ENERGY STAR®
Most Efficient 2018 Update and 2019 Criteria

September 11, 2018

12:00pm - 2:00pm

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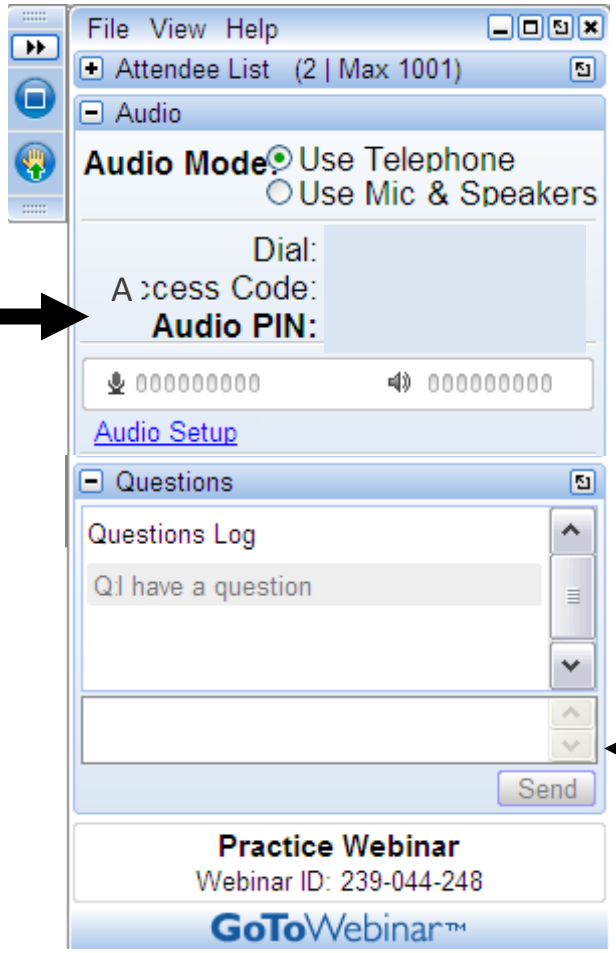

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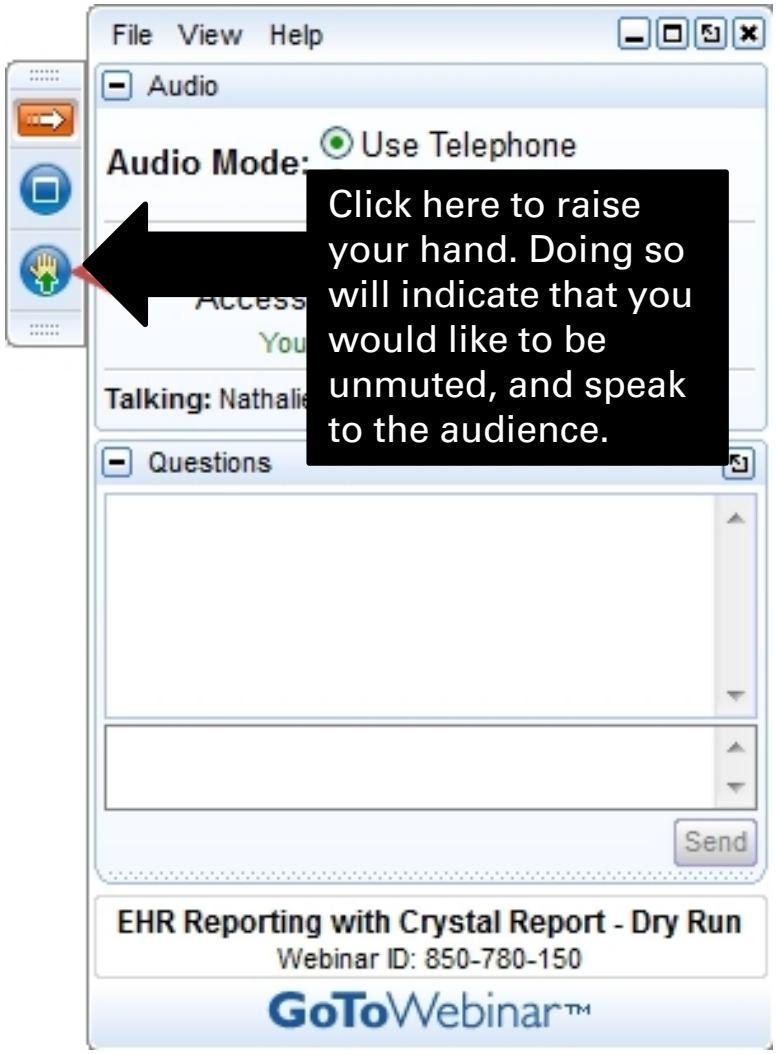


