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SAVE FOR GOOD.

ENERGY STAR®
Most Efficient 2022 Update and 2023 Proposed Criteria

ENERGY STAR Most Efficient

Categories in 2023

- Ceiling and Ventilating Fans
- CAC/ASHP
- Clothes Washers
- Computer Monitors
- Dehumidifiers
- Dishwashers
- Dryers
- Geothermal Heat Pumps
- Refrigerators, Freezers, and Compact Products
- *NEW!* Room Air Cleaners
- Room Air Conditioners
- Windows and Sliding Glass Doors

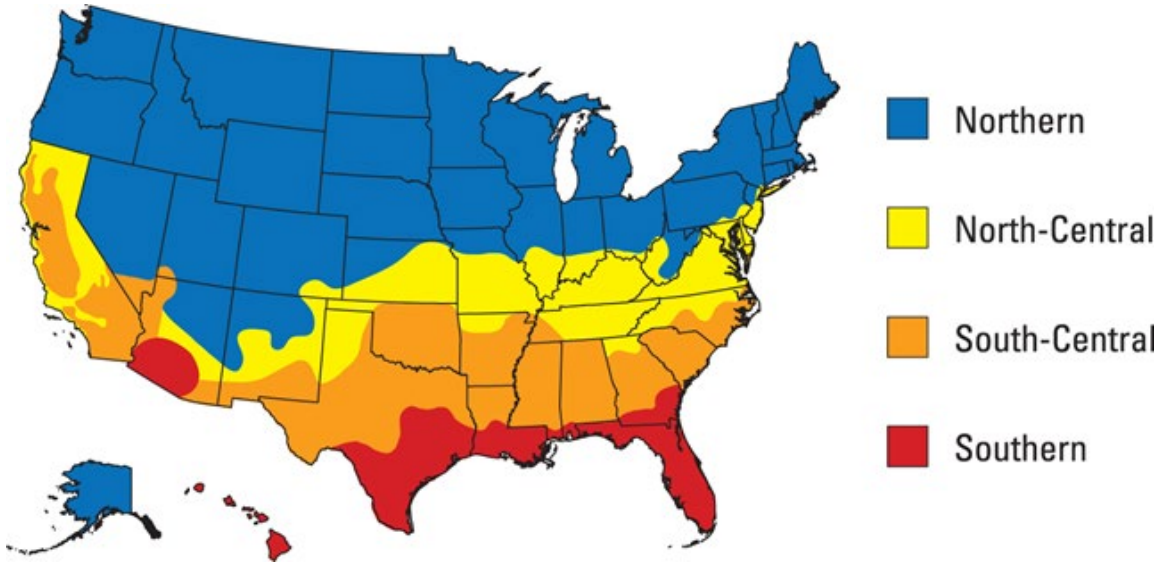
Draft 2023 ENERGY STAR Most Efficient Recognition Criteria and Rationale

Residential Windows and Sliding Glass Doors

- **2023 Proposal:**
  - Maintain current U-factor and SHGC criteria (No change)
  - Residential window and sliding glass door products only (No swinging doors, skylights, or TDDs)
- **Rationale:**
  - High Performance Most Efficient window and sliding glass door products are widely available; but still a relatively small slice of total market
    - 46 manufacturers
    - 532 ME product lines
  - The ENERGY STAR Windows Version 7.0 expected to complete in September 2022; EPA expects to re-evaluate Most Efficient levels for 2024.

Residential Windows and Sliding Glass Doors

Climate Zone	U-factor	SHGC
Northern	≤ 0.20	≥ 0.20
North-Central	≤ 0.20	≤ 0.40
South-Central	≤ 0.20	≤ 0.25
Southern	≤ 0.20	≤ 0.25



Computer Monitors

2023 Proposal: Maintain the current criteria

Total Energy Consumption (E_{TEC}) in kilowatt-hours per year shall be calculated as follows:

$$E_{TEC} = 8.76 \times (0.35 \times P_{ON} + 0.65 \times P_{SLEEP})$$

Where:
P_{ON} = measured On Mode power in watts; P_{SLEEP} = measured Sleep Mode power in watts;

Total Energy Consumption (E_{TEC}) shall be less than or equal to Maximum allowable Total Energy Consumption in kilowatt-hours per year calculated as follows:

$$E_{TEC_MAX} = (1.9 + (0.12 \times A) + [3.1 \times (r + C)]) \times eff_{AC_DC}$$

Where:

eff_{AC_DC} = 1.00 for AC-powered monitors
0.85 for DC-powered monitors

A= viewable screen area in square inches;
r = Total Native Resolution in megapixels; and

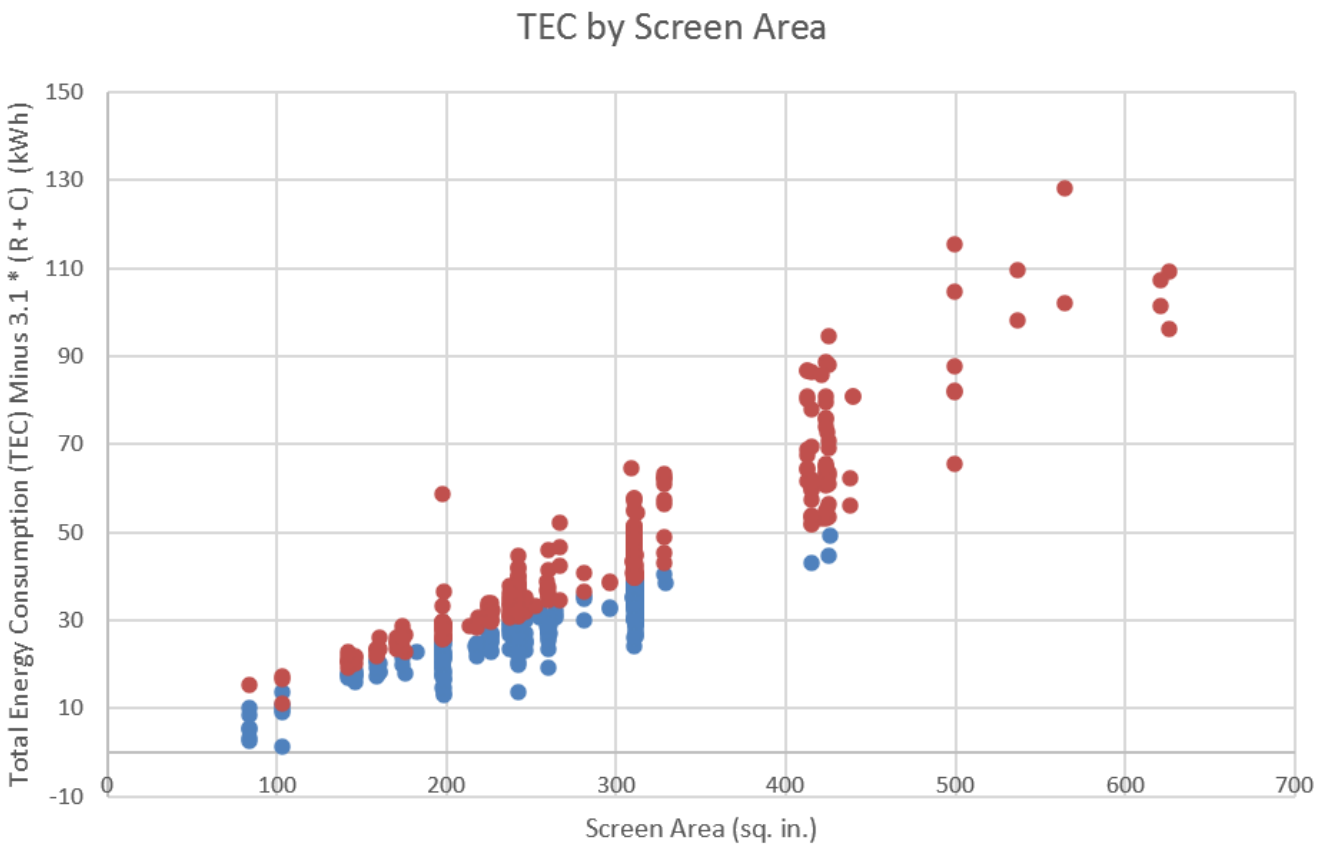
$$c = \begin{cases} 0 & \text{if } A < 180 \text{ in}^2 \text{ (previously 1.2)} \\ -0.2 & \text{if } 180 \text{ in}^2 \leq A < 220 \text{ in}^2 \text{ (previously 2.0)} \\ -1 & \text{if } A \geq 220 \text{ in}^2 \text{ (previously 1.2)} \end{cases}$$

Computer Monitors

- **Rationale:**
  - EPA proposes to maintain the recognition criteria for 2023 as the number of models in the market is steady since the last update.
  - Models in the QPL demonstrate significant energy savings and there has been no technology update due to chip shortage.
  - The proposed criteria follows the same Total Energy Consumed approach as the Version 8.0 specification.

