effect and approximately 71,270 $MTCO_2e$ after full stock turnover in 2029.

Table 13: Estimated California Statewide Greenhouse Gas Savings for Standards Case

Year	Annual GHG savings ($MTCO_2e/yr$)	Stock GHG savings ($MTCO_2e/yr$)
2020 (first year standard is in effect)		
EL 2	4,460	4,460
EL 3	7,860	7,860
2029 (product stock turns over)		
EL 2	4,160	40,420
EL 3	7,340	71,270

Source: Statewide CASE Team analysis 2018.

5.6.2 Indoor or Outdoor Air Quality

The Statewide CASE Team did not find evidence that the measure has a significant impact on indoor or outdoor air quality. However, in California, CARB has recently announced that they are considering standards to reduce the global warming potential (GWP) of refrigerants used in air conditioners and other refrigerant-using products. Under this proposal, by 2021, refrigerants with a GWP of 750 or greater would be prohibited in new stationary air conditioning systems containing two or more pounds of refrigerant (CARB 2017). The potential standards would require a move from R-410A, which has a GWP above the limit, to lower GWP refrigerants like R-32. This limit would could affect portable ACs, as a large portion of the air conditioning market would shift towards lower GWP refrigerants, making the use of these refrigerants more likely. If portable AC manufacturers elect to move towards lower GWP refrigerants as an efficiency design option, it would contribute to lower greenhouse gas emissions in California.

5.6.3 Hazardous Materials

The technology options manufacturers could pursue to meet the standard level, such as increased heat exchanger area, improved compressor efficiency, improved blower motor efficiency, and decreasing the standby power consumption of electronic controls, would not have any known hazardous material impacts.

5.7 Impact on California's Economy

The proposed standard is expected to have a positive impact on the California economy by providing cost-effective savings to California consumers. Manufacturers may be negatively impacted due to the need to redesign products to meet the standard; however, since U.S. DOE rulemakings to set standards for these products began in 2013, manufacturers have had ample time to prepare for standards. The standards are not expected to have any impact on small businesses. Table 14 shows the anticipated lifecycle costs and benefits of the proposed standard.

Table 14: Statewide Total Lifecycle Costs and Benefits for Standards Case [a]

Product class	Lifecycle B/C ratio [b]	NPV ($) [c]	
		For first-year shipments ($ million)	Stock turnover [d] ($ million)
EL 2	7.6	$32.22	$287.62
EL 3	6.0	$54.54	$483.76

Source: Statewide CASE Team analysis 2018.

[a] The analysis does not include cost savings associated with embedded energy savings.

[b] Total PV benefits divided by total PV costs. Positive value indicates a reduced total cost of ownership over the life of the appliance.

[c] It should be noted that while the proposed standard is cost-effective, it may be more cost-effective if using alternative rate structures. For example, marginal utility rates may more accurately reflect what customers save on utility bills as result of the standard.

[d] Stock Turnover NPV is calculated by taking the sum of the NPVs for the products purchased each year following the standard's effective date through the stock turnover year (i.e., the NPV of "turning over" the whole stock of less-efficient products that were in use at the effective date to more efficient products, plus any additional non-replacement units due to market growth, if applicable). For example, for a standard effective in 2015 applying to a product with a five-year design life, the NPV of the products purchased in the fifth year (2019) includes lifecycle cost and benefits through 2024, and therefore, so does the Stock Turnover NPV.

5.8 Consumer Utility/Acceptance

From the consumer perspective, there is no notable difference in the utility of non-qualifying products and qualifying ducted portable ACs. Qualifying products have the same form factor and offer the same features that lower efficiency non-qualifying products do. Depending on the mechanism used to increase product efficiency, a qualifying product may be slightly nosier or heavier than a non-qualifying product; however, U.S. DOE analysis deemed that negative impacts to consumers would be reasonably minor. Therefore, the Statewide CASE Team does not anticipate issues with consumer usage or acceptance of qualifying products. Additional education and labeling for consumers could be useful in ensuring that products are used correctly to maximize efficiency. The Statewide CASE Team recommends that product packaging clearly indicate that portable AC units are meant to be used with ducting so that consumers do not attempt to use the products without setting up ducting for heat rejection.

It may be necessary to educate portable AC manufacturers on the standard requirements since these products are currently not subject to state or federal requirements. The Association of Home Appliance Manufacturers (AHAM) represents many manufacturers of portable ACs, and therefore, it may be useful to engage them in any manufacturer education effort.

5.9 Manufacturer Structure & Supply Chain Timelines

According to U.S. DOE, most portable ACs are manufactured overseas by three major manufacturers and sold in the U.S. under a variety of different brands (U.S. DOE 2016c). Portable AC manufacturers and importers include the following:

> Bigwall Enterprises Inc., Danby, De'Longhi America Inc., Electrolux, Friedrich, GD Midea Air Conditioning Equipment Co. Ltd., Grainger, Gree Electric Appliances Inc. of Zhuhai, Haier America Trading LLC, Hisense Kelon Electrical Holdings Co. Ltd., Honeywell International Inc., LG

Electronics Inc., Living Direct, Luzerne Trading Company Inc., Motors and Armatures Inc., New Widetech Electric Co. Ltd., NewAir, Ningbo Bole Electric Appliance Co. Ltd., Royal Sovereign International, Inc., Sealed Unit Parts Co (SUPCO), Sears Holding Corporation, Sharp Electronics, Sunpentown International Inc., Whynter LLC, Wilco-USA Inc. (Climax Air), Yoau Electrical Co. Ltd, and Zhejiang Aoli Electric Appliance Co. Ltd.

U.S. DOE estimates that the following manufacturers have the largest share of the U.S. portable AC market: Haier America and LG (more than 20 percent each), and De'Longhi America and Danby (approximately ten percent each). Other manufacturers are thought to have a market share of five percent or less.

Typically, consumers purchase portable ACs through retail channels such as big-box retail stores, home improvement stores, discount stores, and online retailers. Product procurement via heating, ventilation, and air conditioning (HVAC) distributors is not as common. Consumer-facing retailers or distributors buy product from original equipment manufacturers (OEMs) or from intermediary companies that source products from foreign OEMs.

