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ENERGY STAR®
Most Efficient 2021 Update and 2022 Proposed Criteria

July 29, 2021
1-3pm ET

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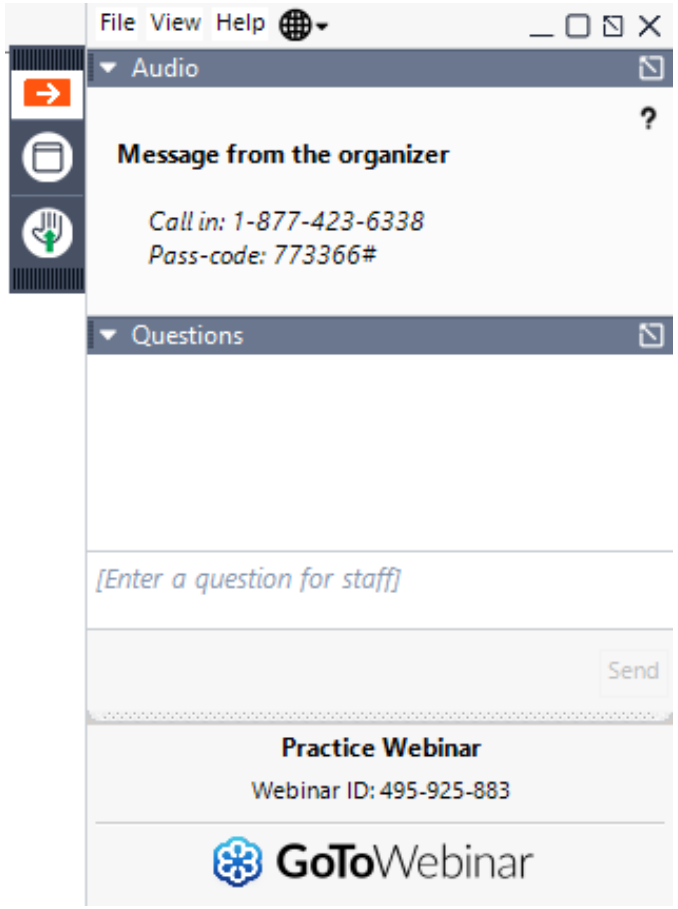

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Introductions

Doug Anderson, U.S. Environmental Protection Agency

Abigail Daken, U.S. Environmental Protection Agency

Katharine Kaplan, U.S. Environmental Protection Agency

James Kwon, U.S. Environmental Protection Agency

Ga-Young Park, U.S. Environmental Protection Agency

Taylor Jantz-Sell, U.S. Environmental Protection Agency

Jeremy Dommu, U.S. Department of Energy

Bryan Berringer, U.S. Department of Energy

Catherine Rivest, U.S. Department of Energy

Stephanie Johnson, U.S. Department of Energy

ENERGY STAR Most Efficient

- An extension of the **trusted** ENERGY STAR brand
- Recognizing the **most efficient** products among those that qualify for ENERGY STAR in a given year
- Target audience: environmentally conscious, early adopters
- Represents the **"best of the best"** in energy efficient products
- Each year, we review our criteria and raise the bar as needed to ensure ENERGY STAR Most Efficient is awarded to only the top performers

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ENERGY STAR Most Efficient 2021

Update: Recognizing the Best from Range of Partners (June)

Product Category	Models	ENERGY STAR Partners
Ceiling Fans	268	18
Central Air Conditioners and Air Source Heat Pumps	247	10
Clothes Dryers	23	7
Clothes Washers	48	6
Compact Freezers	11	5
Compact Refrigerators	98	23
Computer Monitors	384	25
Dehumidifiers	175	27
Dishwashers	101	9
Freezers	4	2
Furnaces	159	7
Geothermal Heat Pumps	611	10
Refrigerators	540	44
Room Air Conditioners	16	4
Ventilating Fans	166	22
Windows and Sliding Glass Doors	510	46
Total*	3,361	203

ENERGY STAR Most Efficient 2021 Update: Utility Collaboration

- 29 energy efficiency program sponsors are leveraging ENERGY STAR Most Efficient.
  - Serving over 7 million households (18.5 million consumers)
  - Featuring one or more Most Efficient product categories; includes 2 water utilities
- ENERGY STAR Most Efficient leveraged for retailer incentives through ENERGY STAR Retail Products Platform (ESRPP)
  - Innovative, nationally coordinated, market transformation initiative
  - ESRPP retailers now represent more than 75% of the appliance market, with more than 900 stores in current program sponsors' service areas. 15 efficiency program sponsors participate and serve more than 16% of U.S. households
  - Future: ESRPP striving for large-scale market participation – serving more than 30% of the US population –a key milestone in the ESRPP vision to transform the market for energy efficient consumer products

ENERGY STAR Most Efficient 2021 Update: Consumer Education

- ENERGY STAR Most Efficient website:
  - Consumers frequently visit the ENERGY STAR Most Efficient web page in their search for the best products on the market. On average, more than 40,000 visit per month
  - Includes product images and real-time information on retail pricing and where to locate and buy these models
- More Consumer Education:
  - ENERGY STAR Emerging Technology Award
  - 19 models from four different brands have received the Emerging Technology Award for advanced adaptive compressors with use of low global warming potential refrigerants and foams.

ENERGY STAR Most Efficient

Categories in 2022

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

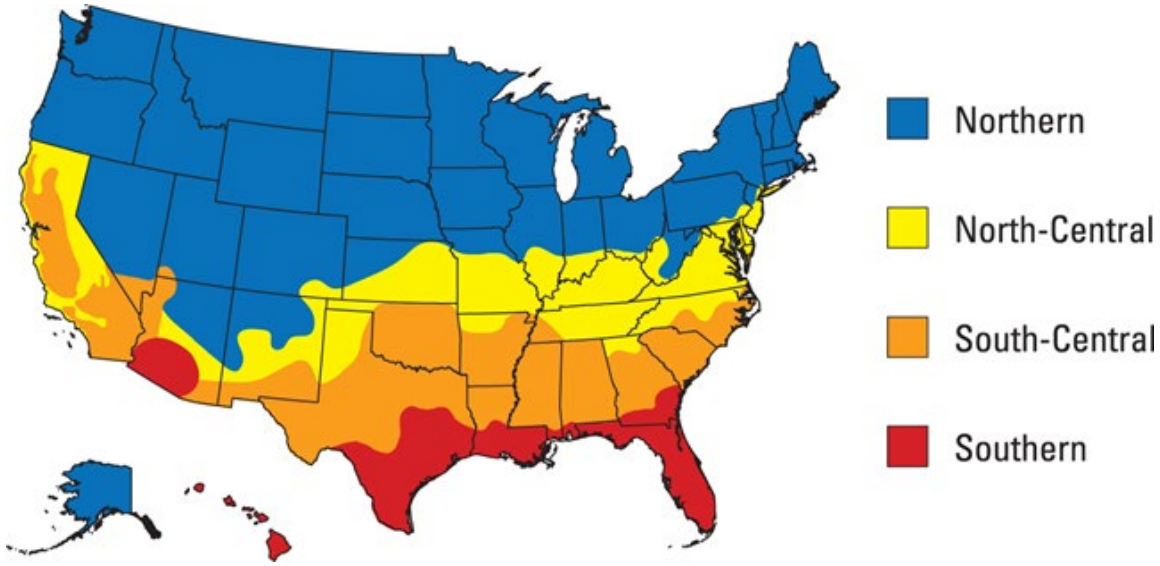
Draft 2022 ENERGY STAR Most Efficient Recognition Criteria

Residential Windows and Sliding Glass Doors

- **2022 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 ME window and sliding glass door products are widely available; but still a relatively small slice of total market
    - 45+ manufacturers
    - 500+ ME product lines
  - Since are now in the middle of the Version 7 criteria revision, we plan to hold the criteria for ME windows and sliding glass doors the same for now until the basic ES criteria revision is completed. Then we can decide what makes sense based on that outcome.
  - The ES WDS Ver 7.0 will likely be in effect no earlier than Jan 1, 2023

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

2022 Proposal:

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

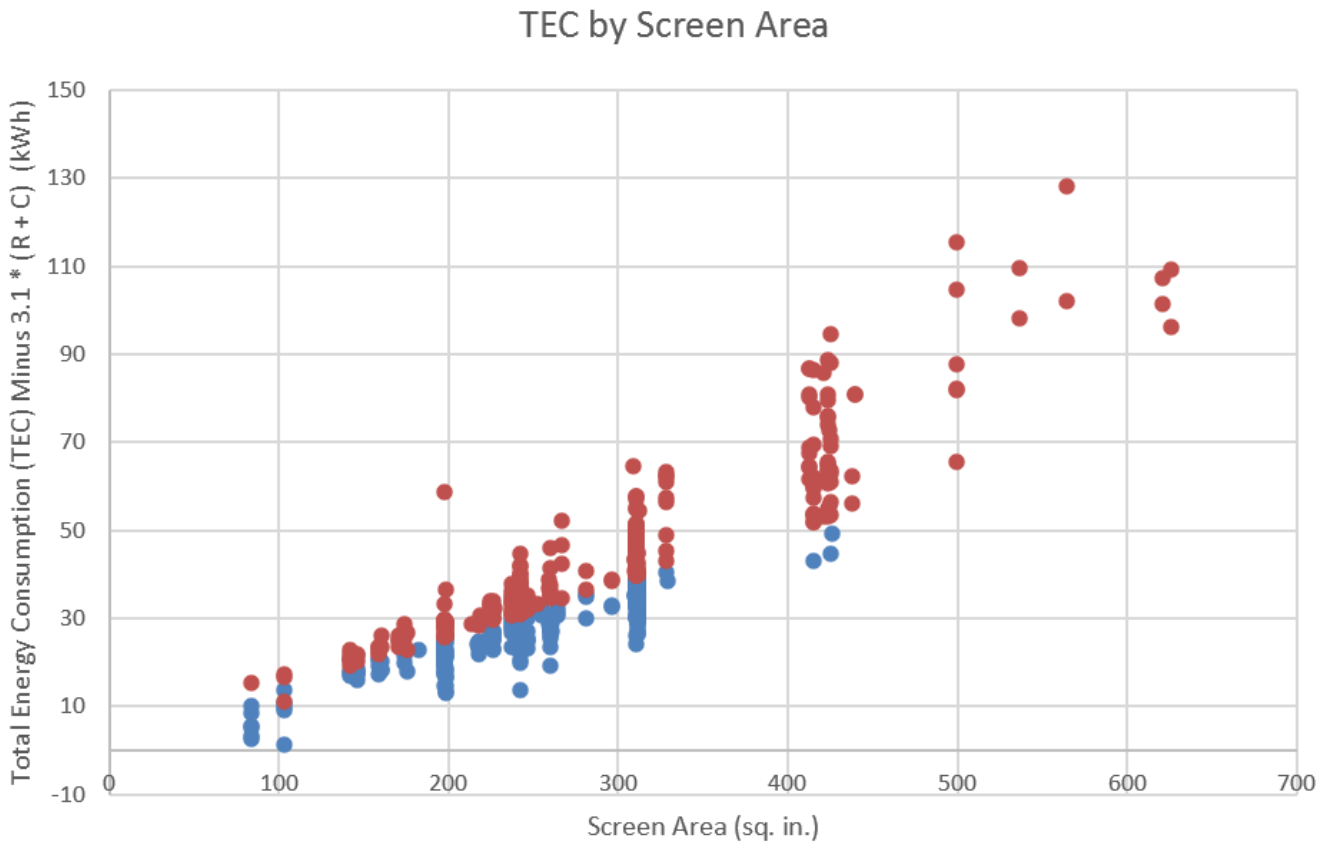
$$c = \begin{cases} 0 & \text{if } A < 180 \text{ in}^2 \text{ (previously 1.2)} \\ -0.2 & \text{if } 180 \text{ in}^2 \leq A < 220 \text{ in}^2 \text{ (previously 2.0)} \\ -1 & \text{if } A \geq 220 \text{ in}^2 \text{ (previously 1.2)} \end{cases}$$