Area	Monitors in Current ES QPL	Monitors Meeting ESME 2023	% Meeting ESME 2023
< 180 sq. in.	76	11	14%
180 - 220 sq. in.	134	12	9%
> 220 sq. in.	1260	82	7%
All	1470	105	7%

Computer Monitors



- ESME 2023
- Non-ESME 2023

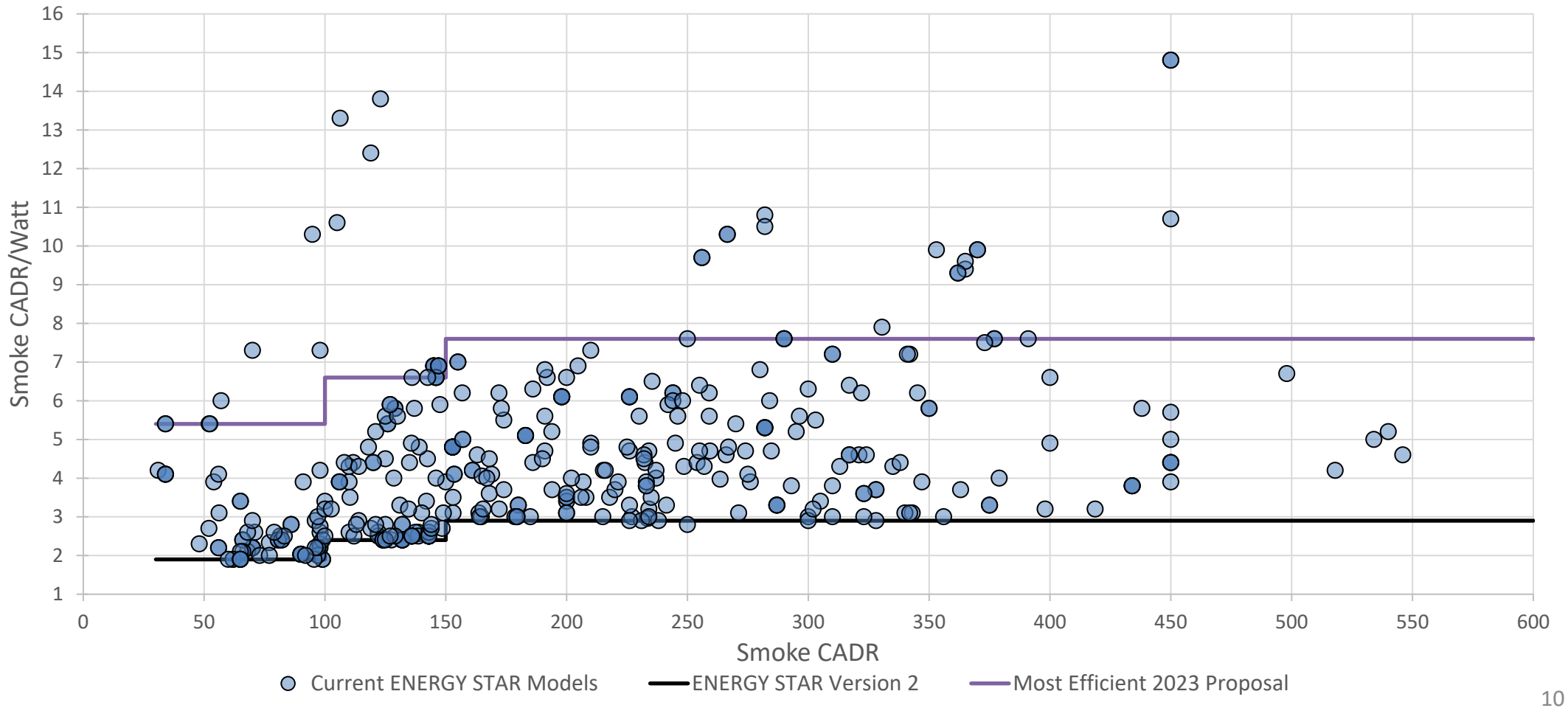
Room Air Cleaners

Smoke CADR Bins	Minimum Smoke CADR/W
30 ≤ Smoke CADR < 100	5.4
100 ≤ Smoke CADR < 150	6.6
150 ≤ Smoke CADR	7.6

- **2023 Proposal:**
  - Add Room Air Cleaners (RACLs) to the ENERGY STAR Most Efficient portfolio

- **Rationale:**
  - Technology break within ENERGY STAR certified models
    - Currently, 392 base models from 96 brands are ENERGY STAR
  - Tremendous growth in shipments over the past couple of years due to COVID and wildfires
  - ENERGY STAR Retail Products Platform (ESRPP) includes RACLs; ENERGY STAR Most Efficient recognition would support these efforts
  - A RACL meeting the ENERGY STAR Most Efficient proposals saves 65-72% in energy compared to ENERGY STAR Version 1.2, the level used in numerous state standards.

Room Air Cleaners – Reported Values



Room Air Cleaners – Product Count & Savings

- EPA used the current ENERGY STAR model count as a baseline for total model counts because currently, there is no public source for total model counts in the U.S.
- The ENERGY STAR market share is 50%, meaning 6% of all models would meet the proposed Most Efficient criteria.
- Using ENERGY STAR Version 1.2 as baseline, the savings are significant at 314 kWh/yr saving $41 in operating costs annually.

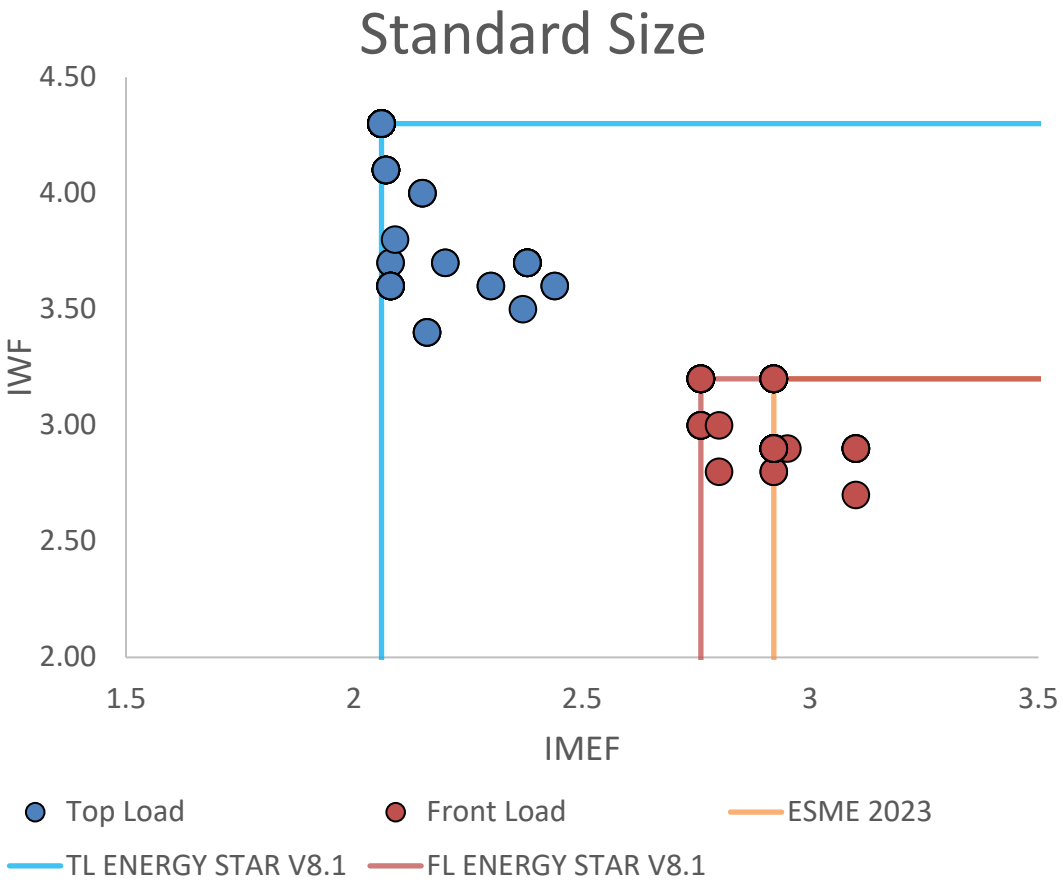
Product Count	Number of Models	% of all Models	Number of Brands
Estimated Total Models (Baseline)	392	100%	--
Version 2.0 ENERGY STAR	392	100%	96
2023 Most Efficient Criteria	47	12.0%	24

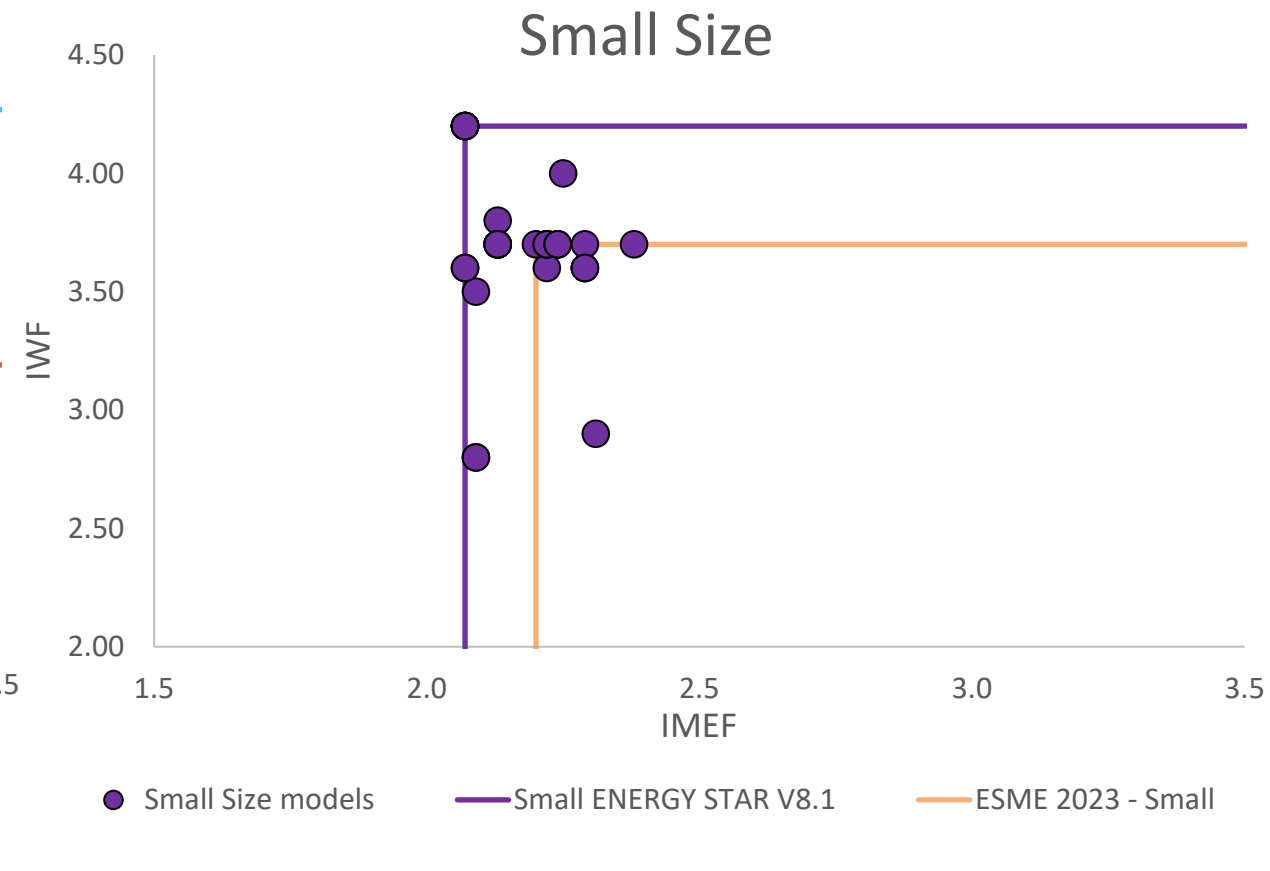
Product Class Weighted Savings	Annual Energy Savings (kWh/yr)	% Better than Baseline (%)	Annual Cost Savings ($)
Version 1.2 ENERGY STAR (Baseline)	--	--	--
2023 Most Efficient Criteria Proposal	314	72%	$41