Because the federal government instituted a rulemaking regarding proposed energy conservation standards for portable ACs in 2013, equipment manufacturers have long known that products would soon be subject to tighter energy efficiency requirements. Therefore, they are expected to have prepared to some extent for the possibility of regulation. The Statewide CASE Team therefore suggests a standard effective date of one year after the adoption of the standard, or January 1, 2020 if sooner, to maximize the amount of cost-effective savings to the consumer while giving manufacturers time to comply with the standard.

5.10 Stakeholder Positions

Key stakeholders for this rulemaking include the portable AC manufacturers (listed in Section 5.9) and AHAM, the association that represents these manufacturers. In addition to these, the California IOUs and other efficiency advocates provided comments to U.S. DOE in response to their rulemaking.

In their comments on the U.S. DOE NOPR (AHAM 2016), AHAM was not supportive of U.S. DOE's selected efficiency level for the proposed energy conservation standard. At the time, AHAM was concerned that manufacturers did not have enough time to become familiar with the test procedure prior to the finalization of the energy conservation rule; however, the Statewide CASE Team notes that since the test procedure was finalized in mid-2016, manufacturers have now had ample time to become familiar with the U.S. DOE test procedure. AHAM offered an alternative proposed standard level and minimum CEER equation based on their own analysis, which they claim would be less burdensome to manufacturers by requiring a lesser number of units to be redesigned as a result of the standard. AHAM's proposed performance ratio is approximately equivalent to a performance ratio of 0.895 using U.S. DOE's framework, placing it just above U.S. DOE's EL 1. As a comparison, U.S. DOE's EL 1 corresponds to a performance ratio of 0.85, and EL 2 corresponds to a performance ratio of 1.04.

AHAM and De'Longhi Appliances also contested U.S. DOE's use of room AC data from the U.S. EIA's RECS as a proxy for portable AC data, stating that the usage patterns differ between the two products, particularly the hours of use in cooling mode. AHAM suggested instead using data from a De'Longhi survey of portable AC owners or the aforementioned LBNL study which monitored portable AC use at 19 sites in the northeastern United States; however, the LBNL study stated that due to the limited number of test sites in the study it is not intended to be statistically representative of portable AC users in the Unites States. AHAM provided a comparison between RECS room AC data and AHAM portable AC data that showed differences in the two datasets. For example, the AHAM comparison showed that portable ACs are more common in the western United States than room AC data suggests. AHAM questioned U.S. DOE's lifecycle cost analysis stating that households with very low annual cooling hours will not recoup cost savings from more efficient units.

Efficiency advocates including the Appliance Standards Awareness Project, Alliance to Save Energy, American Council for an Energy-Efficient Economy, National Consumer Law Center, Natural Resources Defense Council, Northeast Energy Efficiency Partnerships, Northwest Energy Efficiency Alliance, and the California IOUs supported U.S. DOE's effort to put forth product standards. These stakeholders agreed with U.S. DOE's consideration of single- and dual-duct portable ACs as a single product class; supported the exploration of variable-speed compressors and alternative refrigerants as efficiency technology options; and recommended that U.S. DOE adopt a standard at EL 3 to increase savings for consumers.

5.11 Other Regulatory Considerations

5.11.1 Federal Regulatory Background

In accordance with the Energy Policy and Conservation Act of 1975, the U.S. DOE has proposed a pre-publication final rule addressing portable ACs. The pre-publication final rule was not published in the Federal Register, so the regulation of portable ACs is not preempted.

5.11.2 California Regulatory Background

California does not currently have energy efficiency standards or energy design standards for portable ACs. Title 20 of California's Code of Regulations does contain the following definition for "spot air conditioners" (referred to as "spot coolers" in this report), a portable AC product class:

> "Spot air conditioner" means an air conditioner that discharges cool air into a space and discharges rejected heat back into that space, where there is no physical boundary separating the discharges.

Title 20 requires testing spot coolers using the ANSI/ASHRAE 128-2001 Method of Rating Unitary Spot Air Conditioners test procedure (for units at or above 65,000 Btu/h) and reporting of the following data:

- Type (Single package, air-cooled; single package, evaporatively-cooled; split system: air-cooled condensing unit, coil with blower; split system: evaporatively-cooled condensing unit, coil alone)
- Cooling Capacity
- Total Electrical Input
- Cooling Efficiency Ratio
- Fan Electrical Input
- Refrigerant Type (ozone-depleting, non-ozone-depleting)

5.11.3 Utility and Other Incentive Programs

Portable ACs are not typically incentivized in utility or other incentive programs, likely due to their generally inefficient operation.

5.11.4 Model Codes and Voluntary Standards

Unlike room ACs, for which an ENERGY STAR® product category exists, the Statewide CASE Team is not aware of any existing voluntary or mandatory standards, or model codes for portable ACs.

5.11.5 Compliance

There is currently no required rating or labeling system for portable ACs. The Statewide CASE Team recommends reporting product SACC and CEER values in product literature to facilitate review of products for compliance. Additionally, as discussed in Section 5.8, additional labeling for consumers could be useful in ensuring that products are used correctly to maximize efficiency. The Statewide CASE Team found that many photos used to advertise portable ACs omit showing the ducting necessary for the unit to operate properly. The Statewide CASE Team recommends that product packaging clearly indicate that portable AC units are meant to be used with ducting so that consumers do not attempt to use the products without setting up ducts necessary for heat rejection.

6. Conclusion

The Statewide CASE Team proposes that the Energy Commission adopt energy conservation standards for portable ACs. Standards are needed to address the inefficient operation of this product class, and they will provide cost-effective savings to the consumer. The U.S. DOE considered energy conservation standards for portable ACs in a rulemaking between 2013 and 2016, but to date have not published rules for these products. The Statewide CASE Team used information from the U.S. DOE's rulemaking to support this proposal.

The Statewide CASE Team proposes minimum CEER standards for single-duct and dual-duct portable ACs manufactured after January 1, 2020. The minimum CEER standard proposed aligns with EL 3 from U.S. DOE's proposal. The proposed standards would achieve significant, cost-effective energy and cost savings for California consumers, including the following benefits after stock turnover in 2029:

- 367 GWh/yr in energy savings and 510 MW of demand reduction;
- 71,270 $MTCO_2e$ of GHG savings;
- $55 million in first-year savings and a NPV of $484 million in cost savings to California's consumers; and
- a B/C ratio of 6.0.