ENERGY STAR® Most Efficient

- 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

ENERGY STAR® Most Efficient 2018

Update as of July

Product Category	Models	ENERGY STAR Partners
Boilers	726	29
Ceiling Fans	24	5
Central Air Conditioners and Air Source Heat Pumps	165	8
Clothes Dryers	14	4
Clothes Washers	72	9
Computer Monitors	132	21
Dehumidifiers	14	5
Dishwashers	71	8
Furnaces	51	6
Geothermal Heat Pumps	611	10
Refrigerators-Freezers	405	30
Ventilating Fans	195	11
Windows	419	40
Total*	**2,899**	**155**

ENERGY STAR® Most Efficient 2018 Update: Growing Utility Collaboration

- Over 30 energy efficiency program sponsors are leveraging ENERGY STAR Most Efficient.
  - Serving over 14 million households (or roughly 30 million consumers).
  - Featuring one or more Most Efficient product categories; reflecting a diverse geographic spread, including two water utilities in California.
- ENERGY STAR Most Efficient is also being leveraged for retailer incentives through ENERGY STAR Retail Products Platform (ESRPP)
  - Innovative, nationally coordinated, market transformation initiative.
  - In 2016, during its first pilot year, three retailers and eight energy efficiency program sponsors representing 11 states and almost 18% of the U.S participated in the ESRPP. ENERGY STAR certified models in five product categories were promoted by program sponsor-labeled signage in almost 700 stores.
  - In 2017, with new sponsors and the addition of Lowe's and Nationwide Marketing Group. ESRPP retailers now represent more than 80% of the appliance market, with more than 1,200 stores in current program sponsors' service areas.
  - Going forward, the ESRPP is 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 2018 Update: Redoubling Consumer Education

- In 2018, developed and implemented targeted social media campaign
  - Drove nearly 1 million impressions with a link to energystar.gov/mostefficient, where partners' products and programs are featured
- To come this year, geo-targeted outreach that lines up with new product launches i.e., heat-pump dryer promotion this fall
- And in 2019, re-run of the successful 2018 campaign supplemented by more customized, product-focused education coordinated with *Flip Your Fridge* and *Laundry Made Better* national promotions

ENERGY STAR® Most Efficient 2018 Update: Added Web Highlighting

- ENERGY STAR Most Efficient website:
  - Includes product images and real-time information on retail pricing and where to locate and buy these models
  - Now available for ceiling fans, clothes washers, dryers, dishwashers, monitors, refrigerators, and ventilating fans found at select major retailers.
  - Available for TVs in 2019

ENERGY STAR® Most Efficient Categories in 2019

- Boilers
- Ceiling and Ventilating Fans
- CAC/ASHP
- Clothes Washers
- Computer Monitors
- Dehumidifiers
- Dishwashers
- Dryers
- Furnaces
- Geothermal Heat Pumps
- Refrigerators- Freezers
- TVs
- Windows