Clothes Washers

- **2023 Proposal:**
  - Maintain current energy and water criteria for clothes washers:
    - ≤2.5 cu-ft: IMEF ≥ 2.2, IWF ≤ 3.7
    - >2.5 cu-ft: IMEF ≥ 2.92, IWF ≤ 3.2
    - Total Cleaning Score (CS_t) ≥ 85
  - Laundry centers must meet the ENERGY STAR Most Efficient criteria for both washers and dryers
- **Rationale:**
  - The number of models/brands remain steady from previous year
    - 20 models from 6 brands (Blomberg, Bosch, Electrolux, Kenmore, LG, and Samsung)
  - Criteria continues to provide significant average energy and water savings:
    - Large volume: 43% less energy and 46% less water than a conventional model
    - Small volume: 24% less energy and 37% less water than a conventional model
  - The ENERGY STAR Retail Products Platform (ESRPP) currently incentivizes washers at this level for their advanced tier

Clothes Washers





Clothes Dryers

- **2023 Proposal:**
  - Maintain current criteria for all dryer product types

Cycle Setting	Product Type	CEF_{BASE} (lbs/kWh)
Normal	Compact Ventless Electric (240V)	≥ 3.7
	Electric (all other)	≥ 4.30
	Gas	≥ 3.80
Normal, Maximum Dryness	Compact Ventless Electric (240V)	≥ 2.68
	Electric (all other)	≥ 3.93
	Gas	≥ 3.48

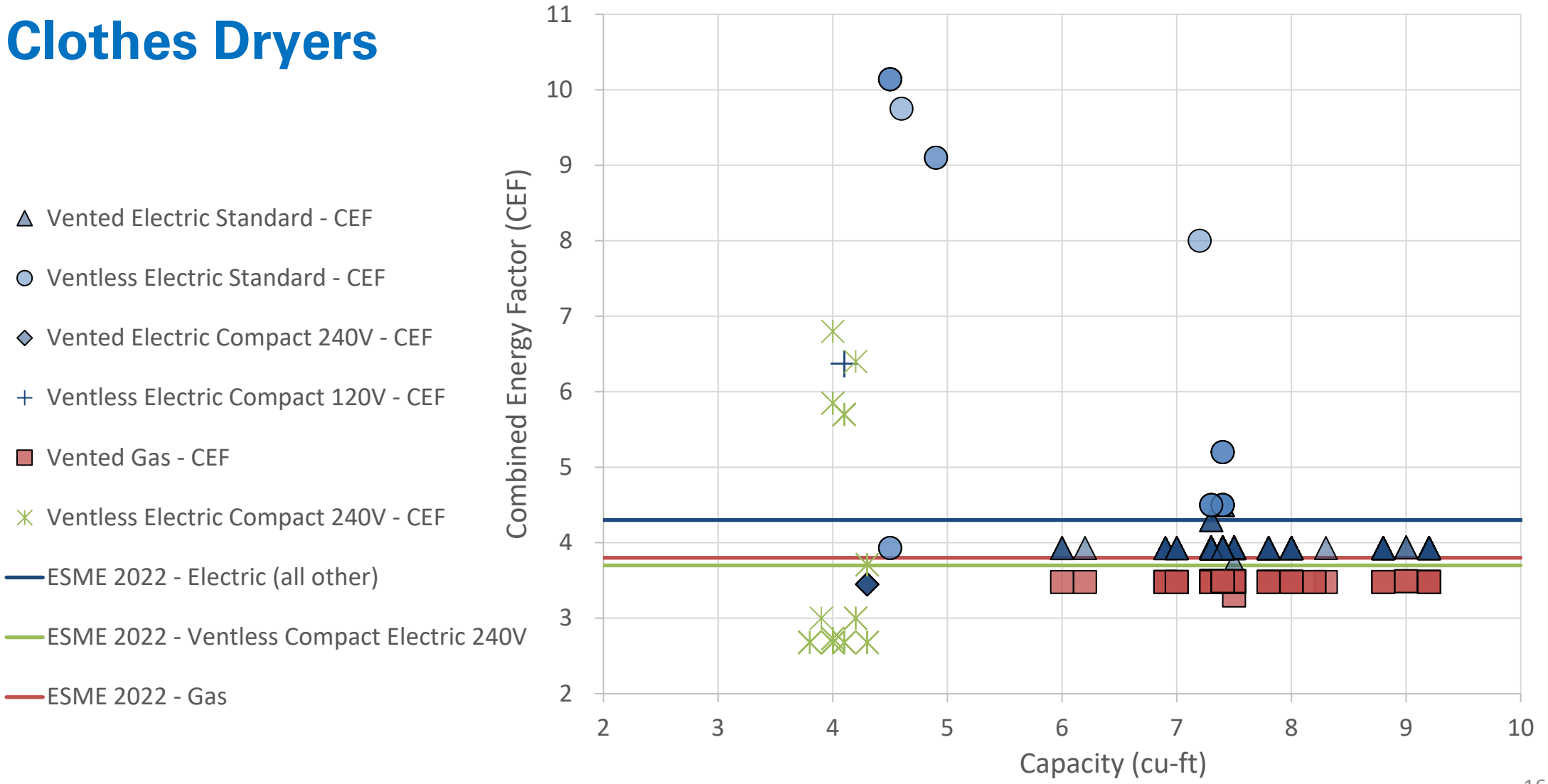
  - The criteria requires testing at 2 cycles/settings:
    - Testing at Normal Cycle, Max Temp, Medium Dry (per DOE Test Method requirements)
    - Testing at Normal Cycle, Max Temp, Max Dry (per ESME requirements)

Clothes Dryers

- **Rationale:**
  - The number of models/brands remain steady from previous year
    - 30 base models from 8 brands (Asko, Beko, Blomberg, Bosch, LG, Miele, Samsung, Whirlpool) meet criteria
  - Criteria for clothes dryers continues to provide significant savings over federal minimum
    - Standard-sized electric models save 28% energy
    - Compact models save 30-51% energy
    - Gas models save 25% energy
  - ESRPP currently incentivizes dryers at this level for their advanced tier

- **Additional info:**
  - Heat pump or hybrid heat pump technologies and refrigerants are identified on the QPL
    - EPA encourages partners to complete these optional field during certification; enables utilities to easily incentivize

Clothes Dryers



Refrigerators

- **2023 Proposal – Top Freezers**
  - Maintain current criteria for Top Freezers
    - ≥ 10% more efficient than the Federal minimum
  - Optional reporting of refrigerant type

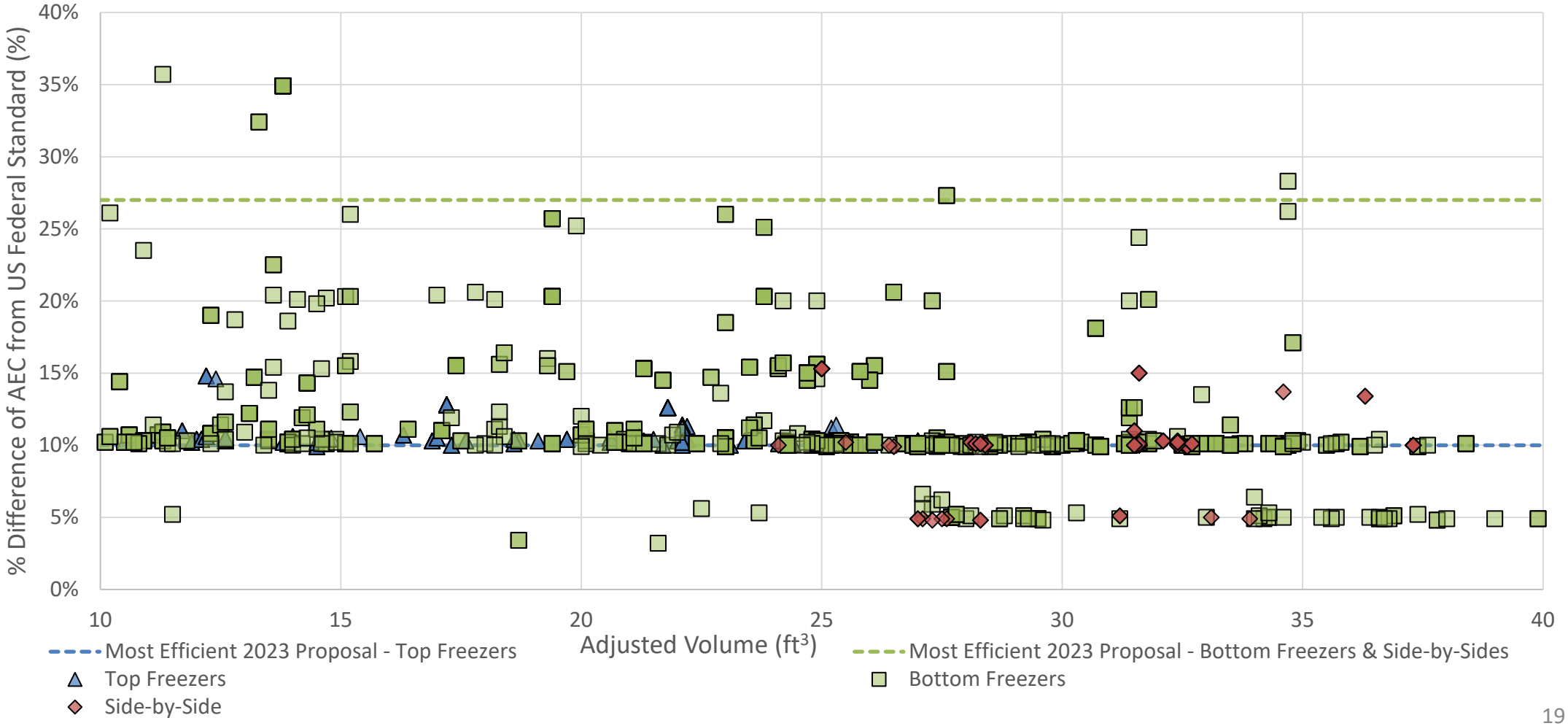
- **Rationale:**
  - Top Freezers remain the lowest energy-consuming standard-size refrigerator-freezer product type
  - Criteria recognizes 196 base models from 47 brands
  - ESRPP currently incentivizes refrigerators at this level for their basic tier