Computer Monitors

- **Rationale:**
  - EPA proposes to update the recognition criteria for 2022 as more efficient models have emerged in the market since the last update.
  - Models recently added to the QPL have allowed for greater product differentiation and increased the savings potential for more stringent criteria.
  - 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 2022	% Meeting ESME 2022
< 180 sq. in.	64	7	11%
180 - 220 sq. in.	109	12	11%
> 220 sq. in.	600	60	10%
All	773	79	10%

Computer Monitors

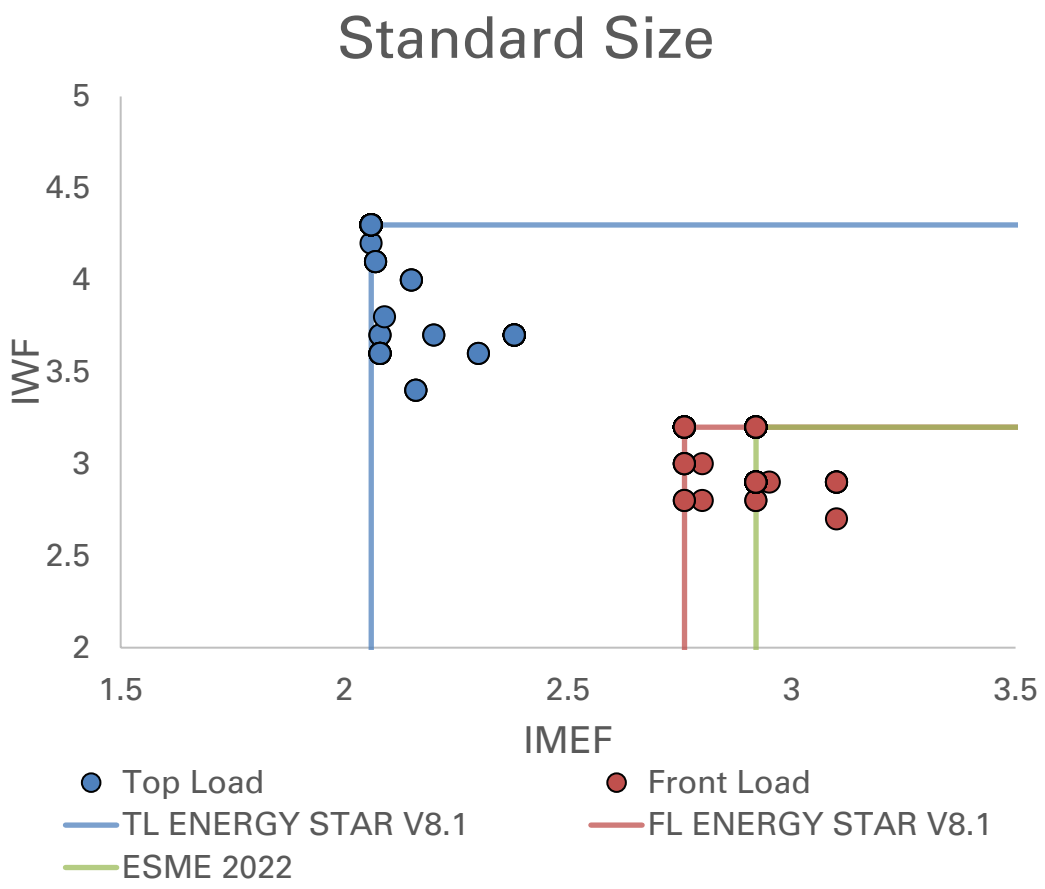


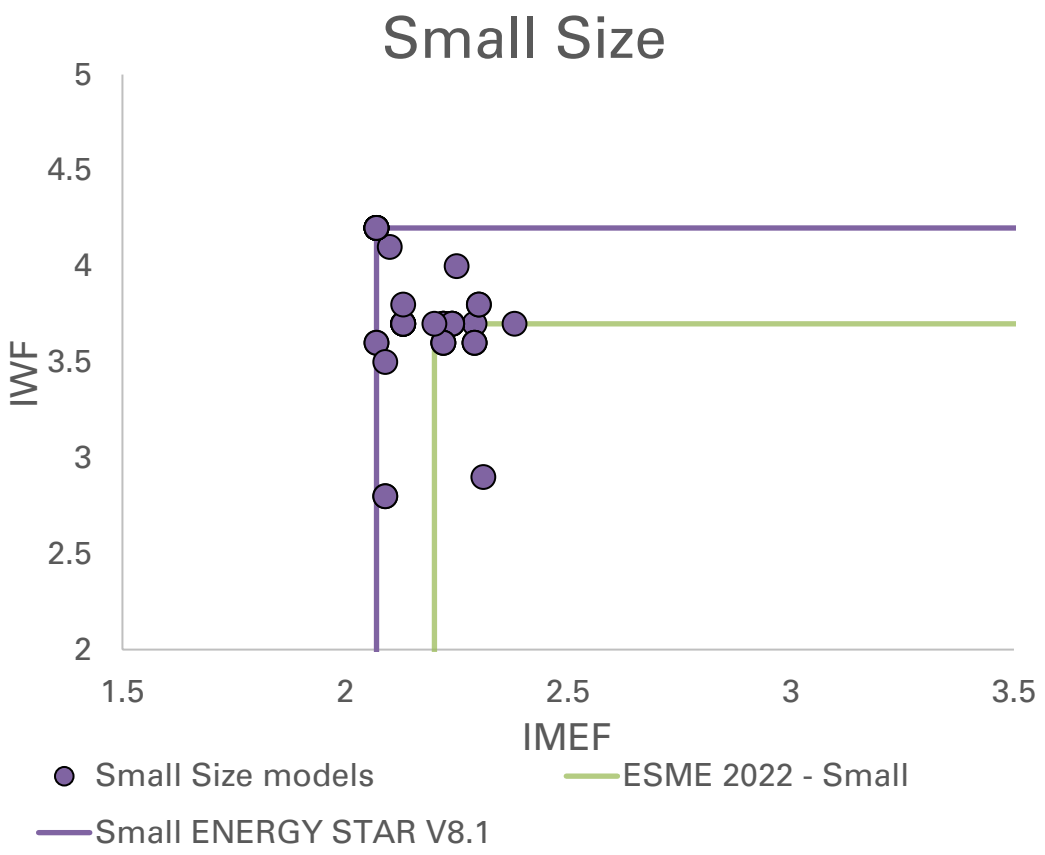
- ESME 2022
- Non-ESME 2022

Clothes Washers

- **2022 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
    - ~18 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

- **2022 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

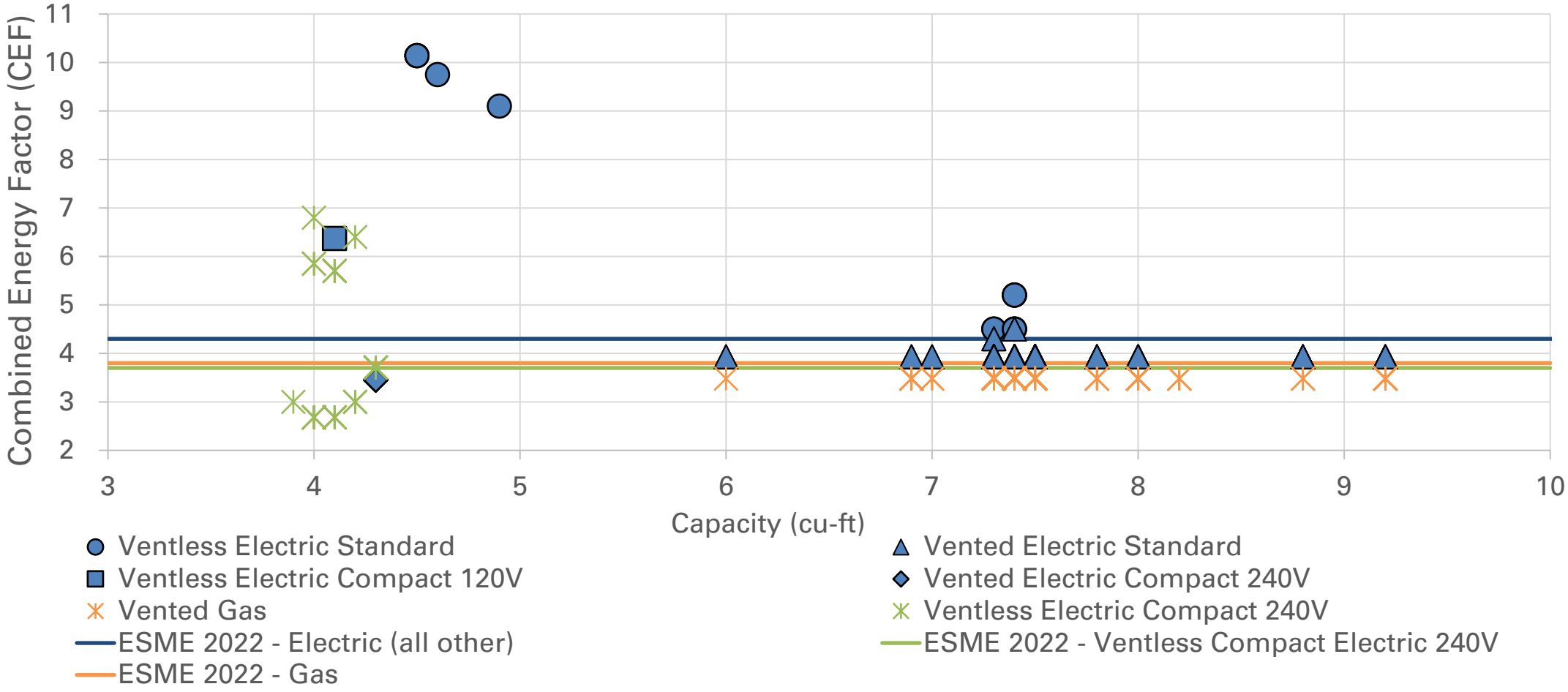
  - The criteria requires testing at 2 cycles/settings:
    - Testing at Normal Cycle, Max Temp, Medium Dry (per DOE Test Method requirements)
    - Testing at Normal Cycle, Max Temp, Max Dry (per ESME requirements)

Clothes Dryers

- **Rationale:**
  - The number of models/brands remain steady from previous year
    - 19 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

- **2022 Proposal – Top Freezers**
  - Maintain current criteria for Top Freezers
    - ≥ 10% more efficient than the Federal minimum
  - Optional reporting of refrigerant type