Draft 2019 ENERGY STAR® Most Efficient Recognition Criteria

Refrigerators

- **2019 Proposal:**
  - Maintain current criteria for top freezer product types
    - ≥ 10% more efficient than the Federal minimum
  - Updating criteria for side-by-side and bottom freezer product types
    - ≥ 20% more efficient than the Federal minimum
- **Rationale:**
  - Top freezers remain the lowest energy-consuming standard-size refrigerator-freezers
  - Currently available refrigerator technologies yield significant efficiency improvement (at least 20% relative to the Federal minimum)
    - Technologies include innovative refrigerants, variable speed compressors, and updated vacuum-insulated panels (VIPs)
  - EPA estimates there are currently at least 122 base models from 36 brands that are able to meet the criteria
    - Representative of 11% of the market

Refrigerators

	Base Model Count of the Rated Annual Energy Consumption at each Level			Base Model Count at or above the Percentage Better than the Federal Minimum Standard Using the Known Performance of Products with a 5% Engineering Factor				
	Federal Minimum	ENERGY STAR	ESME 2018	10%	15%	20%	25%	30%
Top Freezer	335	134	134	**78**	20	1	0	0
Side-by-Side	199	52	7	52	4	**4**	2	1
Bottom Freezer	546	405	97	405	97	**40**	18	3

Red Text indicates the estimated base model counts for the proposed ESME 2019 levels.

Clothes Washers

- **2019 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
  - Set a minimum cleaning performance level (total cleaning score, CS_t) of ≥ 85

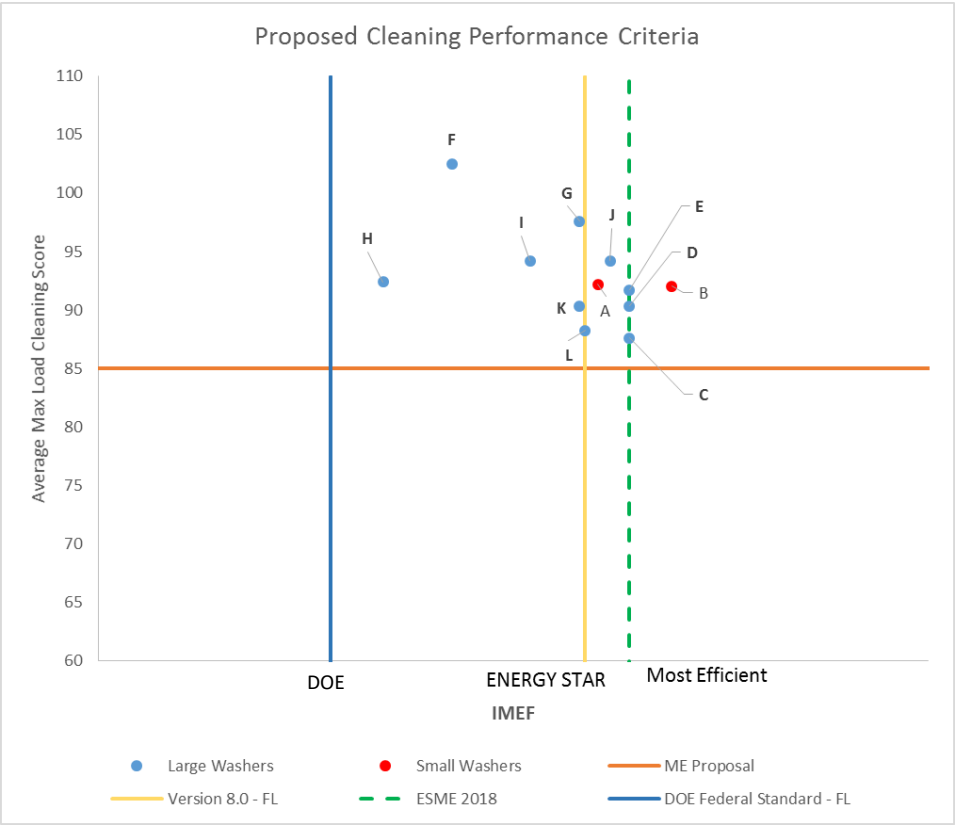
- **Rationale:**
  - The ENERGY STAR Most Efficient 2019 criteria will be equivalent to the Most Efficient 2018 criteria, along with the addition of a cleaning performance criteria
  - Currently ESME 2018 recognizes about 30 models from 11 brands meeting the proposed energy and water criteria, representing 16% of the market
  - Significant average energy and water savings:
    - Standard size: 46% less energy and 48% less water than a conventional model
    - Small volume size: 24% less energy and 38% less water than a conventional model