Refrigerators

- **2023 Proposal – Side-by-Side and Bottom Freezers**
  - Maintain the criteria for Side-by-Side and Bottom Freezer product types
    - ≥ 27% more efficient than the Federal minimum
  - Optional reporting of refrigerant type

- **Rationale:**
  - EPA's current Emerging Technology Award (2020 – 2021) recognizes refrigerators with advanced adaptive compressors that can meet a level similar to 2022 ENERGY STAR Most Efficient criteria
    - ETA QPL features 71 bottom freezers and side-by-side models that meet ETA criteria.
    - ESRPP currently incentivizes refrigerators at this level for their advanced tier
  - EPA launched the JUMP initiative in 2020 in response to manufacturers showing interest in bringing refrigerators that are 30% better than federal standards to the US market
    - In response to increased efficiency requirements in EU in 2021
    - EEPS have shown high interest in incenting refrigerators at these advanced levels
  - 8 base models from 6 brands that currently meet proposed criteria

Refrigerators - % Annual Energy Consumption Better than Federal Standard

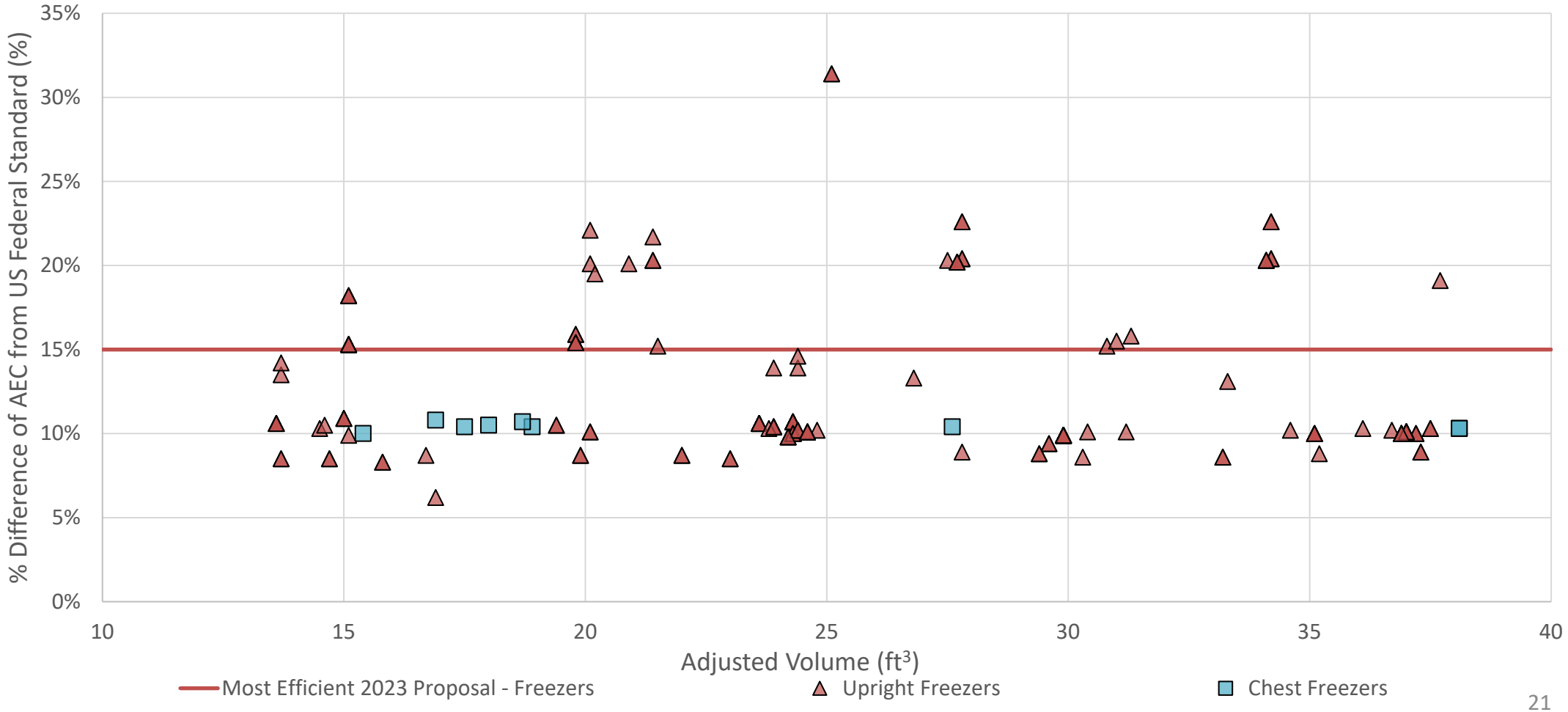


Freezers

- **2023 Proposal:**
  - Maintain criteria for standard-size Upright Freezers and Chest Freezers
    - ≥ 15% more efficient than the Federal minimum
  - Optional reporting of refrigerant type

- **Rationale:**
  - The number of models/brands remain steady from previous year
    - 12 Upright Freezer and Chest Freezer base models from 5 brands that meet the criteria
  - ESRPP currently incentivizes freezers for their advanced tier

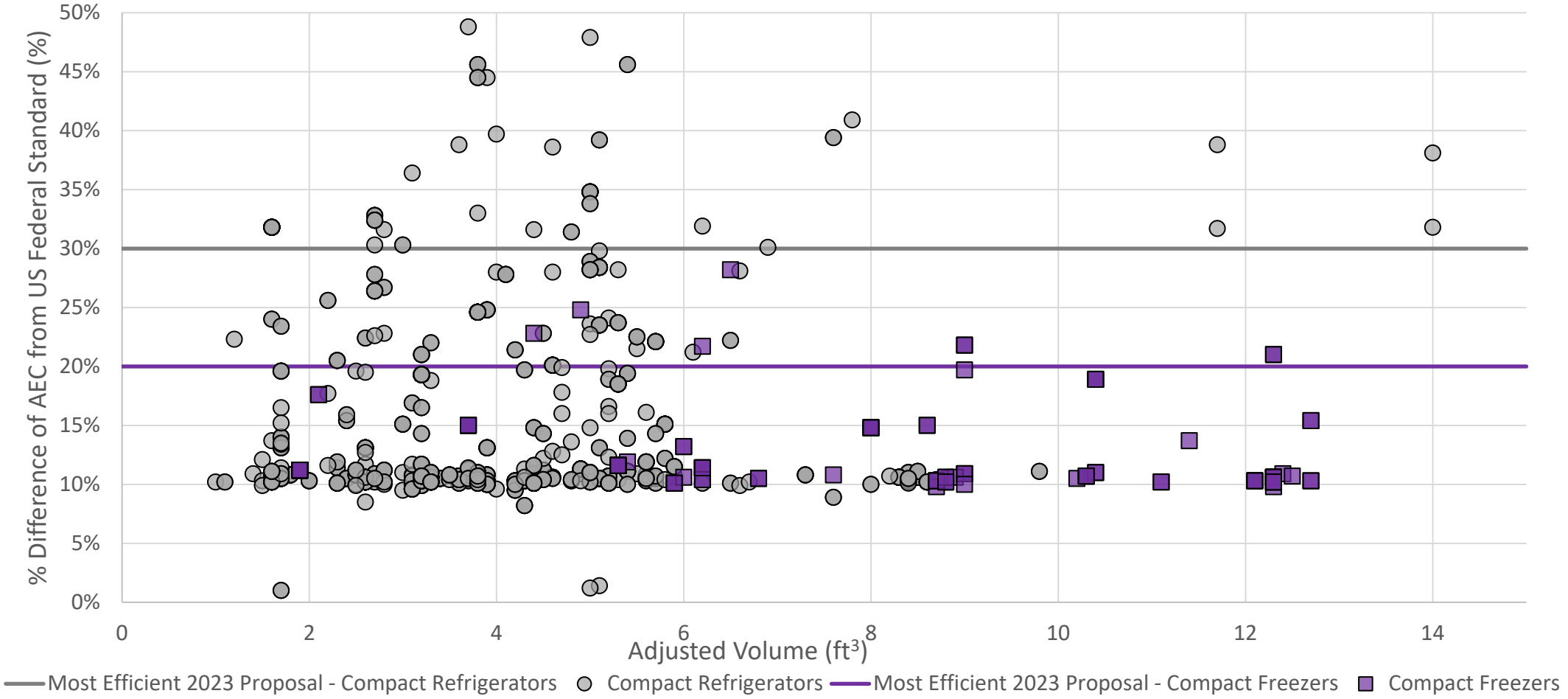
Freezers - % Annual Energy Consumption Better than Federal Standard



Compact Refrigerators and Freezers

- **2022 Proposal:**
  - Maintain criteria for compact Refrigerators and Refrigerator-Freezers
    - ≥ 30% more efficient than the Federal minimum for compact Refrigerators and Refrigerator-Freezers
  - Maintain criteria for compact Freezer product types
    - ≥ 20% more efficient than the Federal minimum for compact Freezers
  - Optional reporting of refrigerant type
- **Rationale:**
  - The number of compact Refrigerator and Refrigerator-Freezer models/brands remain steady from last year.
    - 44 compact Refrigerator and Refrigerator-Freezer base models from 24 brands
    - 8 compact Freezer base models from 6 brands
  - ESRPP currently incentivizes compact refrigerators at this level for advanced tier.