7. References

1. AHAM (Association of Home Appliance Manufacturers). 2016. "Comment Response to the Published Notice of Proposed Rulemaking (NOPR) and Announcement of Public Meeting; Reopening of Public Comment Period." https://www.regulations.gov/document?D=EERE-2013-BT-STD-0033-0043
2. Brown, R.E., and J. G. Koomey. 2002. "Electricity Use in California: Past Trends and Present Usage Patterns." Table 3. Energy Policy (also LBNL-47992) 31: 849-864.
3. Burke, T., H. Willem, C. Chun Ni, H. Stratton, Y. Chen, M. Ganeshalingam, M. Iyer, S. Price, and C. Dunham. 2014. Using Field-Metered Data to Quantify Annual Energy Use of Portable Air Conditioners. Lawrence Berkeley National Laboratory Environmental Energy Technologies Division. http://eta-publications.lbl.gov/sites/default/files/lbnl-6868e.pdf
4. CARB (California Air Resources Board). 2017. "Public Workshop on Rulemaking Proposal: High-Global Warming Potential Refrigerant Emissions Reduction." https://www.arb.ca.gov/cc/shortlived/meetings/10242017/public_workshop_snap-california_10-24-17_presentation.pdf
5. CEC (California Energy Commission). 2017. California Code of Regulations. Title 20. Public Utilities and Energy. Division 2. State Energy Resources Conservation and Development Commission. Updated April 2017. http://www.energy.ca.gov/2017publications/CEC-140-2017-002/CEC-140-2017-002.pdf
6. ____. 2016. Demand Analysis Office. Communications with M. Tian.
7. ____. 2018. Adopted California Energy Commission Demand Forecast Report 2018-2030. Mid-Case Final Demand Forecast. Form 2.3. Updated January 22, 2018. http://www.energy.ca.gov/2017_energypolicy/documents/2018-02-21_business_meeting/2018-02-21_middemandcase_forecst.php
8. Dryco Group. "Spot Cooler." http://www.drycogroup.com/wp-content/uploads/spot-cooler-3-261x300.png
9. Kingersons Air Conditioner Wholesale. "How Does It Work?" http://www.kingersons.com/how_it_works.html
10. LG Electronics. "LG LP0815WNR." http://www.lg.com/us/images/air-conditioners/md05186704/gallery/large02.jpg
11. Sylvane. "Avallon APAC120S." https://www.sylvane.com/media/images/products/avallon-APAC120S-portable-air-conditioner-in-use.png
12. U.S. Census Bureau. 2014. "Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2014." http://factfinder2.census.gov/bkmk/table/1.0/en/PEP/2014/PEPANNRES/0400000US06.05000
13. ____. 2016. "Selected Housing Characteristics: 2012-2016 American Community Survey 5-Year Estimates." https://factfinder.census.gov/bkmk/table/1.0/en/ACS/16_5YR/DP04/0100000US%7C0400000US06

14. U.S. DOE (United States Department of Energy). 2015. "Energy Conservation Program: Test Procedures for Portable Air Conditioners; Notice of Proposed Rulemaking." https://www.regulations.gov/document?D=EERE-2014-BT-TP-0014-0009

15. ___. 2016a. "Energy Conservation Program: Energy Conservation Standards for Portable Air Conditioners; Final Rule." https://www.energy.gov/eere/buildings/downloads/issuance-2016-12-28-energy-conservation-program-energy-conservation-2

16. ___. 2016b. "Energy Conservation Program: Test Procedures for Portable Air Conditioners; Final Rule." https://www.regulations.gov/document?D=EERE-2014-BT-TP-0014-0026

17. ___. 2016c. "Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Portable Air Conditioners." https://www.regulations.gov/document?D=EERE-2013-BT-STD-0033-0047

18. ___. 2016d. "Final rule Spreadsheet: National Impact Analysis." https://www.regulations.gov/document?D=EERE-2013-BT-STD-0033-0048

19. U.S. DOL (United States Department of Labor). 2018. Bureau of Labor Statistics. "CPI Inflation Calculator." http://www.bls.gov/data/inflation_calculator.htm

Appendix A: Electricity Rates

The electricity rates used in the analysis presented in this report were derived from projected future prices for residential, commercial, and industrial sectors in the Energy Commission's "Mid-Case" projection of the 2018-2030 Demand Forecast (CEC 2018), which provided prices in 2016 dollars using no discount rate. The sales weighted average of the five largest electric utilities in California was converted to 2018 dollars using an inflation adjustment of 1.03 (U.S. DOL 2018). The Statewide CASE Team then applied a three percent discount rate to future years relative to 2018. See the discounted rates by year in Table 15.

Table 15: Statewide Sales Weighted Average Commercial and Residential Electricity Rates 2018 – 2030 of the Five Largest California Electric Utilities (PG&E, SCE, SDG&E, LADWP, and SMUD) in 2018 cents/kWh with 3% Discount Rate

Year	Commercial electricity rate (2018 cents/kWh)	Residential electricity rate (2018 cents/kWh)	Sector weighted average (2018 cents/kWh)
2017	17.41	17.77	17.72
2018	17.45	17.91	17.85
2019	17.27	17.78	17.71
2020	17.05	17.59	17.52
2021	16.67	17.24	17.17
2022	16.12	16.74	16.66
2023	15.60	16.26	16.17
2024	15.23	15.92	15.83
2025	14.80	15.51	15.42
2026	14.41	15.15	15.05
2027	14.03	14.79	14.69
2028	13.65	14.43	14.33
2029	13.29	14.09	13.98
2030	12.93	13.75	13.64
2031	12.59	13.42	13.31

Source: CEC 2018, Statewide CASE Team Analysis 2018.