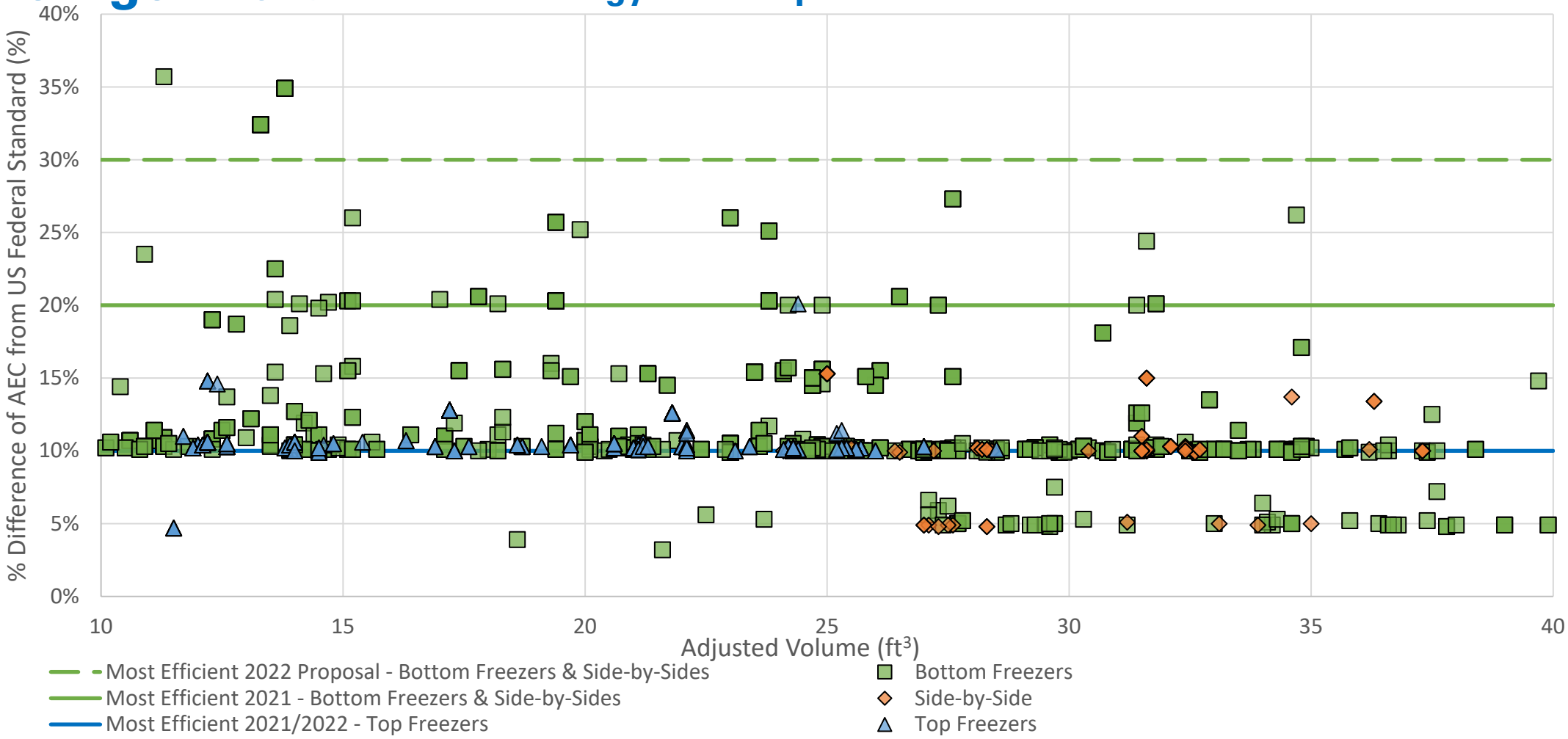
- **Rationale:**
  - Top Freezers remain the lowest energy-consuming standard-size refrigerator-freezer product type
  - Criteria recognizes 193 base models from 46 brands
  - ESRPP currently incentivizes refrigerators at this level for their basic tier

Refrigerators

- **2022 Proposal – Side-by-Side and Bottom Freezers**
  - Revise the criteria for Side-by-Side and Bottom Freezer product types
    - ≥ 30% 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 19 bottom freezers and side-by-side models that meet ETA criteria. EPA is expecting additional models to receive ETA recognition in the upcoming months
    - 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
  - 6 base models from 3 brands that currently meet proposed criteria

Refrigerators - % Annual Energy Consumption Better than Federal Standard

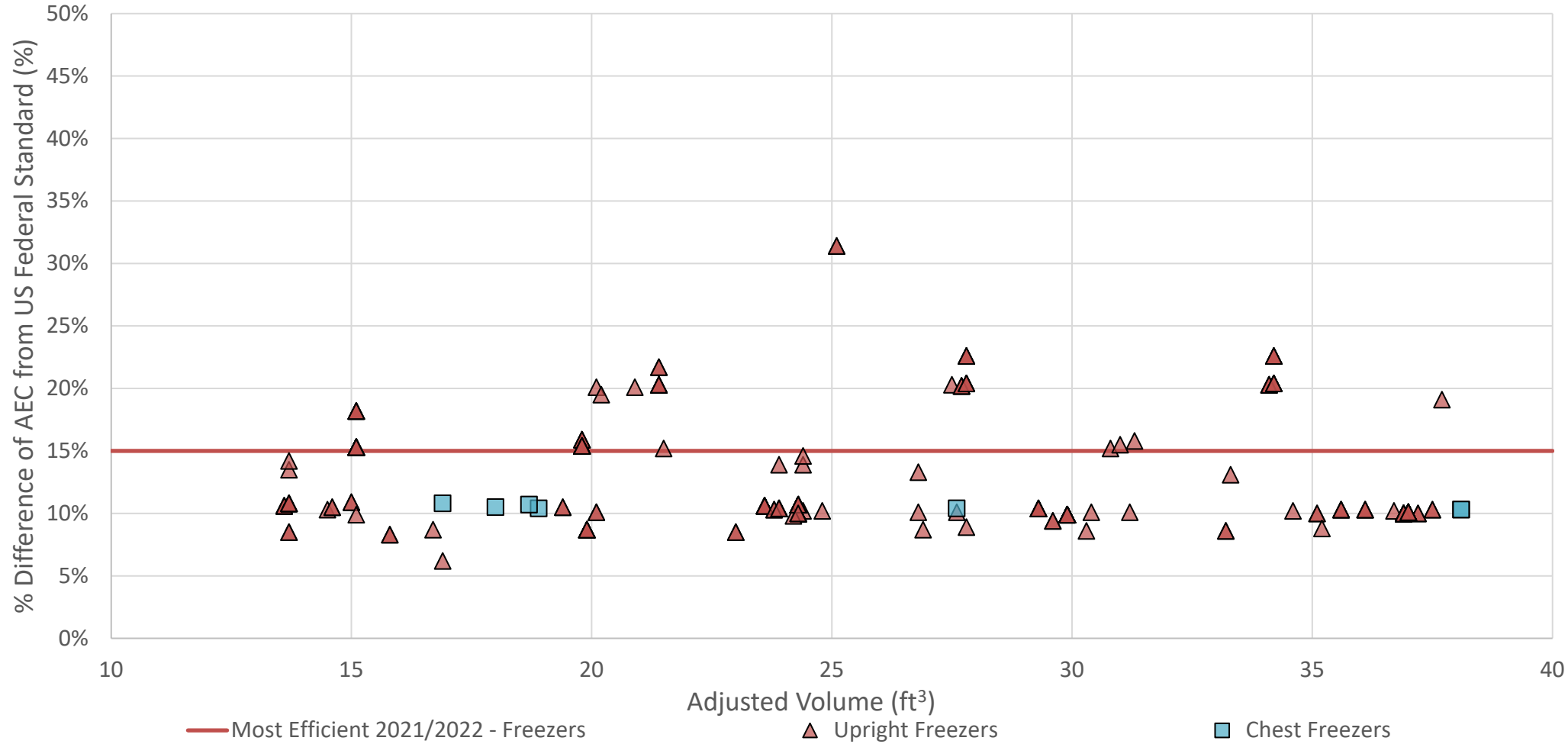


Freezers

- **2022 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
    - 29 Upright Freezer and Chest Freezer base models from 8 brands that meet the criteria
  - ESRPP currently incentivizes freezers for their advanced tier

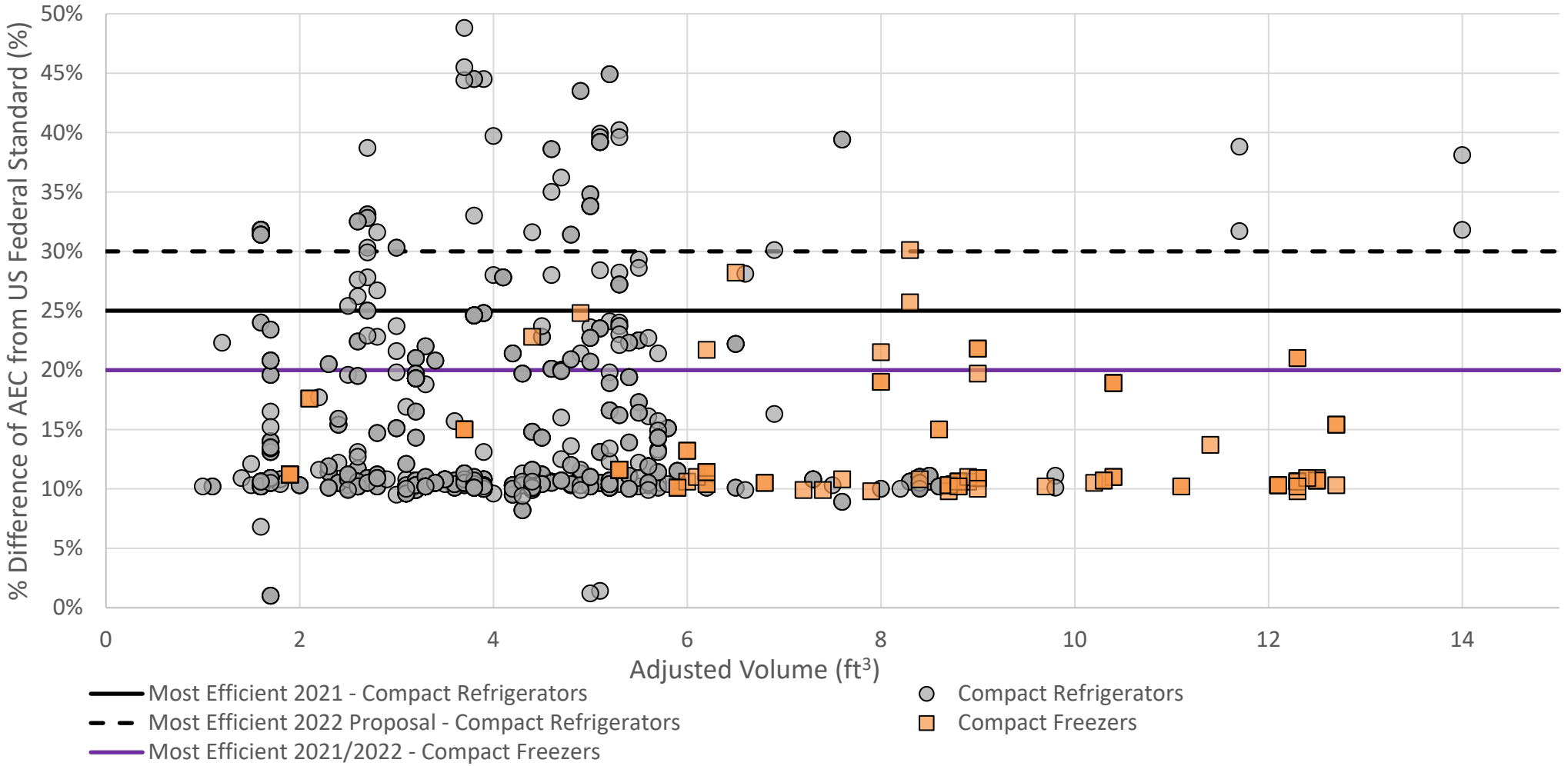
Freezers - % Annual Energy Consumption Better than Federal Standard



Compact Refrigerators and Freezers

- **2022 Proposal:**
  - Revise 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 grew by nearly 50% from last year. The number of compact Freezer models/brands remain steady.
    - 52 compact Refrigerator and Refrigerator-Freezer base models from 23 brands
    - 10 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