Compact Refrigerators & Freezers - % Annual Energy Consumption Better than Federal Standard

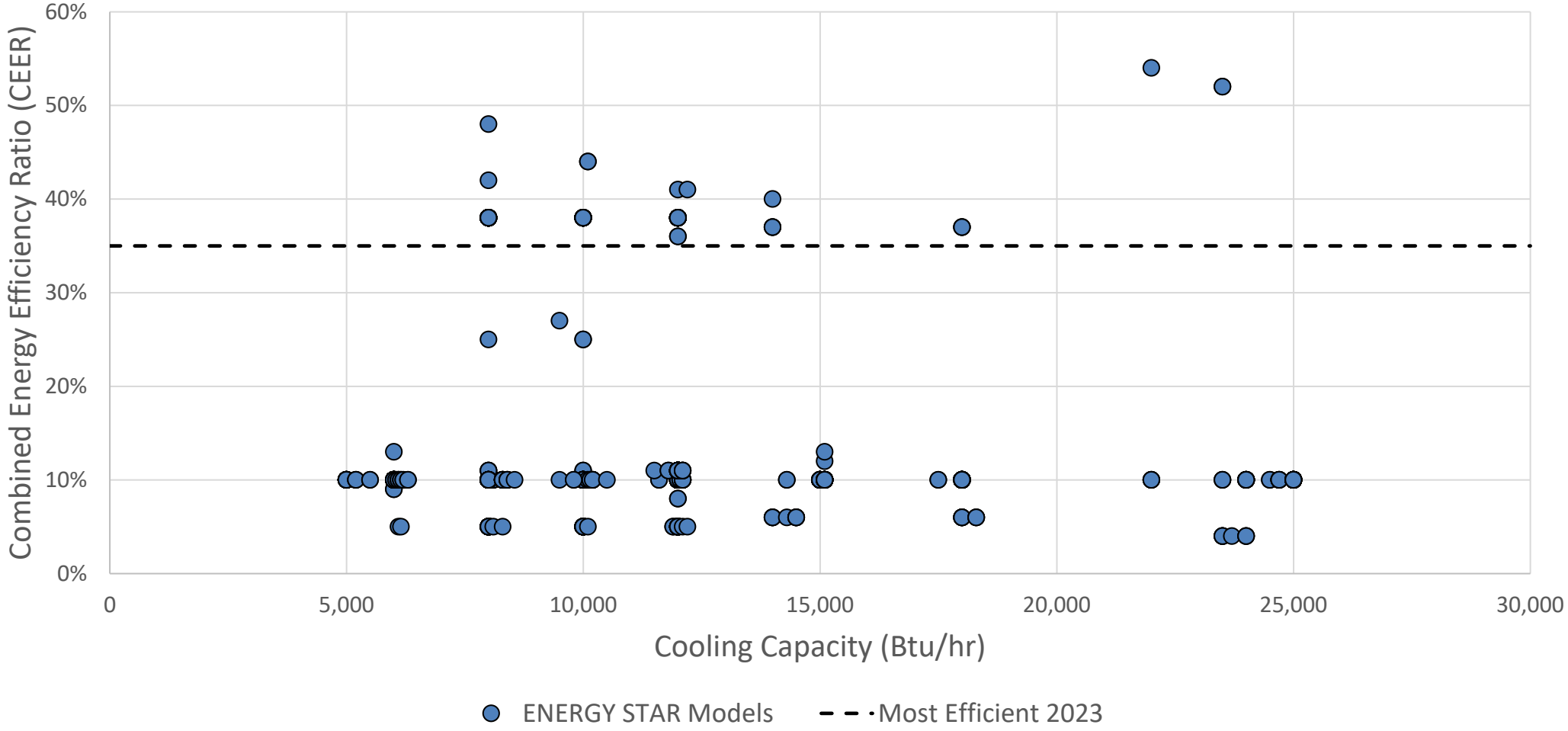


Room Air Conditioners

- **2022 Proposal:**
  - Maintain the criteria for Room Air Conditioner (RAC) product types:
    - Combined Energy Efficiency Ratio (CEER) ≥ 35% Better than the Federal Standard (%)
    - Product must have a sound pressure level at or below 45 dB(A) for the lowest operational mode available
      - Demonstrate in accordance with an internationally recognized ISO or ANSI test procedure measuring sound pressure
      - Document adjustments and submit at the time of certification for each basic model
    - Optional reporting for refrigerant type

- **Rationale:**
  - Number of models meeting criteria doubled in the past year
    - Currently 13 models from 5 brands meeting the criteria
  - ESRPP currently incentivizes RACs for their advanced tier
  - Current models continue to provide significant savings
    - At least 280-615 kWh/yr, depending on the capacity size

Room Air Conditioners



Dehumidifiers

- **2023 Proposal:**
  - Maintain 2022 criteria for dehumidifiers:

Type, Size	Integrated Energy Factor (IEF)
Portable, capacity ≤ 25.00 pints/day	≥ 1.70
Portable, capacity 25.01 to 50.00 pints/day	≥ 1.90
Portable, capacity > 50.00 pints/day	≥ 3.40
Whole-Home, case volume ≤ 8.0 ft^3	≥ 2.22
Whole-Home, case volume > 8.0 ft^3	≥ 3.40

- **Rationale:**
  - 25% of ES models currently meet ESME;
  - Little room for further differentiation in all product categories

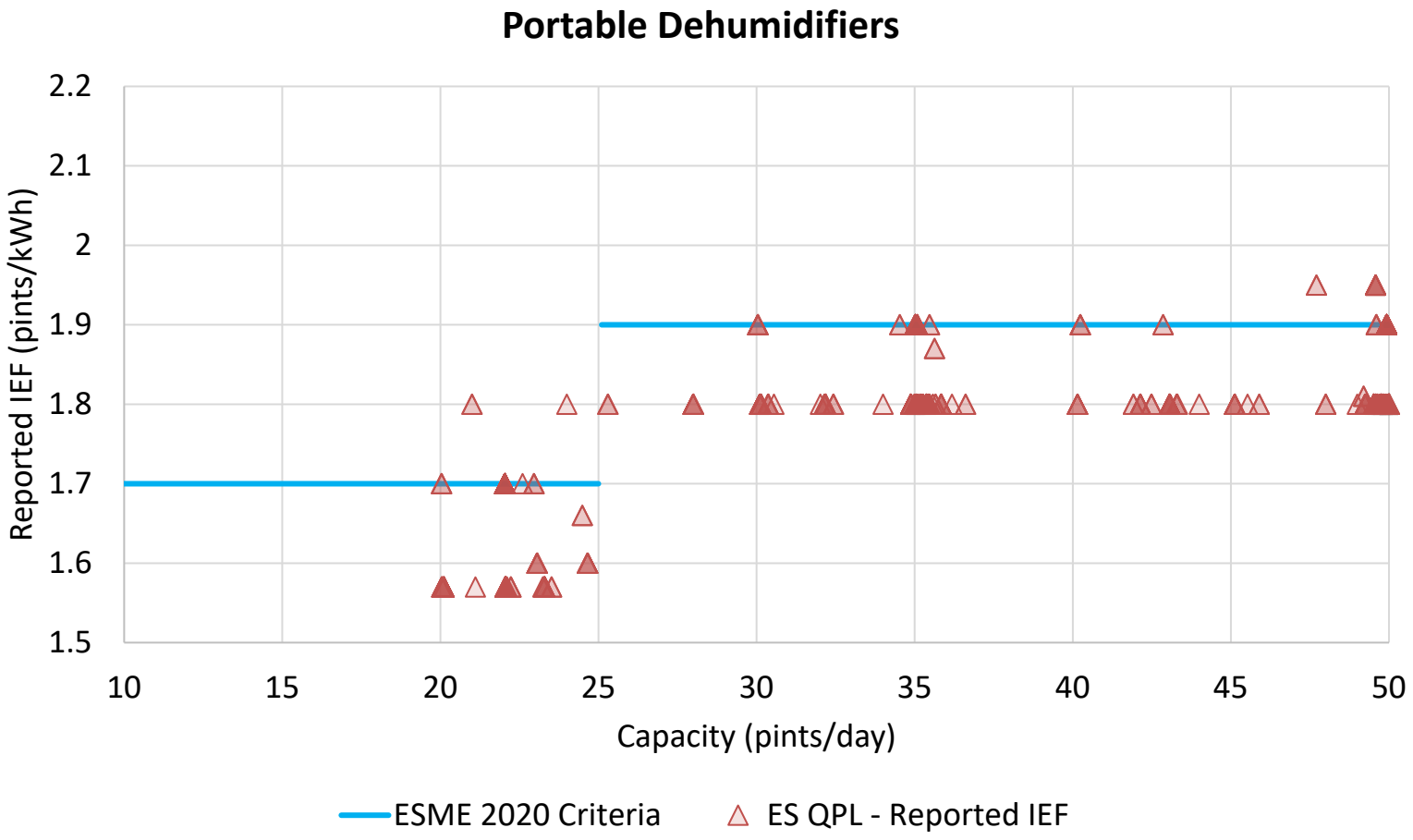
Dehumidifiers

Capacity (pints/day) / Case Volume (ft^3)	IEF (ESME)	IEF (V5.0)	ESME Savings (over DOE)
Portable Dehumidifiers			
<= 25.00 pints/day	1.70	1.57	31%
25.01 – 50 pints/day	1.90	1.80	19%
> 50 pints/day	3.40	3.30	21%
Whole-Home Dehumidifiers			
<= 8.0 ft^3	2.22	2.09	25%
> 8.0 ft^3	3.40	3.30	41%