Appendix B: Load Factors

Table 16: 2013 Electricity Consumption and Peak Demand for the Five Largest California Utilities [a]

Sector & end-use	Coincident load		Annual energy		Load factor [b]
	MW	% of total	GWh	% of total	
Residential					
Cooking	581.4	1%	2833.1	1%	56%
Clothes Dryer	759.4	1%	4419.5	2%	66%
Dishwasher	211.1	0%	2237	1%	121%
Freezer	302.4	1%	2132.1	1%	80%
Miscellaneous	2849.3	5%	23139.9	9%	93%
Multi-Family Water Heater	114.2	0%	1189.4	0%	119%
Pool Heater	33.0	0%	155.6	0%	54%
Pool Pump	769.3	1%	3689.7	1%	55%
Refrigerator	1736.4	3%	13996.2	5%	92%
Solar Water Heat - Back-up	0.0	0%	0.2	0%	63%
Solar Water Heat – Pump	0.8	0%	2.3	0%	31%
Spa Heater	64.9	0%	247.6	0%	44%
Spa Pump	261.5	0%	990.4	0%	43%
Single Family Water Heater	196.5	0%	1709.6	1%	99%
Television	807.2	1%	6003	2%	85%
Waterbed Heater	737.0	1%	12003.7	5%	186%
Clothes Washer	122.2	0%	824.6	0%	77%
Air Conditioning	15739.6	28%	8378.51	3%	6%
Space Heating	0.0	0%	3441.46	1%	0%
Commercial					
Other	3344.8	6%	23762.2	9%	81%
Domestic Hot Water	144.5	0%	675.7	0%	53%
Cooking	94.5	0%	721.9	0%	87%
Office Equipment	263.3	0%	1699.2	1%	74%
Refrigeration	888.4	2%	7872.6	3%	101%
Exterior Lighting	40.9	0%	5909.2	2%	1649%
Interior Lighting	4856.2	9%	30686.2	12%	72%
Ventilation	1787.3	3%	10366.1	4%	66%
Air Conditioning	7714.7	14%	15724.95	6%	23%
Space Heating	0.0	0%	2702.77	1%	0%
Subtotal	19134.6	34%	100120.82	38%	60%

Source: CEC 2016.

[a] The five largest California electric utilities are Pacific Gas & Electric (PG&E), San Diego Gas & Electric (SDG&E), Southern California Edison Company (SCE), Sacramento Municipal Utility District (SMUD), and Los Angeles Department of Water and Power (LADWP).

[b] Load Factor is the ratio of average annual load to coincident peak load. The load factors for commercial exterior lighting and residential waterbed heaters are very high because their consumption is mainly off-peak.

Appendix C: California IOU Team Comment Letter from U.S. DOE Rulemaking

September 23, 2016

Ms. Brenda Edwards, EE–41
Office of Energy Efficiency and Renewable Energy
Energy Conservation Program for Consumer Products
U.S. Department of Energy
1000 Independence Avenue, SW.
Washington, DC 20585–0121

Docket Number:	EERE–2013–BT–STD–0033
RIN:	1904–AD02

Dear Ms. Edwards:

This letter comprises the comments of the Pacific Gas and Electric Company (PG&E), Southern California Gas Company (SCGC), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE) in response to the Department of Energy (DOE) Standard Notice of Proposed Rulemaking (NOPR) for Portable Air Conditioners (ACs).

The signatories of this letter, collectively referred to herein as the California Investor Owned Utilities (CA IOUs), represent some of the largest utility companies in the Western United States, serving over 35 million customers. As energy companies, we understand the potential of appliance efficiency standards to cut costs and reduce consumption while maintaining or increasing consumer utility of the products. We have a responsibility to our customers to advocate for standards that accurately reflect the climate and conditions of our respective service areas, so as to maximize these positive effects.

We appreciate this opportunity to provide the following comments about this NOPR. We fully support DOE proposing the first federal energy conservation standards for single-duct and dual-duct portable ACs, standards that are economically justified and would result in significant energy savings according to the national impacts analysis. Since consumers may use portable ACs as replacements for room ACs and/or dehumidifiers, we encourage DOE to set standards that have similar levels of stringency to those of the competing products. In doing so, we strongly urge DOE to consider the following comments.

1) We support DOE's decision to establish a single product class for single-duct and dual-duct portable ACs.

In the NOPR, DOE has not found a unique consumer utility associated with the number of ducts and, thus, determined that separate product classes for single-duct and dual-duct portable ACs are not warranted. The CA IOUs agreed with this assessment in our previous comments[1], and we reiterate our support of DOE's decision. In addition, while we agree that aesthetics is an important consumer utility, we note that the product images from several major online retailers (e.g., Best Buy, Home Depot, and Sears) typically do not display the ducts. The duct configuration is therefore not likely to be a major consideration for consumers when assessing the aesthetics of a portable AC unit.

[1] California IOUs, No. 15 at pp. 1–2

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2) DOE should require that units with a dehumidifier mode meet the federal standards for dehumidifiers. Furthermore, DOE should require that manufacturers indicate the presence of a dehumidifier mode as a certification requirement.

As DOE is aware, the majority of portable ACs currently available for purchase from major retailers come with a dehumidification mode. The advertised moisture removal capacity (pints per day) for these units is comparable to that of residential dehumidifiers. Retailer websites allow consumers to sort and filter AC units by moisture removal capacity; therefore, consumer purchasing decisions are influenced by the capability of a dehumidification mode. Consumers may opt for a portable AC unit instead of purchasing a separate dehumidifier, or they may choose to use their portable AC as a dehumidifier after purchase. Since these units would not be covered under the federal standards for dehumidifiers[2], DOE should explicitly require that portable ACs with a dehumidifier mode also meet the federal efficiency standards for dehumidifiers when operating in that mode.

DOE first considered dehumidification mode in the test procedure NOPR.[3] In this document, DOE determined the hours of operation in this mode to be insignificant based on the assessment of a metered study.[4] However, the study tested only 19 sites from two states, and those surveyed were informed of the test purpose and scope prior to the study being conducted. The study is therefore a poor representation of the consumer propensity for using dehumidification mode as it does not represent consumers purchasing, or repurposing, a portable AC with the intent of also using it as a dehumidifier.

This additional requirement would mandate that moisture removal performed by portable ACs is tested and labeled in accordance with DOE requirements for residential dehumidifiers. As a result, consumers would be better-informed when making purchasing decisions. In addition, it would ensure that standards for residential dehumidifiers are not circumvented by multi-functional units such as portable ACs.