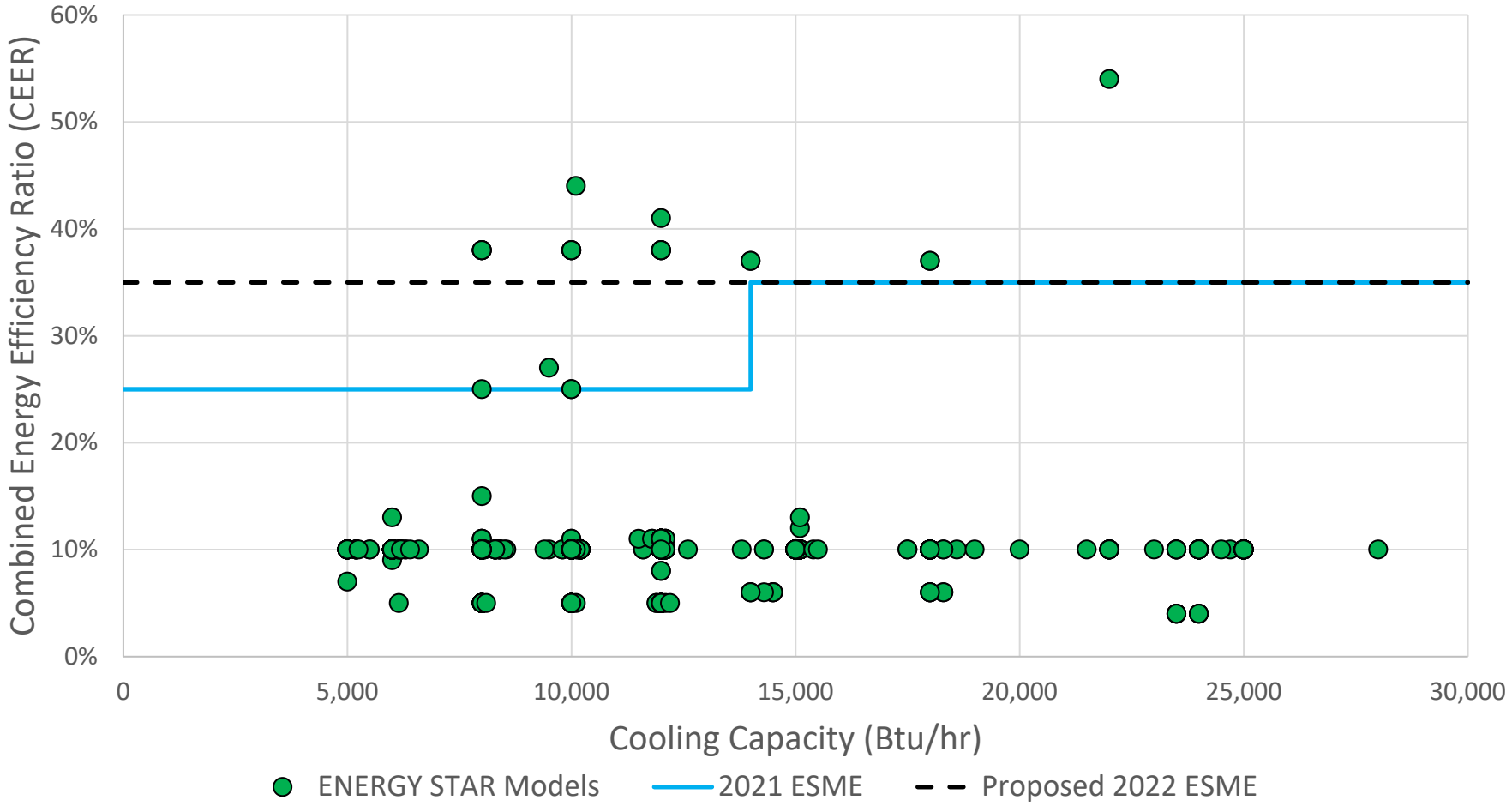


Room Air Conditioners

- **2022 Proposal:**
  - Revise 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 16 models from 4 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



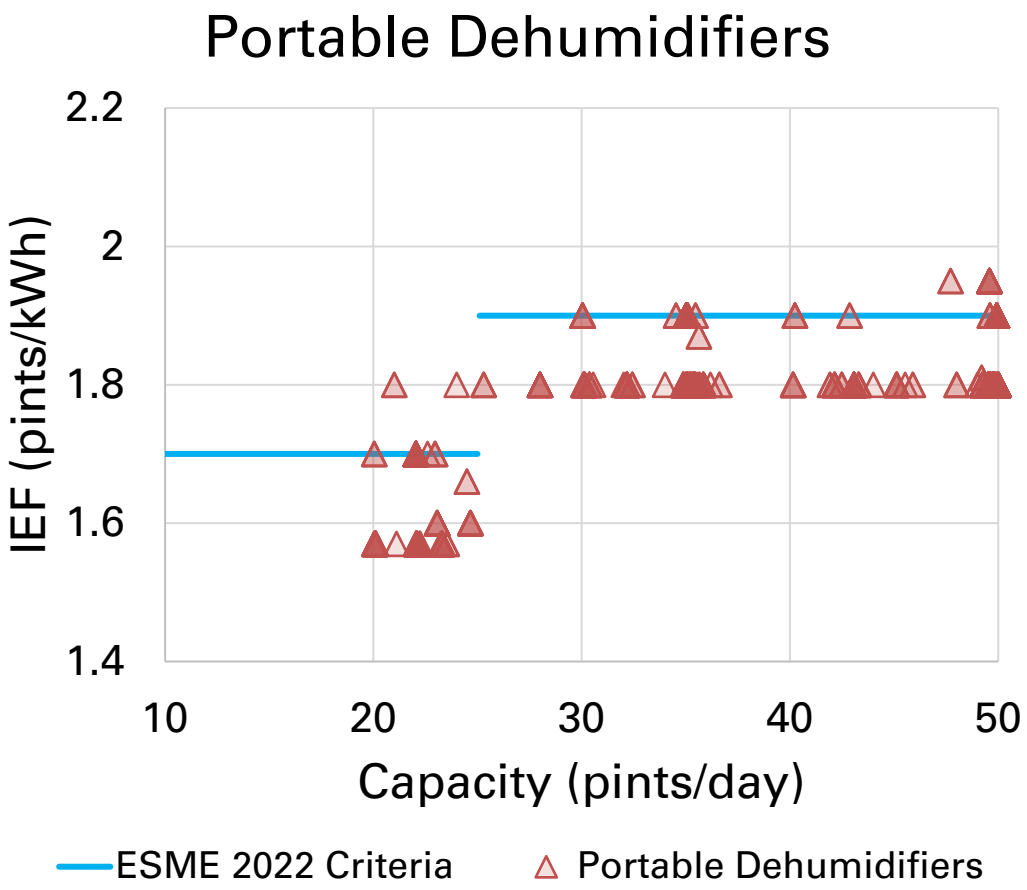
Dehumidifiers

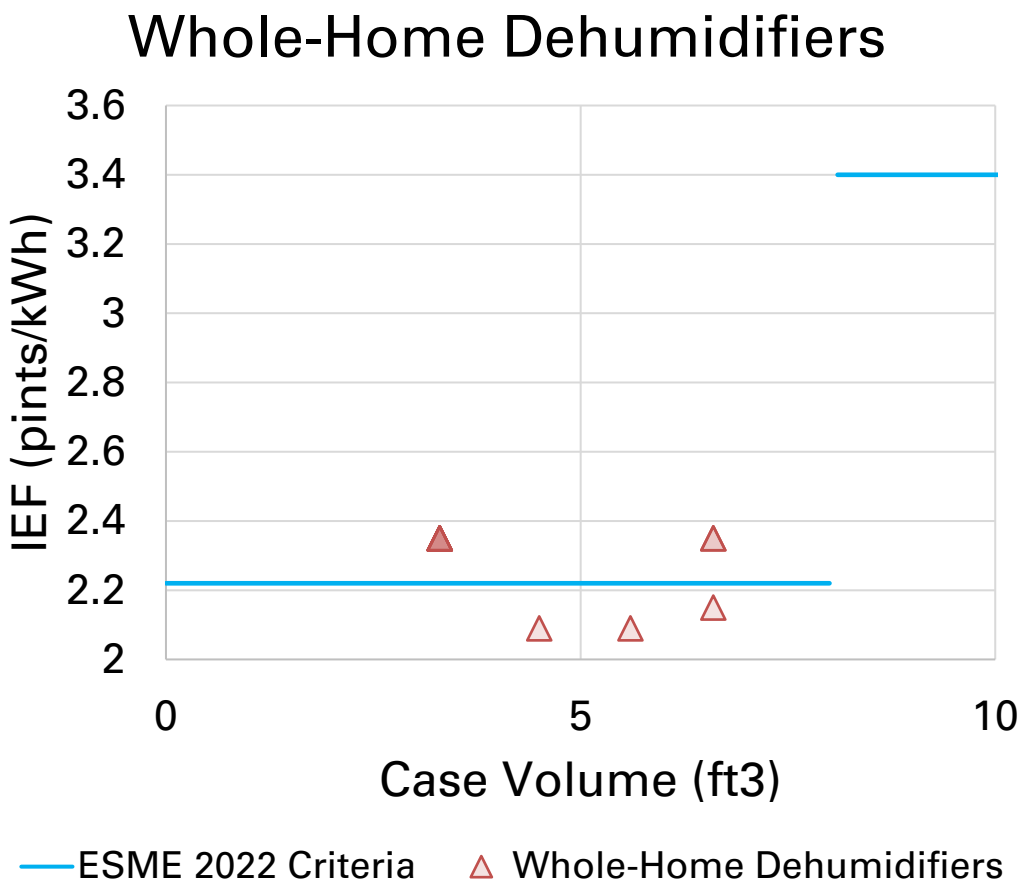
- **2022 Proposal:**
  - Maintain 2021 criteria for dehumidifiers:

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:**
  - Increased model count due to new specification in 2019; no differentiation possible through increased ESME criteria
    - EPA estimates that 130 portable models and 8 whole-home models meet the proposed criteria
  - Significant average energy and water savings:
    - Portable: 22% less energy than a conventional model
    - Whole-home: 25% less energy than a conventional model

Dehumidifiers



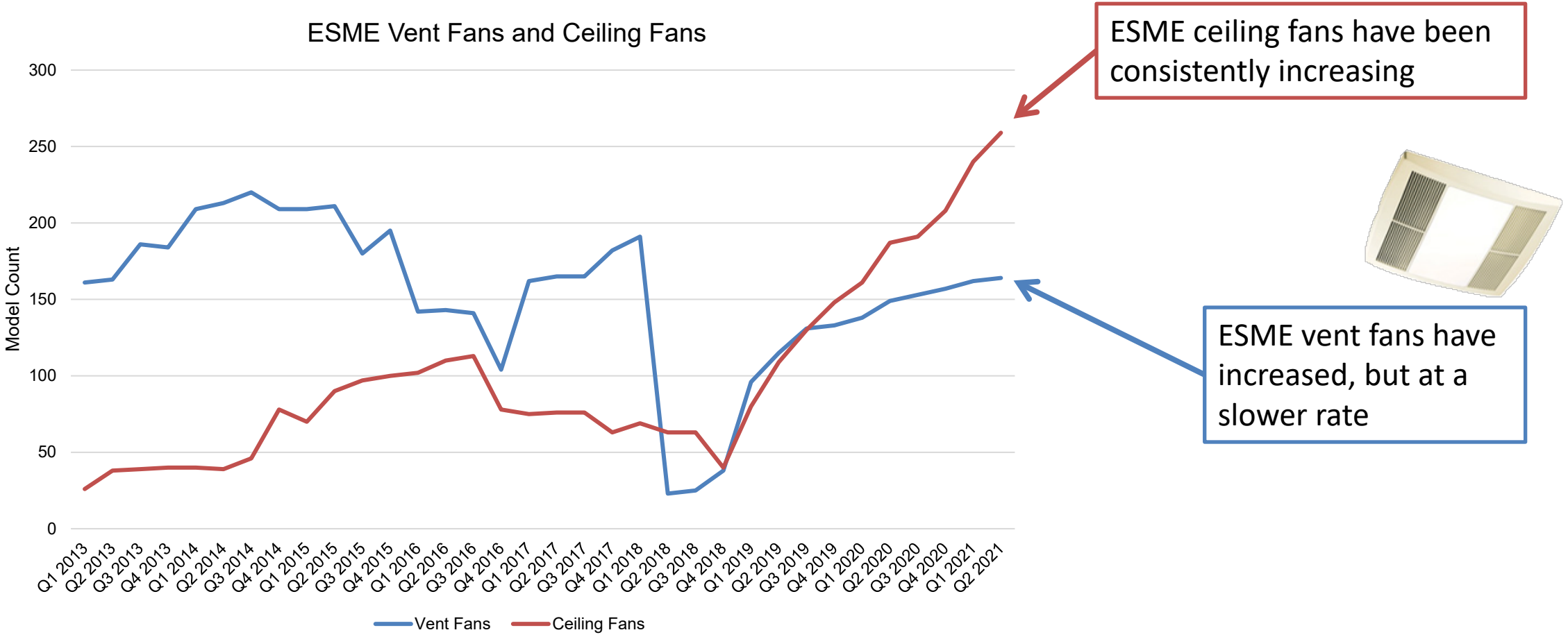


Dishwashers

- The ENERGY STAR specification for Dishwashers is currently under revision; EPA is delaying release of ENERGY STAR Most Efficient 2022 criteria until the revision process is more complete