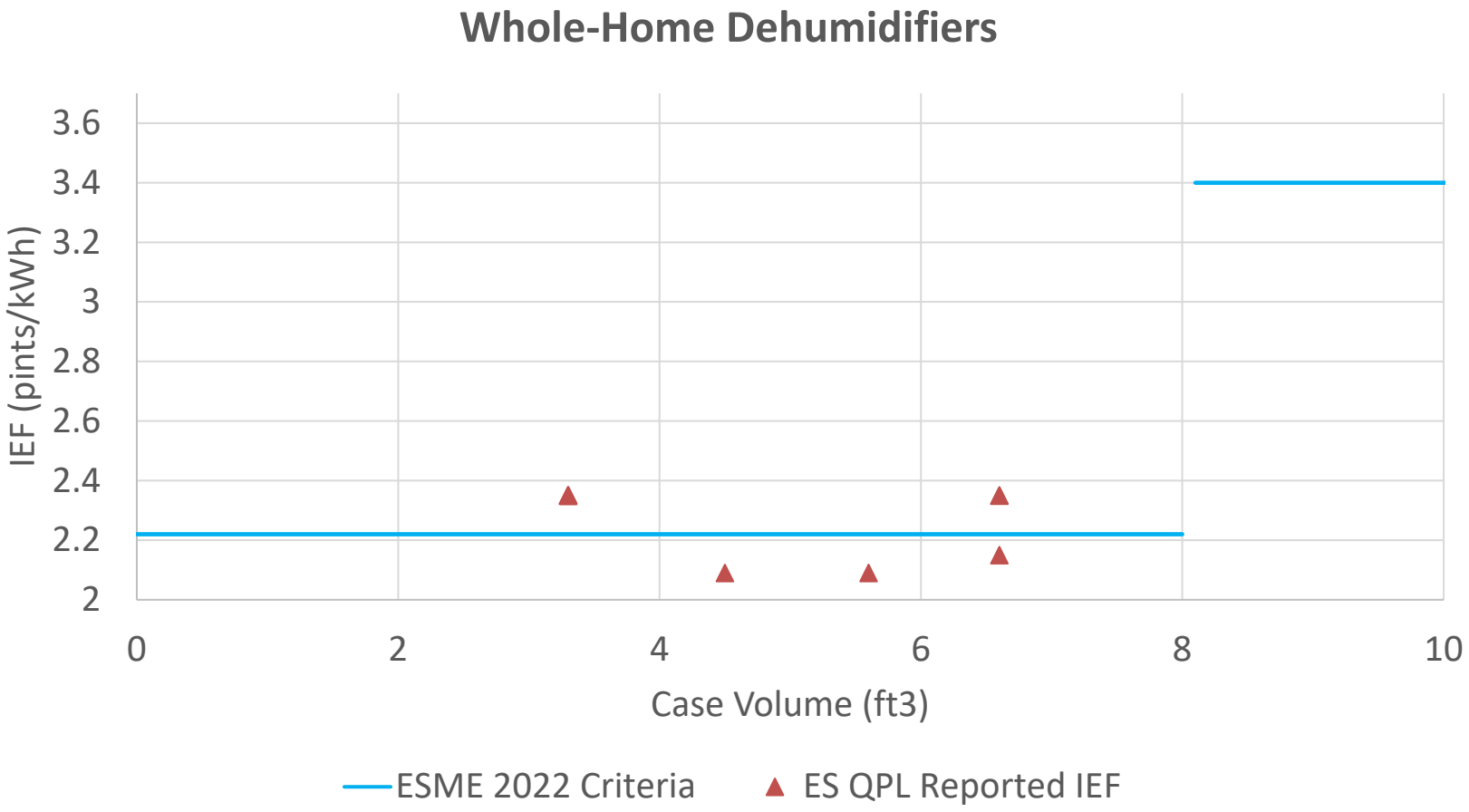
Dehumidifiers – Reported/Rated IEF

Capacity (pints/day) / Case Volume (ft^3)	# of models in QPL	# of models meeting ESME 2022	# of OEMs with qualifying models
Portable Dehumidifiers			
<= 25.00 pints/day	105	30	14
25 – 50 pints/day	427	100	9
> 50 pints/day	0	0	0
Whole-Home Dehumidifiers			
<= 8.0 ft^3	11	8	3
> 8.0 ft^3	0	0	0

Dehumidifiers – Portable, Reported IEF



Dehumidifiers – Whole-Home, Reported IEF



Dishwashers

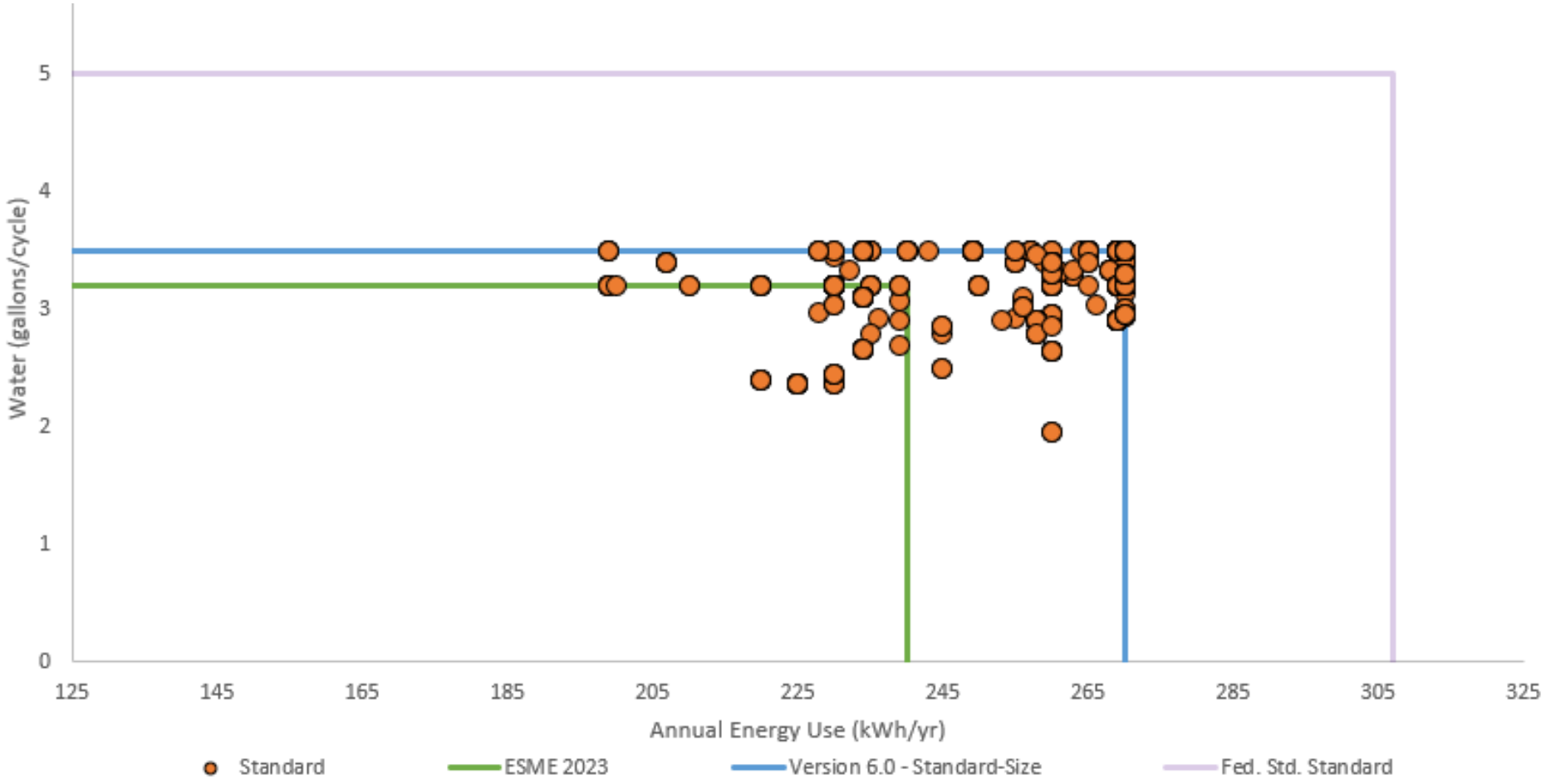
- **2023 Proposal:**
  - Maintain criteria for standard-size dishwashers
    - ≥ 36% more efficient than the Federal minimum

Product Type	Annual Energy Use (kWh/yr)	Water Consumption (gallons/cycle)
Standard Dishwasher	≤ 240	≤ 3.2