Lastly, DOE should require that manufacturers indicate the presence of a dehumidifier mode as a certification requirement, similar to the same requirement for heating mode.

3) We support the inclusion of a variable speed compressor as a technology option and suggest that DOE consider for its energy use analysis currently available models, such as the Climax VS12.

In the screening, DOE opted to include variable speed compressors as a technology option for portable air conditioners; however, DOE was unable to identify any portable AC models that currently use this technology. We agree with DOE's decision to include variable speed compressor technology. In support of DOE's decision, we suggest that DOE consider commercially available models, such as the Climax VS12, in its energy use analysis.[5]

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[2] 81 FR 38338 (June 13, 2016).
[3] 80 FR 10212 (February 25, 2015).
[4] T. Burke, et al., Using Field-Metered Data to Quantify Annual Energy Use of Portable Air Conditioners, Lawrence Berkeley National Laboratory, Report No. LBNL–6868E, December 2014.
[5] "Highest Efficiency Portable Air Conditioner," *Hotspot Energy*, http://www.hotspotenergy.com/portable-air-conditioner/

4) We disagree with DOE's decision to screen out alternative refrigerants as a technology option, because the most common refrigerant for portable air conditioners (R-410A) will likely be prohibited in California and Europe in favor of more efficient alternatives by the 2021 effective date.

In the 2015 preliminary technical support document (PTSD),[6] DOE considered alternative refrigerants as a technology option for portable ACs since the Significant New Alternatives Policy (SNAP) final rule, published by the Environmental Protection Agency (EPA), approved the use of R-290 (propane) and R-32 refrigerants for portable ACs. Since then, the Underwriters Laboratory (UL) updated its standard for room ACs, limiting the allowable quantity of flammable and mildly-flammable refrigerants. DOE concluded in the NOPR that no commercially available portable ACs meet the UL standard, and thus ruled out alternative refrigerants as a technology option. We disagree with this decision, because it does not accurately reflect the likely state of the industry in 2021, the potential effective year of the standard.

DOE should consider the 2016 strategy proposal by the California Air Resources Board (CARB) that is likely to push the industry towards using the more efficient refrigerants, such as R-32 and R-290.[7] This climate pollutant reduction strategy proposes to limit the 100-year global warming potential (GWP) of refrigerants in portable ACs to 750, and will also be effective in 2021. The proposal effectively prohibits the sale of portable ACs that use the R-410A refrigerant in California. The authors of the proposal note that AC refrigerants are likely to meet this requirement due to a fluorinated greenhouse gas regulation[8] by the European Union (EU) and a White House Council on Environmental Quality pledge of $5 billion over the next ten years in research of low-GWP refrigerants for refrigerators and air conditioning equipment.[9]

While the 2016 CARB strategy is still in the proposal stage, the EU regulation will take effect in 2020. Article 11 of this regulation prohibits placing on the market any "movable room air-conditioning equipment" that contains hydrofluorocarbon (HFC) refrigerants with GWP of 150 or more. The regulation would likely prohibit both R-410A and R-32. In response, manufacturers have begun producing portable ACs using R-290, such as the DeLonghi Pinguino ECO100[10] and an unnamed model by the manufacturer Gree,[11] which is claimed to be 10 percent more efficient than its R-410A counterpart.

In spite of these upcoming regulations, DOE should consider models already utilizing the R-32 refrigerant, such as the Cooper & Hunter CH-M09K6S[12] and Qlima P426[13]. These models would meet both CARB and UL requirements. DOE should test these models when determining the maximum observed performance ratio (PR) used for Trial Standard Level (TSL) 3.

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[6] EERE-2013-BT-STD-0033-0007, February 18, 2015, Preliminary Technical Support Document.
[7] http://www.arb.ca.gov/cc/shortlived/meetings/04112016/proposedstrategy.pdf
[8] EU Regulation No. 517/2014. See also: http://ec.europa.eu/clima/policies/f-gas/index_en.htm.
[9] https://www.whitehouse.gov/the-press-office/2014/09/16/fact-sheet-obama-administration-partners-private-sector-new-commitments-
[10] http://www.delonghi.com/en-au/products/comfort/air-conditioning/portable-air-conditioners/pinguino-air-to-air-pac-a100-eco
[11] http://www.hydrocarbons21.com/articles/3388/gree_expands_r290_portfolio_with_portable_acs_and_dehumidifiers
[12] http://cooperandhunter.com/bd/product/portable-air-conditioner-ch-m09k6s/
[13] http://www.atompolska.pl/download.html?id=99006780051216a7edd4c5af0fb7a8112e4f61f3

5) We support DOE's decision to use room AC data in the absence of portable AC data for the energy use analysis. In using room AC data, we encourage DOE to use the most recent data and the most likely projections.

For its energy use analysis, DOE used the operating hours of room ACs as a proxy for that of portable ACs. In the absence of portable AC data, we support this decision since both products serve the same primary utility of cooling and may often be used interchangeably. However, DOE should first consider the 2012 California Lighting and Appliance Saturation Study,[14] which includes data on portable ACs. The data may be useful for identifying for portable ACs efficiency or saturation trends relative to room ACs or other home characteristics.

When using room AC data, DOE should use the most recent data. In the NOPR, DOE used the 2003 Commercial Building Energy Consumption Survey (CBECS), published by the Energy Information Agency (EIA), to determine the operating hours of commercial portable ACs. Since the publication of this notice, the 2012 CBECS has become publicly available. DOE should revise its analysis using the updated CBECS 2012.

In addition, DOE used the 2009 Residential Energy Consumption Survey (RECS) to determine the operating hours of residential portable ACs. DOE limited the data to homes having an average room size less than 1000 square feet, the maximum suggested room size for portable ACs. In determining the average room size of homes in RECS, DOE should refer to a 2013 study by the National Association of Home Builders (NAHB) to estimate the average size of the rooms within the household.[15] By dividing the total cooled floor area by the number of rooms in the current analysis, DOE may be overestimating the average room size, thereby limiting the sample size used for this analysis.