- EPA will release a proposal for stakeholder review and comment

Ceiling and Ventilating Fans



ESME ceiling fans have been consistently increasing

ESME vent fans have increased, but at a slower rate

Ceiling Fans

2022 Proposal:

Raise 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	

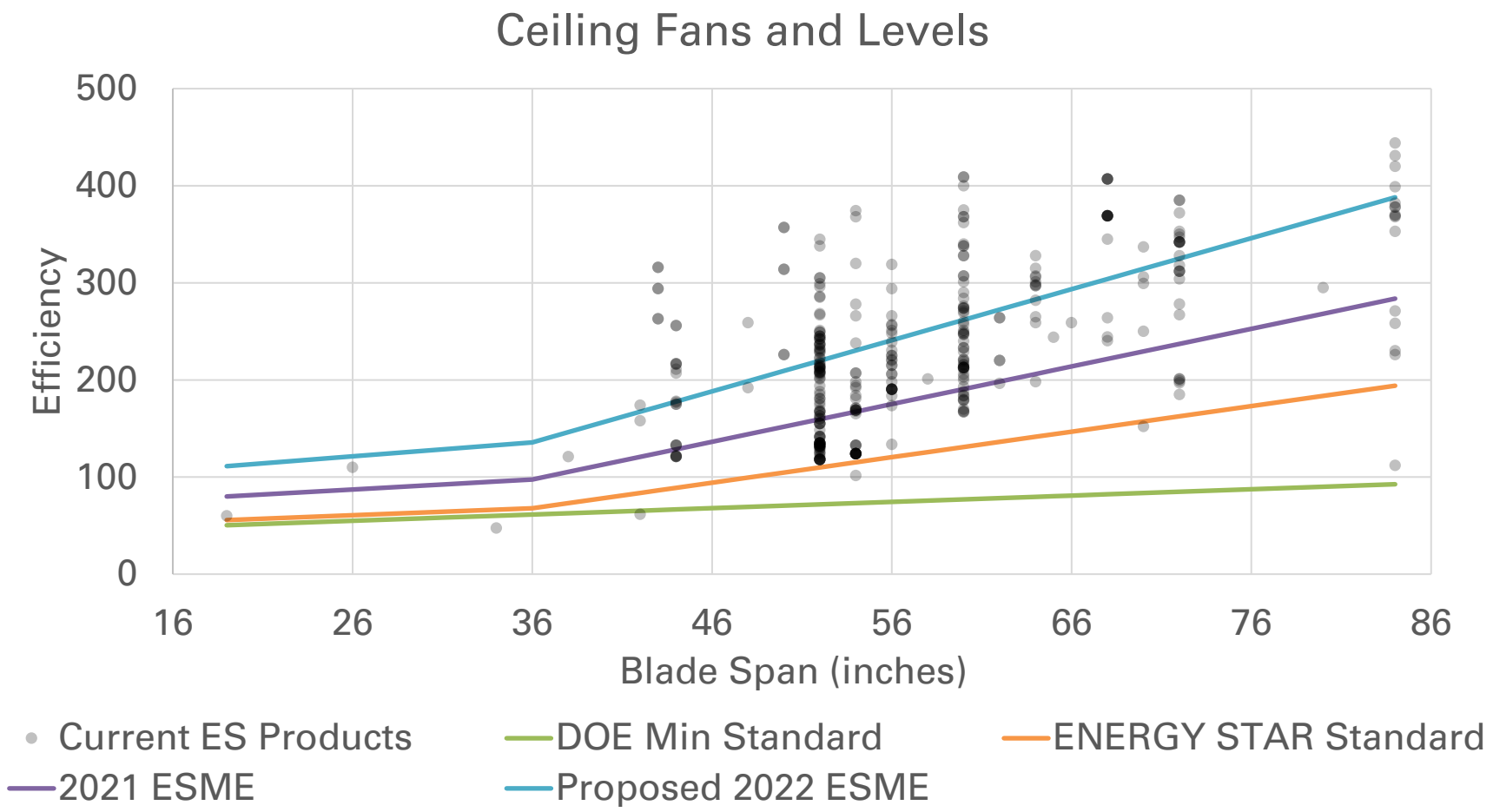
Rationale:

Increased certifications of very efficient ENERGY STAR certified fans.

Ceiling Fans	% Listed ESME 2021 / QPL	% Listed ESME 2021 / DOE CCMS	% Meeting 2022 Proposal / QPL	% Meeting 2022 Proposal / DOE CCMS
Total	76%	19%	35%	6%

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

Ceiling Fans



Proposed 2022 ESME level for ENERGY STAR ceiling fans

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

Ventilating Fans

- **2022 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:**
  - 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	13%	3.5%	33%
Inline – Single Port	56%	5.8%	34%
Inline – Multi Port	32%		
Total	14%	2.3%	-

CAC, HP, GHP, Furnaces

- Current Categories:
  - Non-Ducted Split Air Conditioners and Heat Pumps
  - Centrally Ducted Air Conditioners and Heat Pumps
  - Geothermal Heat Pumps
  - Furnaces

- These products must demonstrate that they meet system status and messaging criteria.
- Most must also meet staged or variable capacity criterion.

System Status and Messaging Criteria

- **2022 Proposal:**

  Small updates to the system status and messaging criteria to align with Version 6.0 and recognize features on the market

  - Unit Setup Information: All products certified to Version 6.0 must meet the Installation Criteria. No change for products certified to Version 5.0
  - Fault History: Must be capable of storing and reporting the last 10 faults
  - Resident Alerts in Plain Text
  - Product must be capable of contacting a service professional when there is a fault that requires professional correction, at the discretion of the owner

Variable Capacity

- **2022 Proposal:** Maintain 2021 criterion
  - Provide heating and cooling at two or more capacity levels
  - Water-to-water GHP are exempt

Centrally Ducted Air Conditioners and Heat Pumps

- **2022 Proposal:**
  - Levels adjusted only where needed to maintain consistency for Version 6.0, namely the HSPF for single packaged heat pumps
  - Added criteria for cold climate heat pumps, expecting all Version 6.0 Cold Climate Heat Pumps to meet the criteria for Most Efficient
- **Rationale:**
  - Current criteria continue to recognize a select group of extremely efficient products with features facilitating quality installation and maintenance
  - Number of products meeting the ESME efficiency criteria is increasing, but the number of products recognized is significantly less than 1% of all AHRI listings,
  - Want to align with Version 6.0 Installation criteria without requiring all ESME products to reapply

Proposed Levels and Savings for CAC/HPs

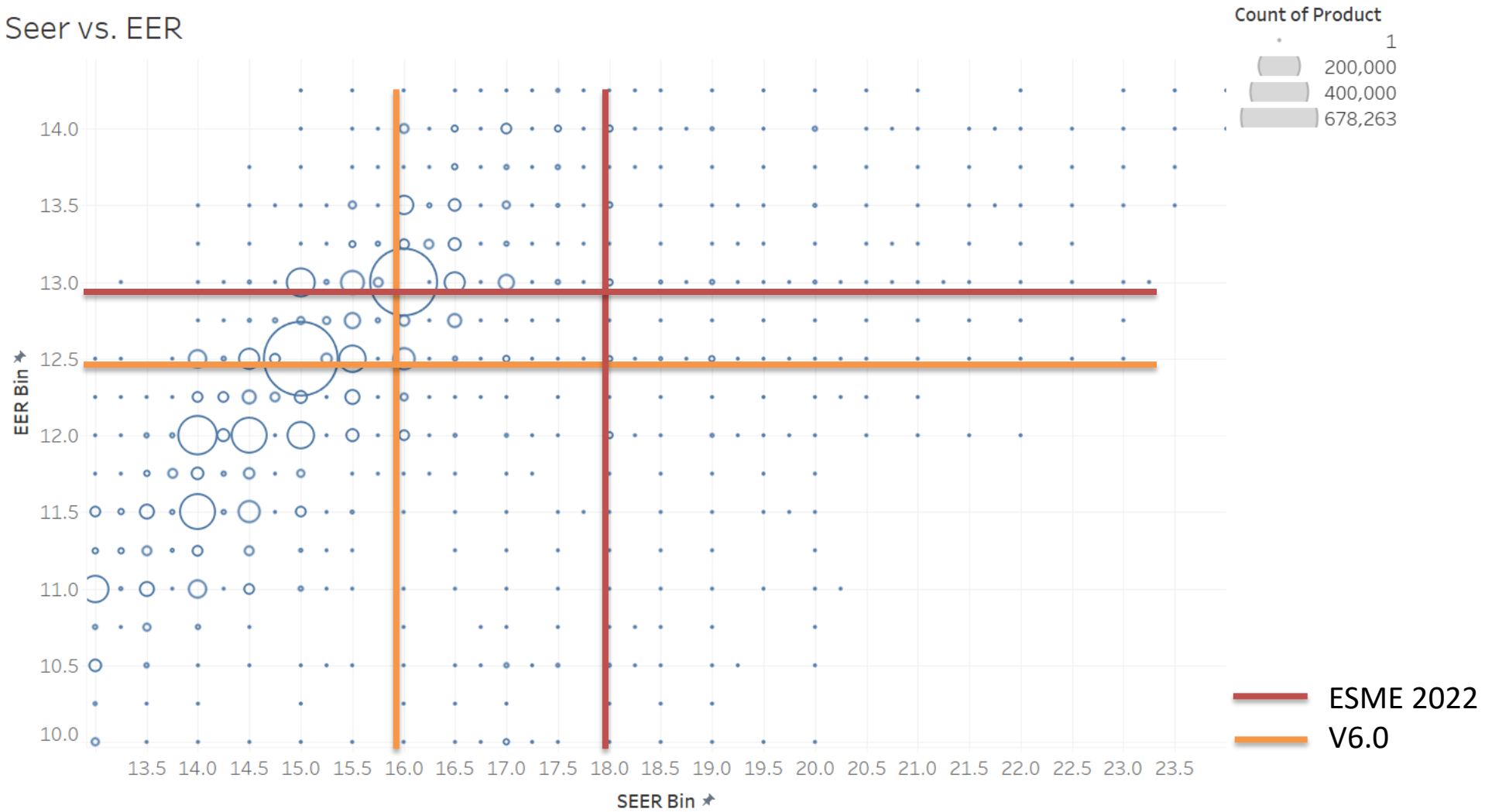
System Type	SEER	EER	HSPF	Savings (North)	Savings (South)
Split AC	18.0	13.0	-	28%	22%
Split HP	18.0	12.5	9.6	18%	20%
Packaged AC	16.0	12.0	-	18%	18%
Packaged HP	16.0	12.0	**8.5**	**9%**	**11%**
Cold Climate	**16.0**	**11.5**	**10**	**16%**	**15%**

COP@5F	% Capacity
1.75	**70%**

Centrally Ducted Air Conditioners and Heat Pumps

System Type	% Meet ESME level from AHRI	% Listed ESME/ AHRI
Split AC	7.6%	0.17%
Packaged AC	14.5%	
Split HP	1.5%	0.11%
Packaged HP	2.8%	
Total	1.7%	0.14%