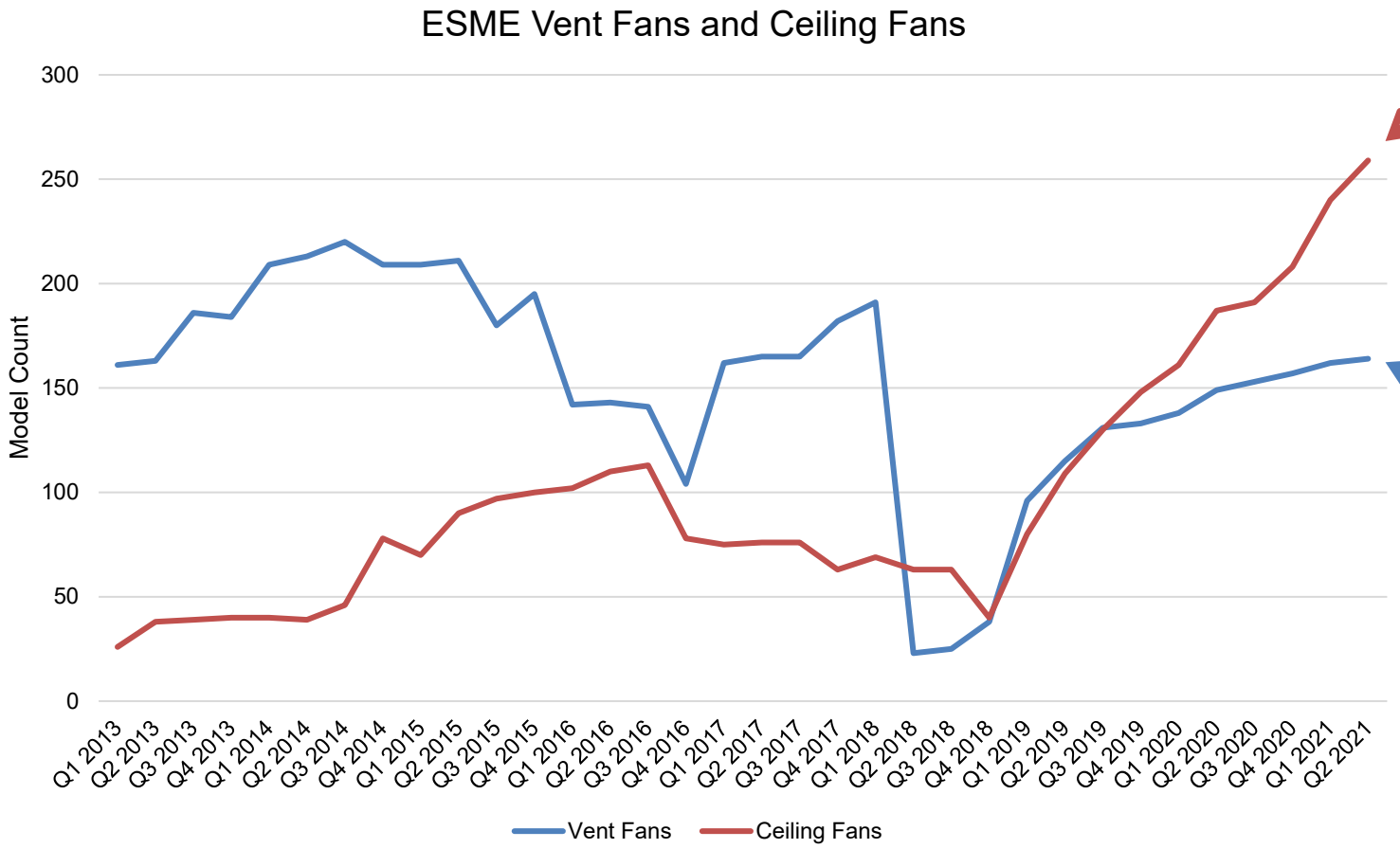
    - Obtain a minimum per cycle cleaning index score of 65 for each test cycle (heavy, medium, and light)

- **Rationale:**
  - ENERGY STAR Dishwasher specification (Version 7.0) is currently underway
  - Moving to a cleaning index score of 65 to align with the proposed ENERGY STAR V7 Dishwasher specification
  - 34 base models from 12 brands meet the criteria, equating to 10% of the market and 19% of brands.

Dishwashers



Ceiling and Ventilating Fans



ESME ceiling fans have been consistently increasing

ESME vent fans have increased, but at a slower rate

Ceiling Fans

2023 Proposal:

Maintain the criteria 2x ENERGY STAR levels for all fans

Blade Span	Minimum Efficiency	Savings*
D ≤ 36 inches	≥ 1.44*D + 83.86	67%
D > 36: inches	≥ 5.26*D – 53.66	

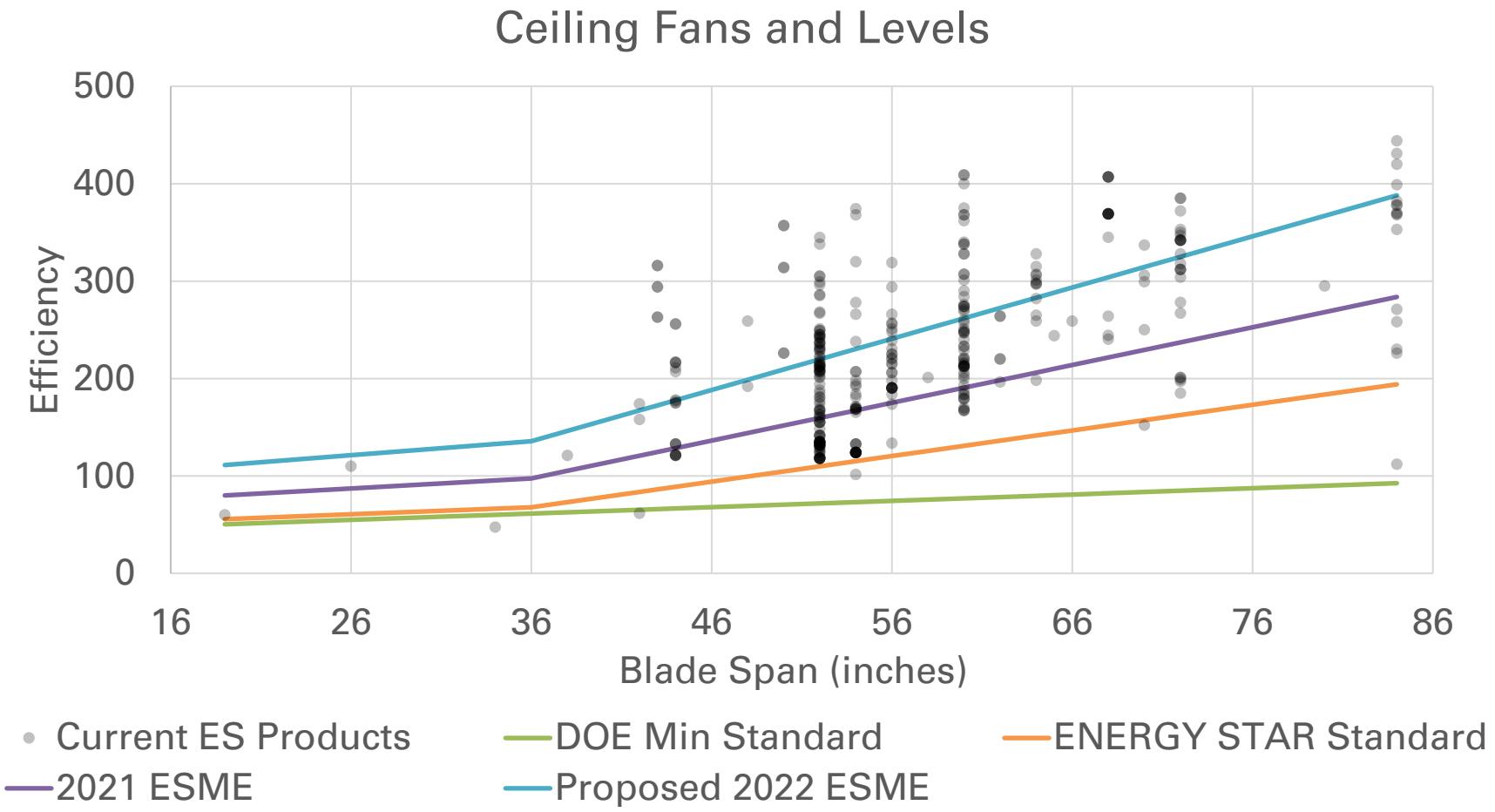
Rationale:

Levels continue to reflect a superior level of efficiency.

Ceiling Fans	Listed ESME 2022 / QPL
Total	186 (31%)

*Savings estimated for 52" fan, as it is the most common size in the market

Ceiling Fans



Proposed 2023 ESME level for ENERGY STAR ceiling fans – NO CHANGE from 2022

- 2X ENERGY STAR Levels
- 67% savings over standard

Ventilating Fans

- **2023 Proposal:** Maintain current criteria
- In-Line Fans
  - Without filter Efficacy at high speed (cfm/W): ≥ 5
  - 6 ≤ MERV < 13 Efficacy at high speed (cfm/W): ≥ 4.7
  - MERV ≥ 13 Efficacy at high speed (cfm/W): ≥ 3.8
- Bathroom/Utility room fans
  - Efficacy at high speed (cfm/W): ≥10
  - Reported sound level (sones): ≤ 4.0 at 0.25 in. w.g. at high speed

- **Rationale:**
  - Offering remains steady
  - Many B/U fans meet efficiency criteria and have not submitted data for Sound Level at 0.25 in. w.g.
  - Efficacy levels for inline fans still significant hurdle.
  - High efficiency range hood market is still limited and capture efficiency test not yet published, but may be used for differentiation in the future

Ventilating Fans

System Type	ESME/ All current QPL Products	% Listed ESME / Listed HVI Products	Per Unit Savings
Bathroom/Utility room fans	123/908 (13%)	3.5%	33%
Inline – Single Port	176/269 (65%)	5.8%	34%
Inline – Multi Port	3/13 (23%)		
Total	17%	2.3%	-

Residential Central ACs and Heat Pumps

- **2023 Proposal:**
  - Maintain levels, update to requiring CAC/HP V6.1 certification.
  - Simplify criteria to allow EPA to nominate products automatically from among certified products, eliminating the need for an application.
- **Rationale:**
  - Version 6.1 certification is challenging in itself. Current levels set in 2022 account for updated specification and DOE minimum efficiency standards, and reward certification to the V6.1 cold climate heat pump criteria.
  - Current application process burdensome for Partners and for EPA
  - Inclusion of optional installation capabilities in Version 6.1 allows automatic recognition of units that meet the criteria as Most Efficient
  - Inclusion of compressor staging (single, dual, multi-stage, variable capacity) in QPX allows automatic recognition of dual and multistage units as Most Efficient

System Status and Messaging Criteria Changes

- **2021 to 2022 changes:**
  - For Version 6 units, Installation Capabilities instead of Unit Setup Information
  - Minor additional changes

- **2022 to 2023 changes:**
  - Version 5 units no longer ENERGY STAR, not eligible for Most Efficient
  - Instead of system status and messaging, installation benefits (optional recognition from V6.1 specification) is required.