Lastly, DOE used a 115-year historic average number of cooling degree-days as an adjustment factor when determining the hours of operation from 2009 RECS. This adjustment decreased the calculated energy use by 10 percent on average. Since the annual cooling degree-days has steadily increased over the last century, we suggest that DOE use a *projected* 2021 cooling degree-days adjustment instead of the historical average.

6) We recommend DOE adopt TSL 3, which ensures that products previously tested as having negative cooling capacities are not able to meet the standards.

In the 2014 Notice of Data Availability (NODA) for portable ACs test procedures, DOE conducted a "calorimeter" test on several portable air conditioners, which was based on ANSI/ASHRAE Standard 16–1983.[16] The results indicated that some units have very low or negative cooling capacities, which DOE concluded is due to infiltration air. Results notwithstanding, DOE ruled in favor of the modified AHAM/PAC–1–2015 test, citing that the calorimeter test would be too large of a burden on manufacturers, a reason that is impertinent to the accuracy of the test results.

In the June 2016 final rule for the portable ACs test procedure, DOE modified the testing parameters such that the outdoor ambient temperature is heavily weighted towards a lower value, greatly diminishing the measured effect of infiltration air.[17] As a result, units that produced low or negative cooling capacities when tested by the "calorimeter" method show an increased capacity when tested under the final test procedure. Specifically, DOE test samples SD5 and SD15 had previously measured cooling capacities of

[14] https://webtools.dnvgl.com/projects62/Default.aspx?tabid=190
[15] https://www.nahb.org/en/research/housing-economics/special-studies/spaces-in-new-homes-2013.aspx
[16] 79 FR 26639 (May 9, 2014)
[17] 81 FR 35242 (June 1, 2016)

150 and minus 2,450 BTU per hour, respectively. These same units would meet the efficiency levels proposed under TSL 2. Therefore, and in conjunction with all of the comments presented in this letter, we recommend that DOE adopt TSL 3, an economically justified efficiency standard that would ensure that only portable ACs utilizing efficient technology options, such as alternative refrigerants, are able to meet the standard.

In conclusion, we would like to reiterate our support to DOE for establishing standards for portable ACs. We thank DOE for the opportunity to be involved in this process and encourage DOE to carefully consider the recommendations outlined in this letter.

Sincerely,

Patrick Eilert
Manager, Codes & Standards
Pacific Gas and Electric Company

Sue Kristjansson
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Southern California Gas Company

Michelle Thomas
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Chip Fox
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Appendix D: Efficiency Advocate Comment Letter from U.S. DOE Rulemaking

Appliance Standards Awareness Project
Alliance to Save Energy
American Council for an Energy-Efficient Economy
National Consumer Law Center
Natural Resources Defense Council
Northeast Energy Efficiency Partnerships
Northwest Energy Efficiency Alliance

September 26, 2016

Mr. Bryan Berringer
U.S. Department of Energy
Building Technologies Program
Mailstop EE-5B
1000 Independence Avenue, SW
Washington, DC 20585

RE: Docket Number EERE–2013–BT–STD–0033/RIN 1904–AD02: Notice of Proposed Rulemaking for Portable Air Conditioners

Dear Mr. Berringer:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), Alliance to Save Energy, American Council for an Energy-Efficient Economy (ACEEE), National Consumer Law Center (NCLC), Natural Resources Defense Council (NRDC), Northeast Energy Efficiency Partnerships (NEEP), and Northwest Energy Efficiency Alliance (NEEA) on the notice of proposed rulemaking (NOPR) for portable air conditioners. 81 Fed. Reg. 38398 (June 13, 2016). We appreciate the opportunity to provide input to the Department.

We urge DOE to adopt TSL 3. In the NOPR, DOE proposes to adopt TSL 2. DOE estimates that the proposed standard would save 0.53 quads of energy and net savings of $2.2-5.2 billion for consumers. However, TSL 3 would increase both national energy savings and NPV savings by 50% to 0.78 quads and $3.2-7.6 billion.[1] As we describe below, we believe that DOE's concerns regarding the availability of high-efficiency compressors to meet higher efficiency levels are unwarranted. Further, there are multiple ways to improve the efficiency of portable ACs that are not captured in the analysis, including the use of alternative refrigerants, and yet manufacturers will be able to use these technology options to help meet the standard. We urge DOE in the final rule to adopt TSL 3, which can be met by the most-efficient units available on the market today.[2] We also note that TSL 4, which would save 1.15 quads, would maximize savings for consumers, with average LCC savings of $276 and NPV savings of $4.5-10.6 billion.

We believe that DOE's concerns regarding the availability of high-efficiency compressors to meet higher efficiency levels are unwarranted. In the NOPR, in rejecting TSLs 3 and 4, DOE raises the concern that the high-efficiency compressors needed to meet TSLs 3 and 4 "may

[1] 81 Fed. Reg. 38446.
[2] 81 Fed. Reg. 38436.

not be available to all manufacturers for the full range of capacities of portable ACs." DOE further states that "because high-efficiency components available at any given time are driven largely by the markets for other products with higher shipments (e.g., room ACs), portable AC manufacturers may be constrained in their design choices."[3] We believe that DOE's concerns regarding the availability of high-efficiency compressors to meet higher efficiency levels are unwarranted for several reasons.

First, because portable ACs are a newly covered product, which means the lead time between the publication of the final rule and the compliance date will be 5 years, the likely compliance date will not be until late 2021 or early 2022.[4] Manufacturers and component suppliers, including compressor manufacturers, will have 5 years to develop new products and components. Second, while DOE notes that the availability of high-efficiency components is often driven by markets for other products with higher shipments, the markets for both room ACs and dehumidifiers in fact will likely drive increased production of high-efficiency compressors. The next room AC standard is scheduled to take effect no later than 2022,[5] which as noted above is roughly when the portable AC standard will take effect. And DOE is funding a project conducted by Oak Ridge National Laboratory (ORNL) in partnership with GE to develop a 13 EER room AC.[6] Dehumidifiers also use similar components as portable ACs. A new ENERGY STAR specification for dehumidifiers that will take effect later this year is roughly equivalent to the max-tech level for small dehumidifiers in the recent DOE rulemaking.[7] Since 2010, the market penetration of ENERGY STAR certified dehumidifiers has been no lower than 84%,[8] and so we would expect a similarly high portion of sales to meet the new 2016 ENERGY STAR dehumidifier specification. And there are dehumidifiers listed in the DOE certification compliance database with efficiency levels that significantly exceed the new ENERGY STAR specification.[9]

Finally, it is important to note that available compressor efficiencies are not fixed in time. For example, in the 2011 final rule for room air conditioners, DOE found that the maximum available efficiency of single-speed R-410A compressors was 10.0 Btu/Wh.[10] At the time of the preliminary analysis for portable ACs, DOE found that the maximum available compressor

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[3] 81 Fed. Reg. 38448.