Split Air Conditioners



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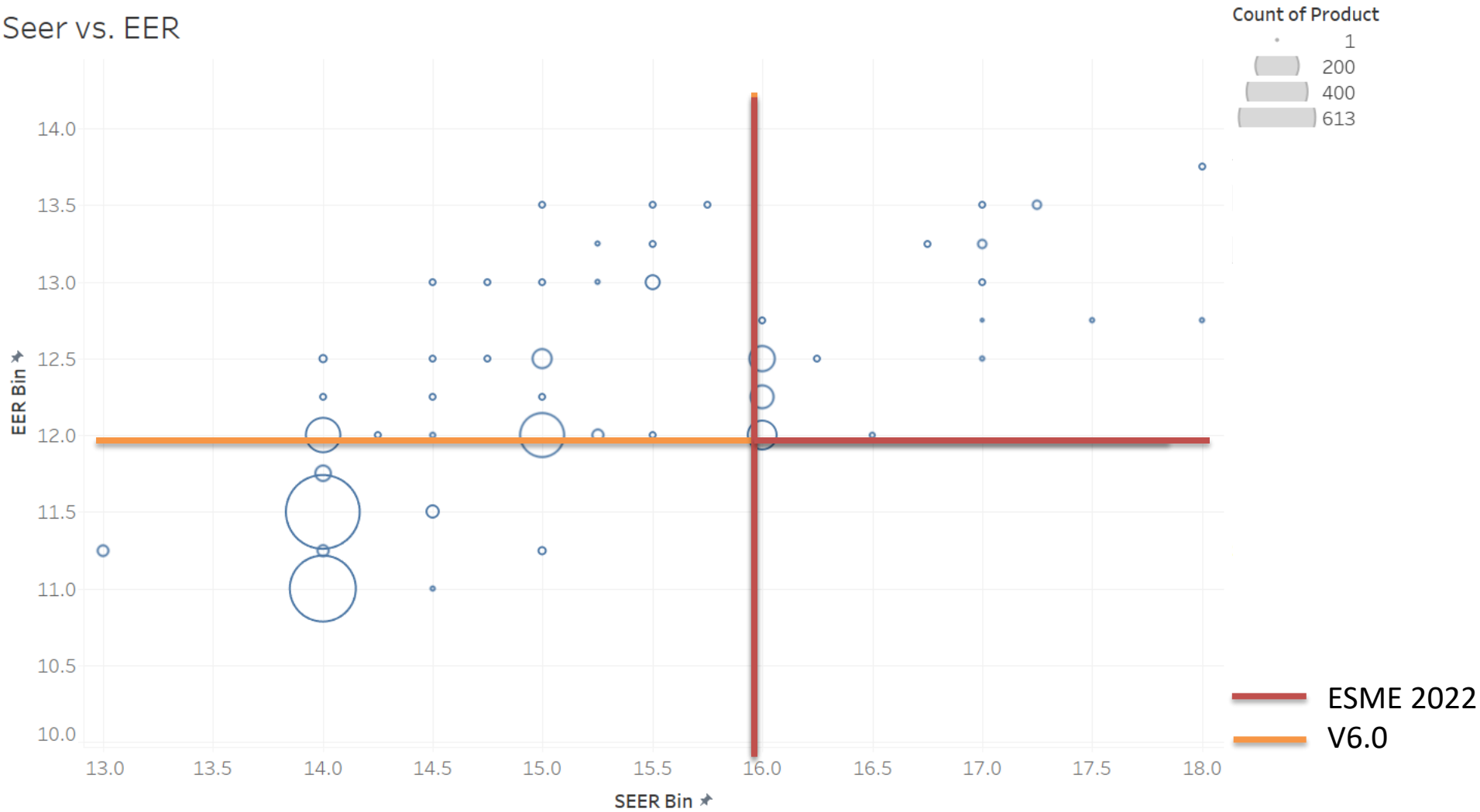
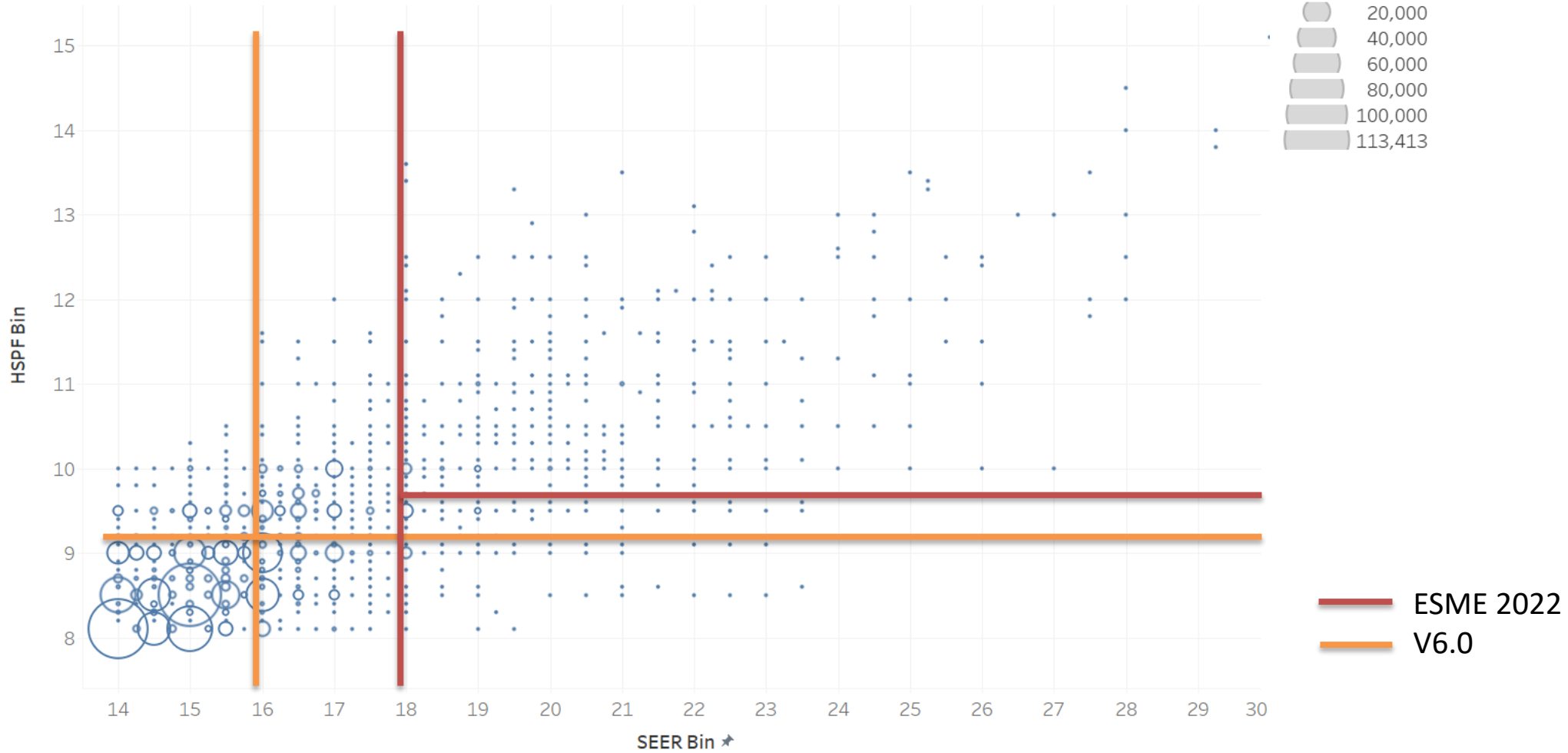
Single Package Air Conditioners