Proposed Levels and Savings for CAC/HPs

System Type	SEER2	EER2	HSPF2	Savings (North)	Savings (South)		
Split AC	16.9	12.4	-	21%	18%		
Split HP	16.9	12.0	8.2	12%	13%		
Packaged AC	15.2	11.5	7.2	12%	12%		
Packaged HP	15.2	11.0	8.5	9%	10%	COP @ 5 °F	$\frac{Capacity_{5°F}}{Capacity_{47°F}}$%
Cold Climate	15.2	11.0	8.5	17%	15%	1.75	≥70%

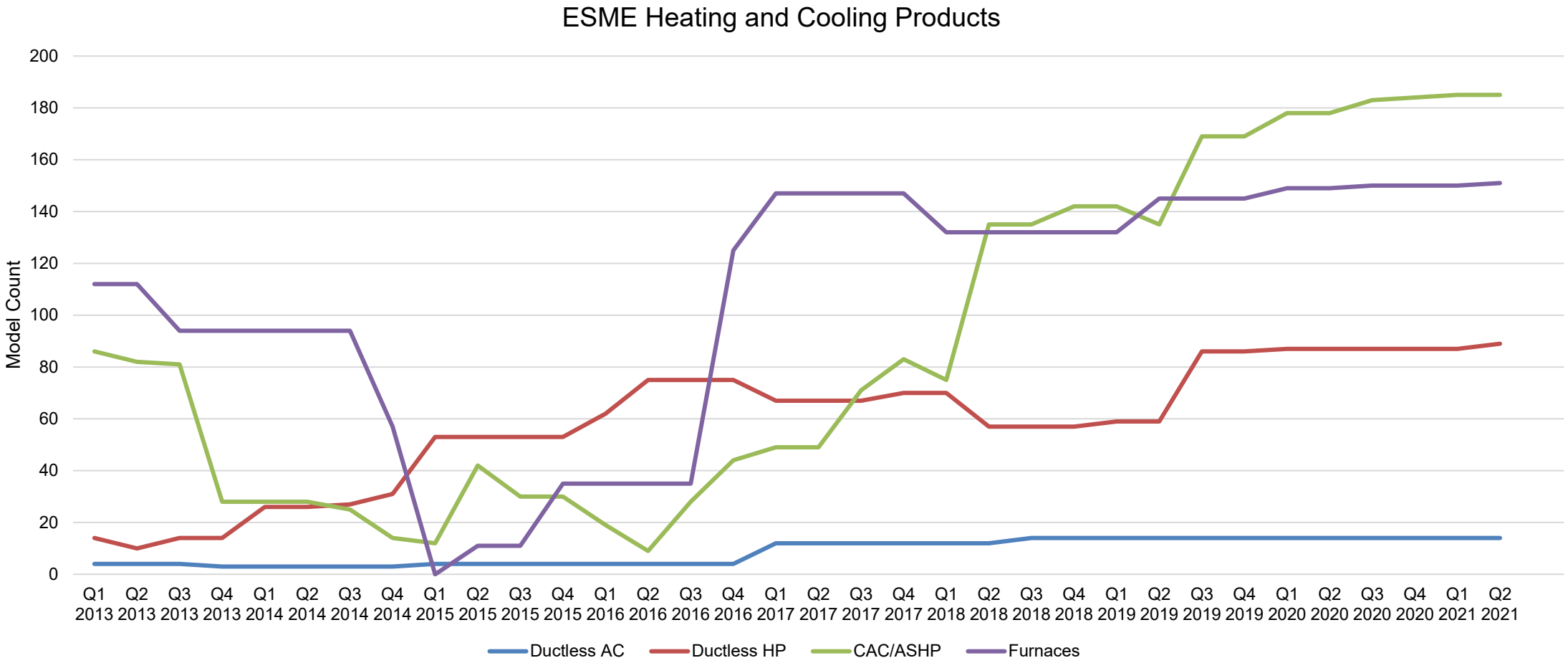
Note: EPA unable to estimate model percentages at this time, due to changing metrics and requirements and delays in V6.1 certification infrastructure.

Ductless Split Air Conditioners and Heat Pumps

System Type	SEER2	EER2	HSPF2	Savings (North)	Savings (South)		
Ductless AC	18.7	12.0	-	28%	26%		
Ductless HP	18.7	12.0	8.5	17%	20%	COP @ 5 °F	$\frac{Capacity_{5°F}}{Capacity_{47°F}}$ %
Ductless Cold Climate	16.9	11.0	8.5	10%	13%	1.75	≥70%

Note: EPA unable to estimate model percentages at this time, due to changing metrics and requirements and delays in V6.1 certification infrastructure.

AC and Heat Pumps



Geothermal Heat Pumps

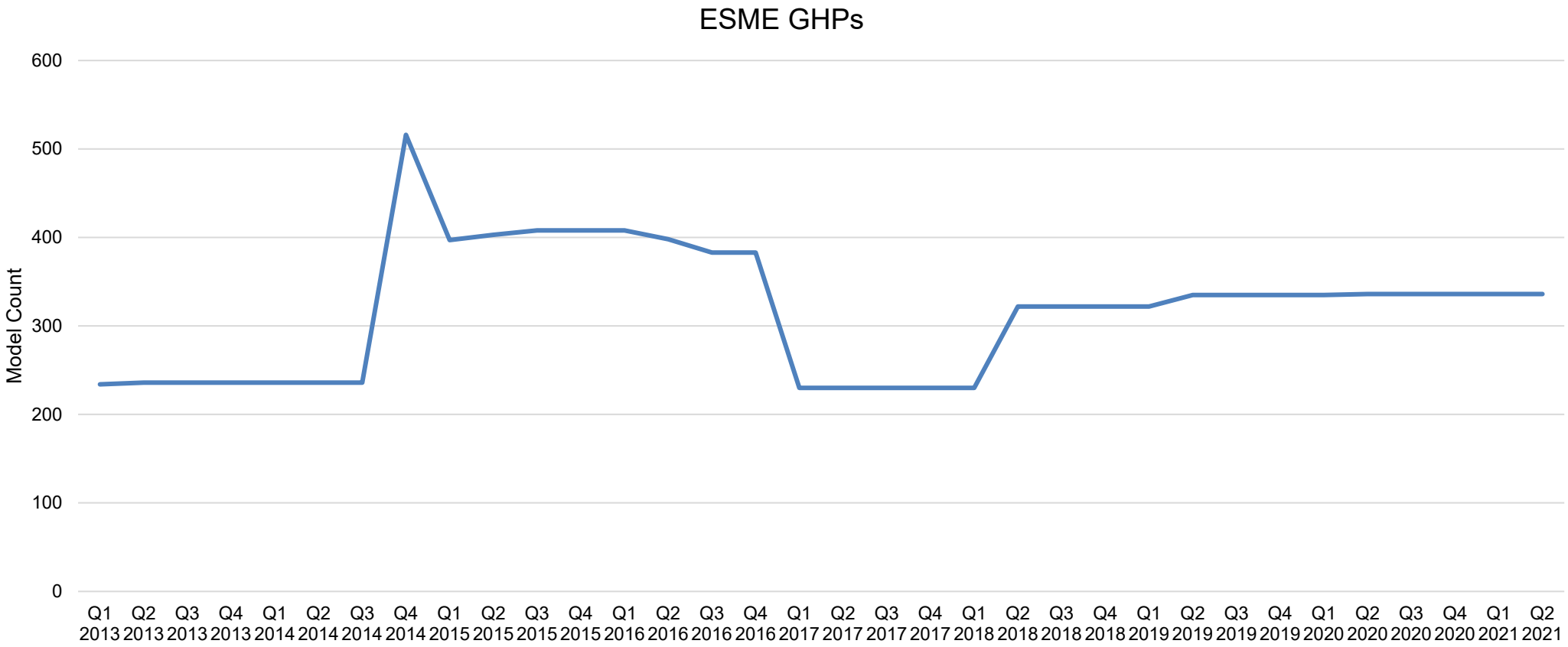
- **2023 Proposal:** Maintain current efficiency levels but eliminate system status and messaging and compressor staging criteria. All ENERGY STAR certified geothermal heat pumps will be recognized as Most Efficient.

- **Rationale:**
  - Recognizes that geothermal heat pumps as a category reflect the intentions of ENERGY STAR Most Efficient.
  - In addition to their efficiency benefit, GHPs also provide better peak power reduction on very hot or very cold days, because their efficiency is not affected by outdoor temperature.

Geothermal Heat Pumps

System Type	EER	COP	Savings
Closed Loop Water-to-Air GHP	17.1	3.6	31%
Open Loop Water-to-Air GHP	21.1	4.1	17%
Closed Loop Water-to-Water GHP	16.1	3.1	37%
Open Loop Water-to-Water GHP	20.1	3.5	25%
DGX-to-air	16.0	3.6	22%
DGX-to-water	15.0	3.1	14%

Geothermal Heat Pumps



Next Steps

- Comments are due Thursday, August 15; send to MostEfficient@energystar.gov
- Slides will be posted to: https://www.energystar.gov/products/energy_star_most_efficient_2023_criteria_development_0
- The 2023 criteria will be finalized in early September 2022
- Products will be recognized as ENERGY STAR Most Efficient 2023 beginning January 1, 2023

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Thank you for your participation today.