[4] Assuming the final rule is published in late 2016 or early 2017.

[5] Based on the 6-year review provision, DOE must publish a proposed rule or a determination that no change is warranted by April 2017 and a final rule no later than two years later. The standard would take effect 3 years after publication of the final rule, or no later than April 2022.

[6] http://energy.gov/eere/buildings/downloads/13-energy-efficiency-ratio-window-air-conditioner.

[7] The new ENERGY STAR dehumidifier specification, effective October 25, 2016, is 2.00 EF for units with capacities less than 75 pints/day (as measured by the current test procedure). The max-tech level in the 2016 final rule for dehumidifiers with capacities less than 25 pints/day (as measured by the new test procedure) is 1.57 IEF, which DOE found is equivalent to 2.01 EF as measured by the current test procedure. See: https://www.energystar.gov/sites/default/files/ENERGY%20STAR_Dehumidifiers_V4%200_Specification_Final.pdf; Final Rule Technical Support Document for Dehumidifiers. Document ID: EERE-2012-BT-STD-0027-0046. p. 5-10; and NOPR Technical Support Document for Dehumidifiers. Document ID: EERE-2012-BT-STD-0027-0030. p. 8-31.

[8] ENERGY STAR Unit Shipment Data. https://www.energystar.gov/index.cfm?c=partners.unit_shipment_data.

[9] Bionaire has two units listed with efficiencies of 2.2 and 2.39 EF. https://www.regulations.doe.gov/certification-data/CCMS-41431694081.html#q=Product_Group_s%3A%22Dehumidifiers%22.

[10] Final Rule Technical Support Document for Clothes Dryers and Room Air Conditioners. Document ID: EERE-2007-BT-STD-0010-0053. p. 5-117. For capacities below 15,000 Btu/h.

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efficiency was 10.5 Btu/Wh, while at the time of the NOPR analysis the maximum compressor efficiency had increased to 11.1 Btu/Wh.[11] Therefore, it is reasonable to expect that the available efficiencies of both single-speed and variable-speed compressors will increase in the years before the standard takes effect.

In sum, we believe that the long lead time before the portable AC standard takes effect along with multiple market drivers will ensure adequate availability of high-efficiency compressors to meet higher efficiency levels.

We believe DOE improperly screened out alternative refrigerants as a technology option. In the analysis for the NOPR, DOE screened out alternative refrigerants, including propane and R-32, as a technology option. DOE's rationale for screening out propane is that the new UL charge limits make propane infeasible, while for R-32, the NOPR states that "DOE is aware of very few portable or room ACs available commercially in other markets that utilize the mildly flammable R–32."[12] We believe that DOE's decision to screen out alternative refrigerants was inappropriate.

The NOPR notes that "propane refrigerant is widely used for portable ACs manufactured and sold internationally,"[13] and the Technical Support Document (TSD) notes that "one manufacturer claims to have achieved a 10-percent portable AC efficiency improvement using propane."[14]As DOE notes in the NOPR, EPA's Significant New Alternatives Policy (SNAP) Program has approved alternative refrigerants, including propane, in sufficient quantities for manufacturers to make portable ACs with those refrigerants.[15] And while UL's revised charge limits for propane are not feasible for providing adequate cooling capacity, UL certification has failed to become industry standard for portable ACs. TopTenReviews' list of 10 "2016 Best" portable ACs includes 4 units that are not UL certified.[16]

Perhaps more importantly, R-32 may be the most likely future refrigerant for the US portable AC market as it presents the simplest transition away from high global warming potential R-410A. And unlike for propane, the charge limits for R-32 in the latest edition of UL 484 are sufficiently high such that R-32 can be used and UL certified across the full range of portable AC capacities. While DOE screened out R-32 due to the limited number of commercially-available portable or room ACs in other markets that use R-32, in other markets UL's charge limitations do not apply, allowing manufacturers to use hydrocarbon refrigerants. And there are, in fact, already several portable ACs on the market using R-32,[17] which demonstrates that R-32 is technologically feasible for portable ACs. Daikin/Amana claims a 10% reduction in energy use using R-32 in PTACs.[18] And ORNL found that R-32 demonstrates a higher COP than R-410A in mini-split

[11] Technical Support Document. p. 5-23.
[12] 81 Fed. Reg. 38411-12.
[13] 81 Fed. Reg. 38410.
[14] Technical Support Document. p. 3-23.
[15] 81 Fed. Reg. 38411.
[16] http://www.toptenreviews.com/home/hvac/best-portable-air-conditioners.
[17] See, for example: http://cooperandhunter.com/bd/product/portable-air-conditioner-ch-m09k6s/ and http://www.atompolska.pl/download.html?id=99006780051216a7edd4c5af0fb7a8112e4f61f3.
[18] http://www.amana-ptac.com/r32.

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ACs engineered for R-410A by 1-6% across a range of test conditions.[19] Portable ACs designed for R-32 should be capable of outperforming R-410A by an even higher margin.

While DOE's analysis has not captured the potential efficiency gains from alternative refrigerants, manufacturers will have the option of using alternative refrigerants—in particular R-32—to help meet the standard. Using alternative refrigerants with improved efficiency performance would mean that manufacturers would not need to utilize all of the design options assumed in DOE's analysis to meet a given standard level.