Seer vs. EER

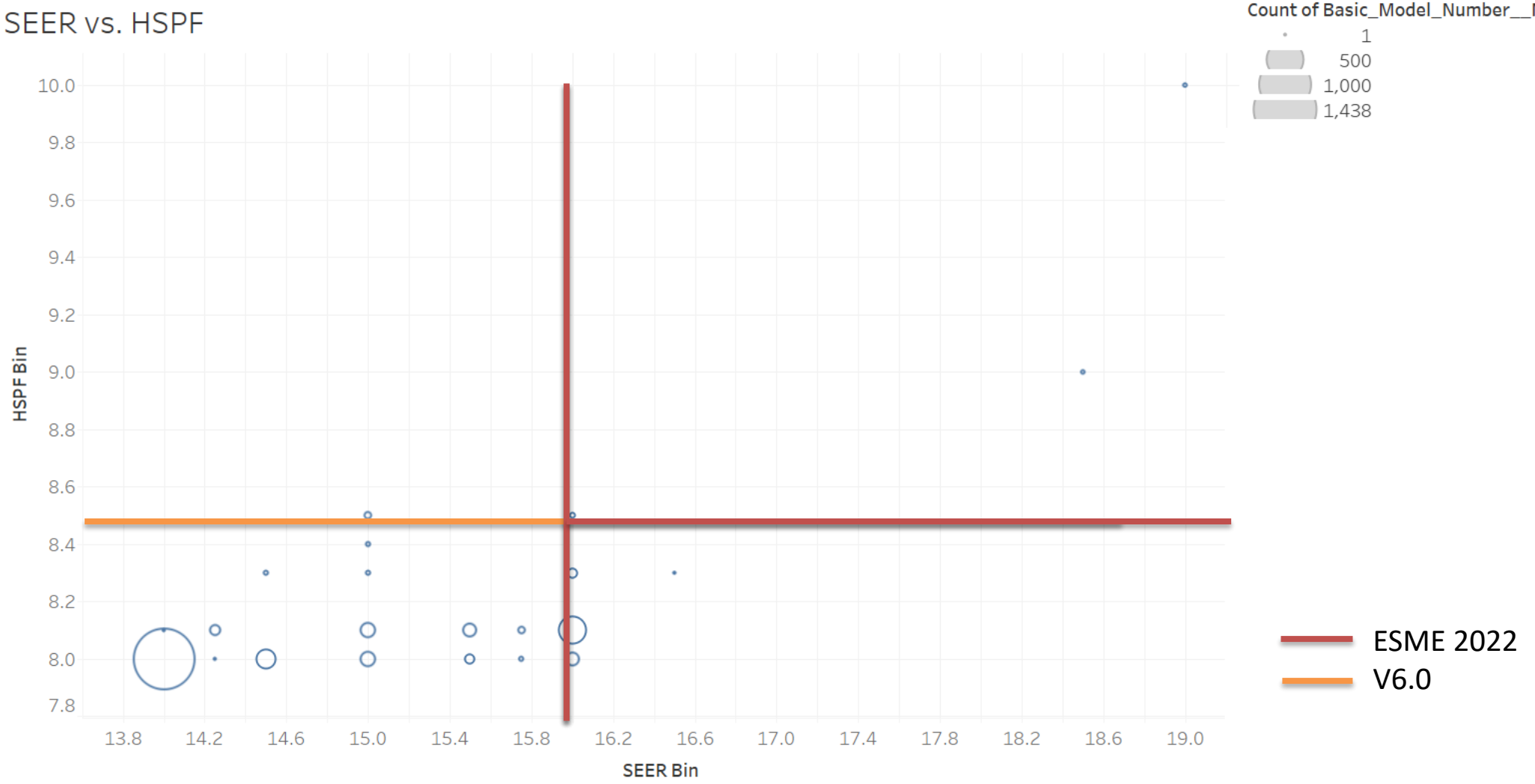


Split Heat Pumps

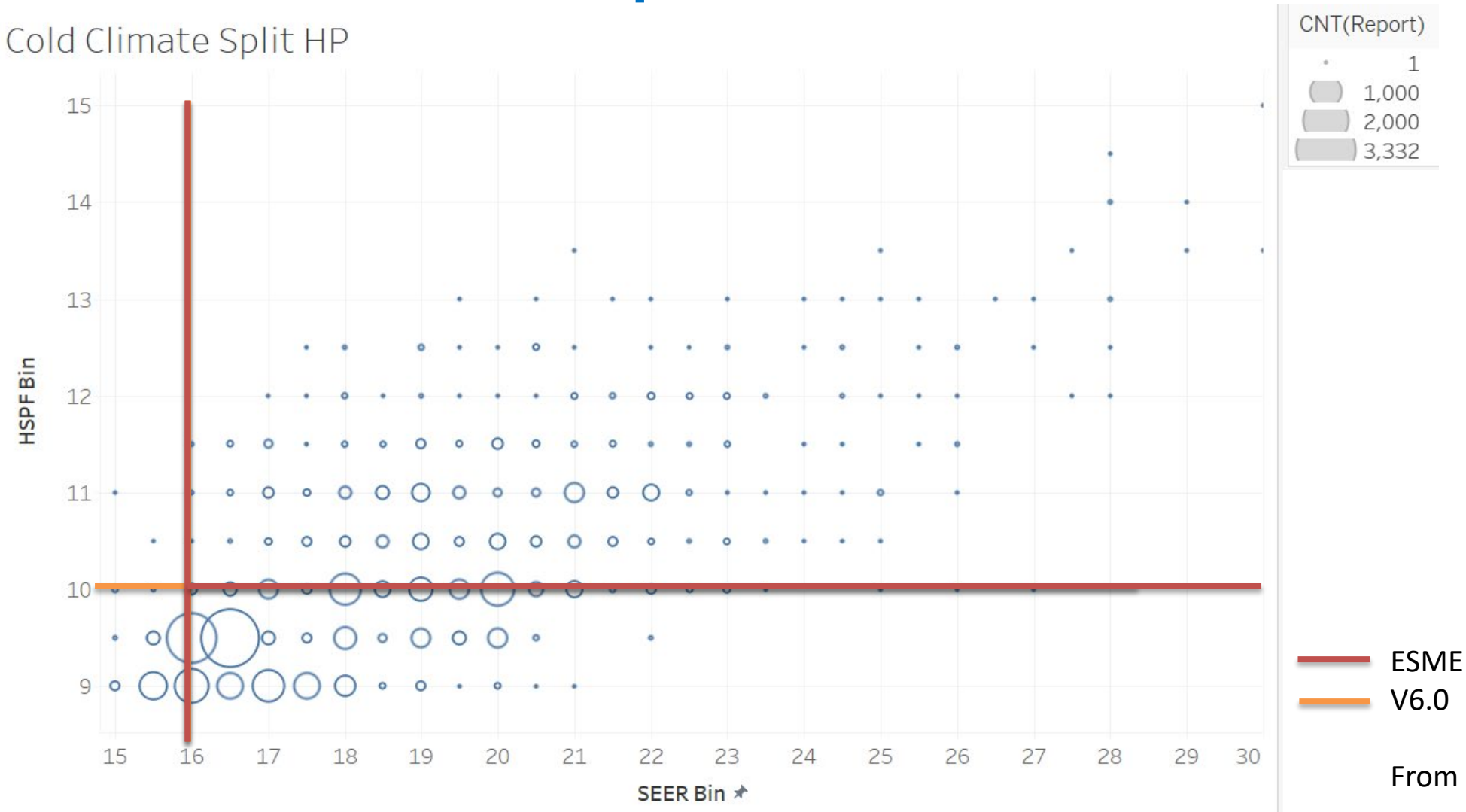
SEER vs. HSPF



Single Package Heat Pumps



Cold Climate Heat Pumps



ESME 2022
V6.0

From NEEP List

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Ductless Split Air Conditioners and Heat Pumps

- **2022 Proposal:** Maintain current performance, with the addition of a cold climate ductless level

System Type	SEER	EER	HSPF	Savings (North)	Savings (South)
Ductless AC	20.0	12.5	-	35%	30%
Ductless HP	20.0	12.5	10.0	24%	27%
Ductless Cold Climate	**18.0**	**11.5**	**10**	**20%**	**21%**

COP@5F	% Capacity
1.75	**70%**

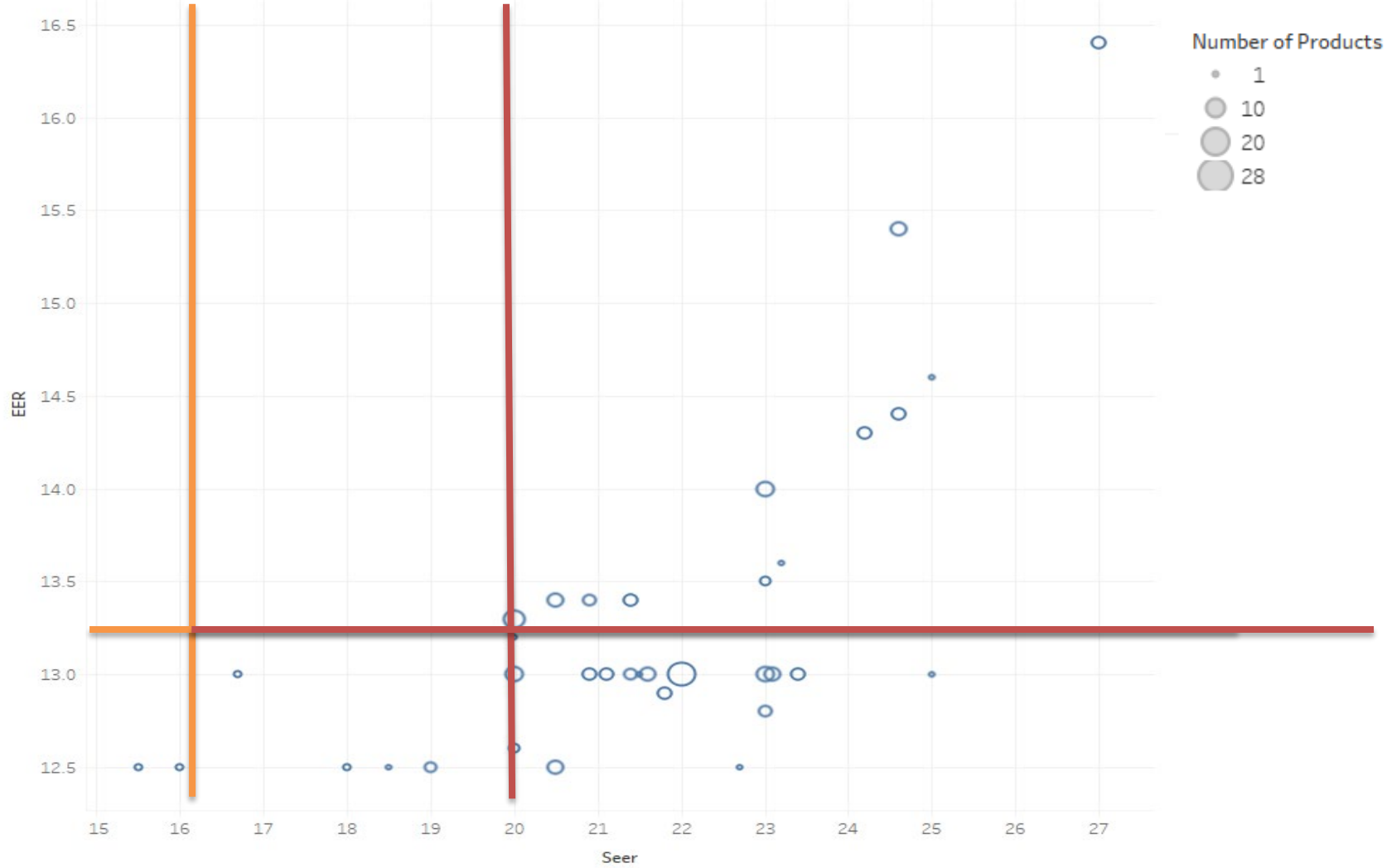
- **Rationale:**
  - While rated performance requirements are not exclusive, the system status and messaging criteria are

Ductless Split Air Conditioners and Heat Pumps

System Type	% Meet ESME level from AHRI	% Listed ESME/ AHRI
Ductless AC	18%	0.8%
Ductless HP	32%	0.9%
Cold Climate Ductless HP	45%*	-
Total	30%	0.8%

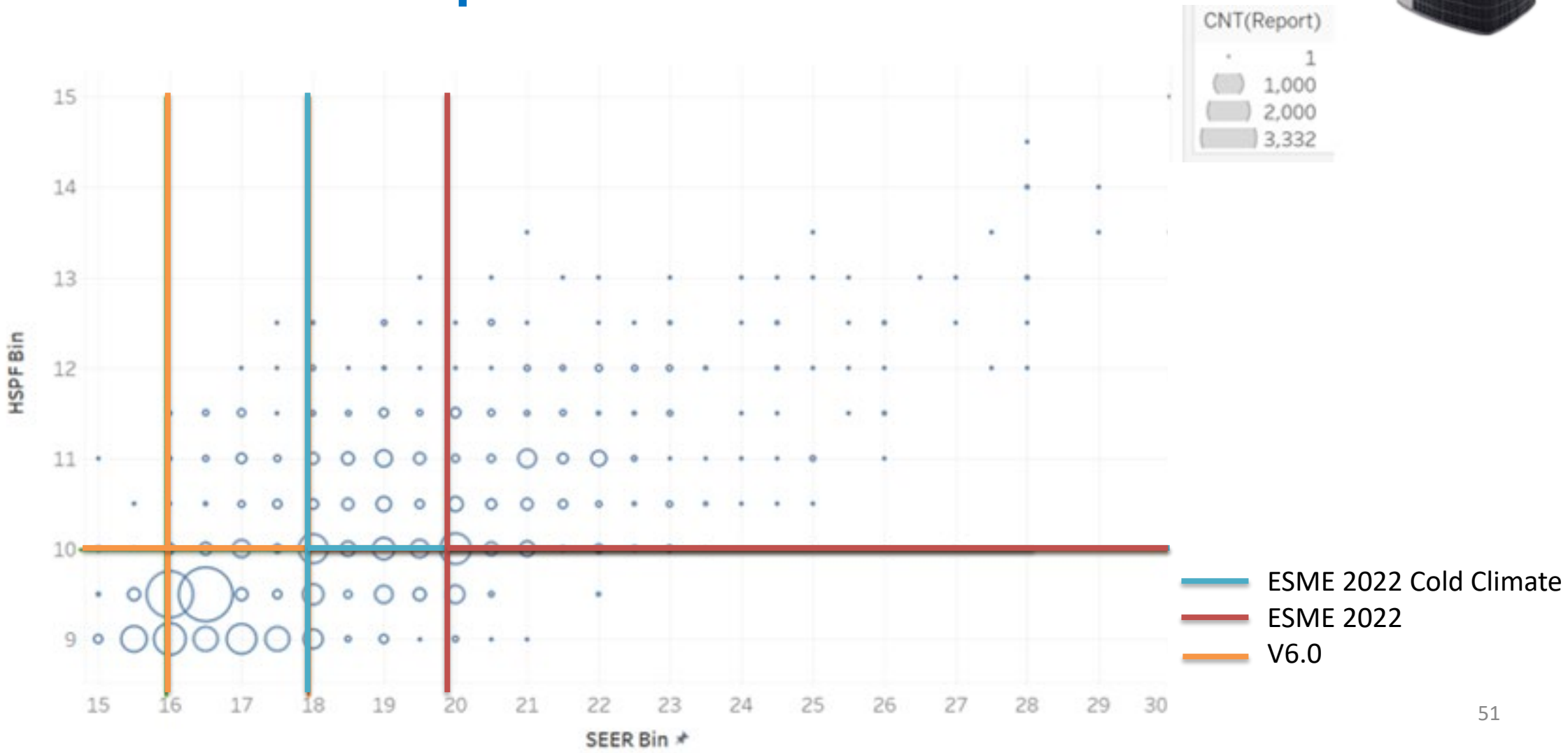
*Does not include 5 degree criteria, actual percentage of products will be lower

Ductless Air Conditioners



ESME 2022
V6.0

Ductless Heat Pumps & Cold Climate



Appendix M1 Criteria

- As of January 1, 2023, all new CAC/HP product certifications will need to be made to Version 6.0, in accordance with Appendix M1
- The criteria for both ducted and ductless CAC/HPs have been provided in both Appendix M and Appendix M1 criteria and are intended to recognize the same subset of products:

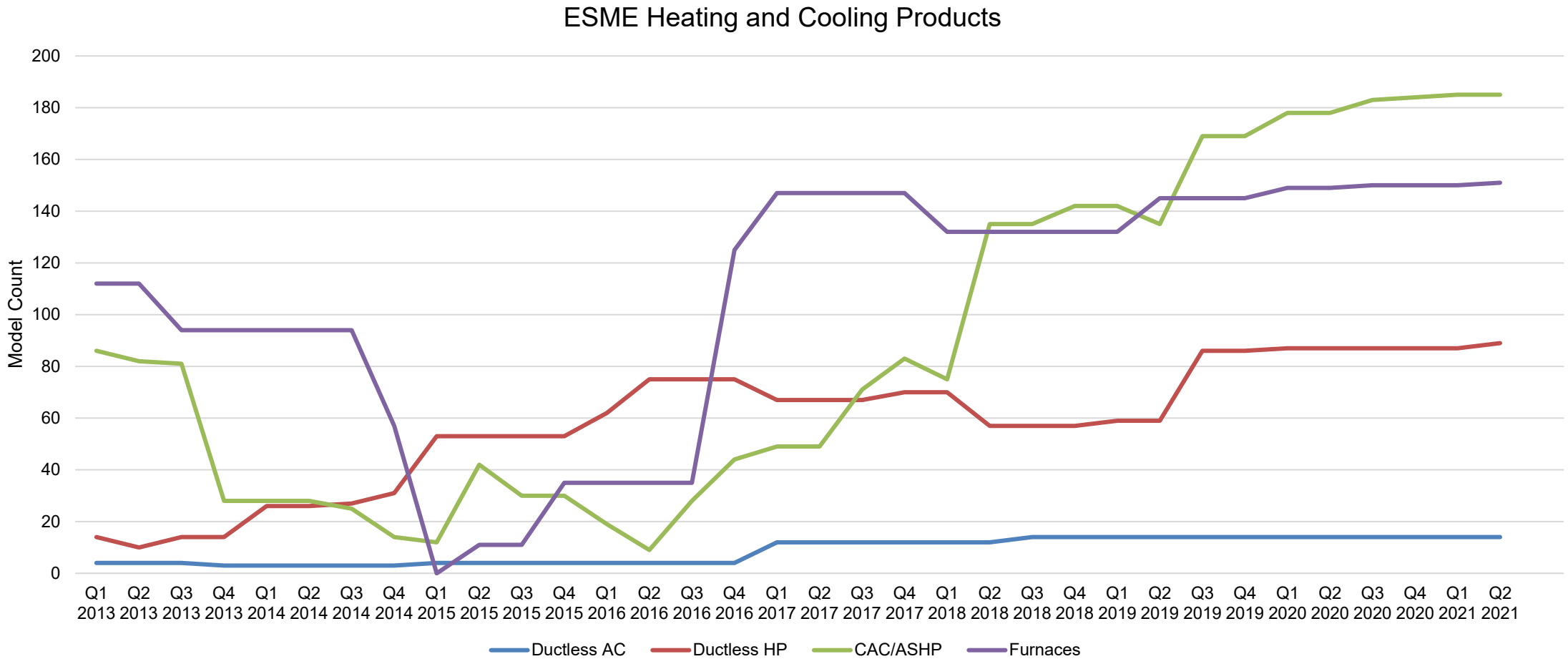
Product type	SEER2	EER2	HSPF2
Split system CAC	16.9	12.4	-
Split system HP	16.9	12.0	8.2
Single-package CAC	15.2	11.5	-
Single-package HP	15.2	11.5	7.2
Cold Climate HP	15.2	11.0	8.5
Ductless CAC	18.7	12.0	-
Ductless HP	18.7	12.0	8.5
Ductless Cold Climate HP	16.9	11.0	8.5

Furnaces

- **2022 Proposal:** Include small updates to the system status and messaging criteria that will be required for new products.
  - ≥ 97 AFUE
  - Fault history must report the last 10 faults not cleared by a service professional
  - Unit shall be capable of directly notifying service personnel of required servicing, at the discretion of the resident
- **Rationale:**
  - AFUE requirement alone offers great differentiation of products and is aligned with CEE Tier 3

System Type	% Meet ESME level from AHRI	% Listed ESME/ AHRI	Per Unit Savings
Gas	4.3%	1.6%	18%

AC, Heat Pumps, & Furnaces



Geothermal Heat Pumps

- **2022 Proposal:** Maintain current performance, system status and messaging, and two capacity criteria with small updates to the fault history criteria and ability to contact a contractor.

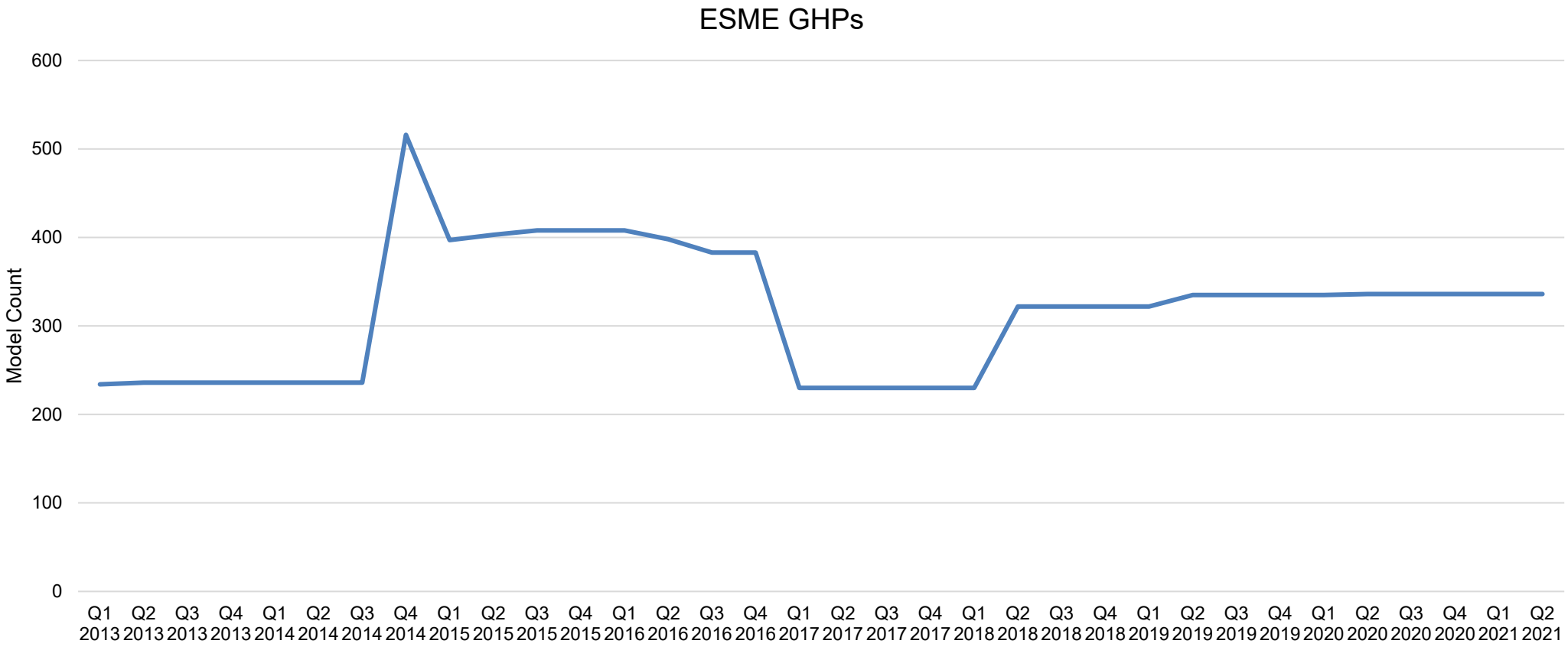
- **Rationale:**
  - Current criteria continue to recognize a select group of extremely efficient products with features facilitating quality installation and maintenance
  - Percent of products recognized is appropriate:

System Type	% Listed ESME/ EStar	% Listed ESME/ AHRI
GHP	5.3%	3.9%

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



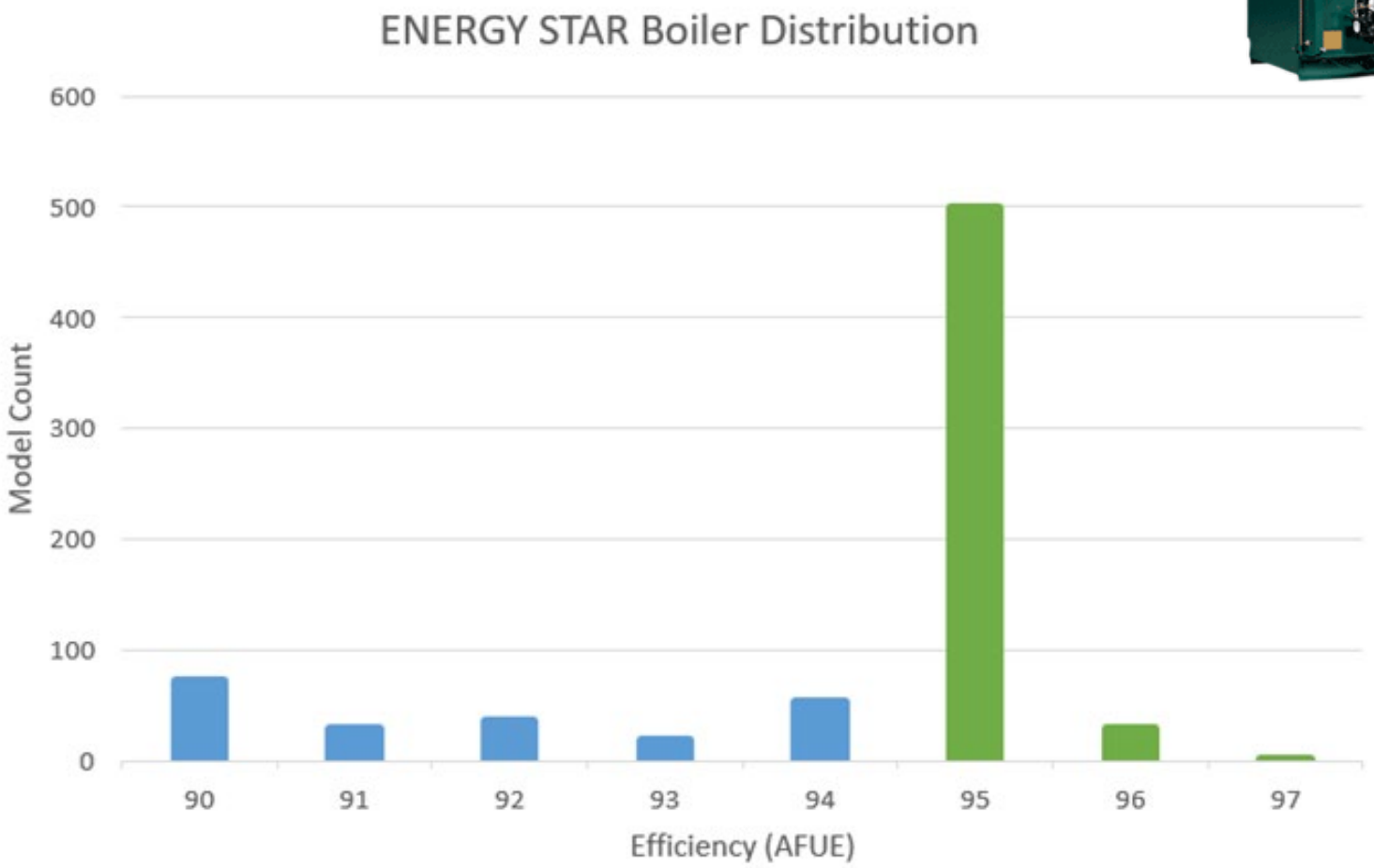
Boilers

- **2022 Proposal:**
  - Gas boilers will once again be eligible for ENERGY STAR Most Efficient
  - 120% AFUE, per ANSI Z21.40.4 Performance Testing and Rating of Gas-Fired, Air Conditioning and Heat Pump Appliances.

- **Rationale:**
  - This category was paused in 2021 due to low differentiation
  - EPA believes that at this time, gas heat pump boilers may be making progress in their development and would like to recognize those products as they are brought to market
  - EPA would appreciate further feedback on the development of the test procedure

Boilers

- Analysis from 2020 shows majority of ENERGY STAR boilers at 95 AFUE
- For boilers' long term viability as a decarbonized heating source, further progress in needed



Next Steps

- Comments are due Thursday, August 19; send to MostEfficient@energystar.gov
- Slides will be posted to: https://energystar.gov/products/spec/energy_star_most_efficient_2022_criteria_development_pd
- The 2022 criteria will be finalized in early September 2021
- Products will be recognized as ENERGY STAR Most Efficient 2022 beginning January 1, 2022

SAVE TODAY. SAVE TOMORROW.
SAVE FOR GOOD.

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Thank you for your participation today.