In addition to alternative refrigerants, there are also other ways to improve the efficiency of portable ACs that similarly are not captured in the analysis. In particular, the engineering analysis for the NOPR did not consider potential efficiency gains from microchannel heat exchangers, reducing air infiltration, or improving duct connections. DOE notes in the TSD that research performed in 2006 found that the use of microchannel condensers can result in a 6-10% increase in COP, and additional research for mobile air conditioning indicated that microchannel heat exchangers can increase COP by 8%.[20]

DOE states in the NOPR that under testing according to the test procedures final rule, "air flow optimization that would lead to zero infiltration air is no longer associated with improved efficiencies."[21] We recognize that compared to the test procedures NOPR, the impact of infiltration on measured efficiency based on the test procedures final rule is significantly reduced. However, we would expect that reducing infiltration air would improve measured efficiency to some extent, in particular at the 95 F ambient test condition. Finally, DOE notes in the TSD that "the duct connections at the window mounting bracket or portable AC are often not well sealed." While DOE was not able to incorporate improved duct connections as a technology option in the analysis due to a lack of data, manufacturers may be able to improve duct connections as a way to improve efficiency.

As with alternative refrigerants, while DOE's analysis has not captured the potential efficiency gains from additional technology options such as microchannel heat exchangers, reducing air infiltration, and improving duct connections, manufacturers may be able to use these additional technology options to help meet the standard. And as with alternative refrigerants, using these additional technology options would mean that manufacturers would not need to utilize all of the design options assumed in DOE's analysis to meet a given standard level.

We continue to strongly support a single product class for portable ACs. We agree with DOE's conclusion that there is "no unique consumer utility associated with the number of ducts for portable ACs that would warrant a division of single-duct and dual-duct units into separate product classes."[22] DOE found that "all window fixtures are of sufficient width to accommodate connections to two ducts" and that there is no correlation between noise levels and duct configuration. DOE also estimated that a dual-duct portable AC would be less than 5 pounds heavier than a comparable single-duct unit with the same capacity, which would not impact

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[19] http://energy.gov/sites/prod/files/2015/10/f27/bto_pub59157_101515.pdf. p. xviii.
[20] Technical Support Document. p. 3-19.
[21] 81 Fed. Reg. 38416.
[22] 81 Fed. Reg. 38410.

portability, especially since all units have wheels.[23] The NOPR also notes that "no manufacturer could identify a situation in which a dual-duct portable AC could not be installed in the same location as a single-duct portable AC."[24] Further, DOE found that there is no correlation between duct configuration and efficiency.[25]

The consideration of additional heat exchanger area increases represents a significant improvement to the analysis. In the preliminary analysis, DOE limited heat exchanger area increases to 10%.[26] For the NOPR, DOE further evaluated the heat exchanger areas as a function of capacity for units in the Department's test sample and found that the heat exchanger areas ranged from approximately 20% below to 20% above the average trend.[27] We agree with DOE's conclusion that these data suggest that heat exchanger areas can be increased beyond what DOE estimated for the preliminary analysis. The incorporation of a 20% increase in heat exchanger area represents a significant improvement to the analysis in order to better capture the full range of potential efficiency improvements.

The incorporation of variable-speed compressors in the engineering analysis represents another significant improvement to the analysis. In the preliminary analysis, DOE did not consider variable-speed compressors in the engineering analysis based on the rationale that they would have no measurable impact on efficiency since portable ACs would be tested under constant ambient conditions.[28] In the NOPR, DOE correctly notes that variable-speed compressors offer improved efficiency not just under varying conditions but also at full load.[29] DOE found that while the current maximum efficiency for single-speed rotary R-410A compressors is 11.1 Btu/Wh, variable-speed compressors are available with efficiencies as high as 13.7 Btu/Wh.[30] The incorporation of variable-speed compressors in the engineering analysis represents another significant improvement to the analysis in order to better capture the full range of potential efficiency improvements.

The assumed cooling mode hours appear to be reasonable. For the analysis for the NOPR, DOE assumed that cooling mode operating hours for portable ACs are the same as those for room ACs.[31] In the absence of other data, it is reasonable to assume the same cooling mode hours for portable ACs as for room ACs since portable ACs are often used in place of room ACs, such as when window configurations or building regulations prevent the installation of room ACs.[32] We also note that DOE conducted a sensitivity analysis where cooling mode hours were assumed to be 50% of those of room ACs. We do not believe that it is realistic to assume that the cooling mode hours of portable ACs are only half of those of room ACs. Nevertheless, even with

[23] Technical Support Document. p. 3-2.
[24] 81 Fed. Reg. 38431.
[25] Technical Support Document. p. 3-2.
[26] 81 Fed. Reg. 38412.
[27] Technical Support Document. p. 5-22.
[28] Preliminary Technical Support Document. Document ID: EERE-2013-BT-STD-0033-0007. p. 5-22.
[29] 81 Fed. Reg. 38412.
[30] Technical Support Document. p. 5-23.
[31] Technical Support Document. p. 7-4.
[32] http://www.consumerreports.org/cro/news/2014/06/are-portableair-conditioner-claims-a-lot-of-hot-air/index.htm.

this assumption, DOE still found all evaluated efficiency levels to be cost effective for consumers, including the max-tech level.[33]

The average lifetime assumed in the analysis appears to be reasonable. For the analysis for the NOPR, DOE assumed that the lifetime distribution of portable ACs is the same as that of room ACs given similar mechanical components and uses.[34] We agree that in the absence of other data, it is reasonable to assume the same lifetime distribution of portable ACs as for room ACs given the similarity between the two products. We also note that portable dehumidifiers are very similar to portable ACs, as the two products share the same basic refrigeration system components and are both portable units placed inside a room. DOE estimates that the average lifetime of a portable dehumidifier (11 years)[35] is slightly longer than the average lifetime of a room AC (10 years). Therefore, DOE's assumption for the average lifetime of portable ACs may actually be conservative.

We support DOE's proposed certification reporting requirements. In the NOPR, DOE proposes that portable AC certification reports include CEER and SACC, duct configuration, presence of heating function, and primary condensate removal feature.[36] We support these proposed certification reporting requirements, which will provide useful information both to the public and to DOE for use in a future rulemaking.

Thank you for considering these comments.

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[33] Technical Support Document. pp. 8F-1, 8F-2.
[34] 81 Fed. Reg. 38425.
[35] Final Rule Technical Support Document for Dehumidifiers. Document ID: EERE-2012-BT-STD-0027-0046. p. 8-22.
[36] 81 Fed. Reg. 38450.

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