Cleaning Performance

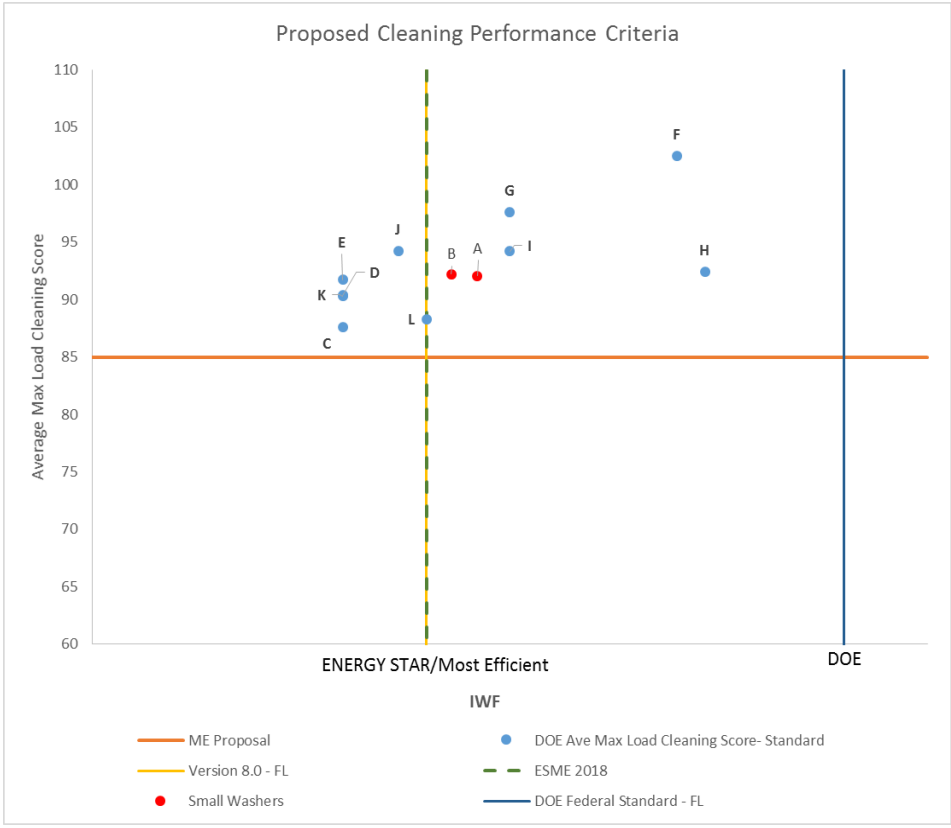
- As the ENERGY STAR program sets more rigorous energy and water levels, the Agency wants to ensure consumer expectations continue to be met.
- EPA is proposing qualifying products must have a Total Cleaning Score of 85 or better, as described in the ENERGY STAR Test Method for determining residential clothes washer cleaning performance.
- Cleaning score will be reported at time of certification or can be added subsequently for currently certified products that wish to be recognized as ENERGY STAR Most Efficient.
- EPA and DOE have released a test method for cleaning performance.
- The test method is based on the Final Draft Test Method published in Feb. 2017, with two minor updates:
  - Load size table extended to reflect the recent DOE test procedure waivers accommodating clothes washers with 6.0 - 8.0 cubic feet capacity.
  - Loading instructions clarified to emphasize that when loading test cloths with stain strips, any overlapping must be avoided, or minimized if overlapping is unavoidable.

Cleaning Performance Data

Cleaning Performance & Energy Use



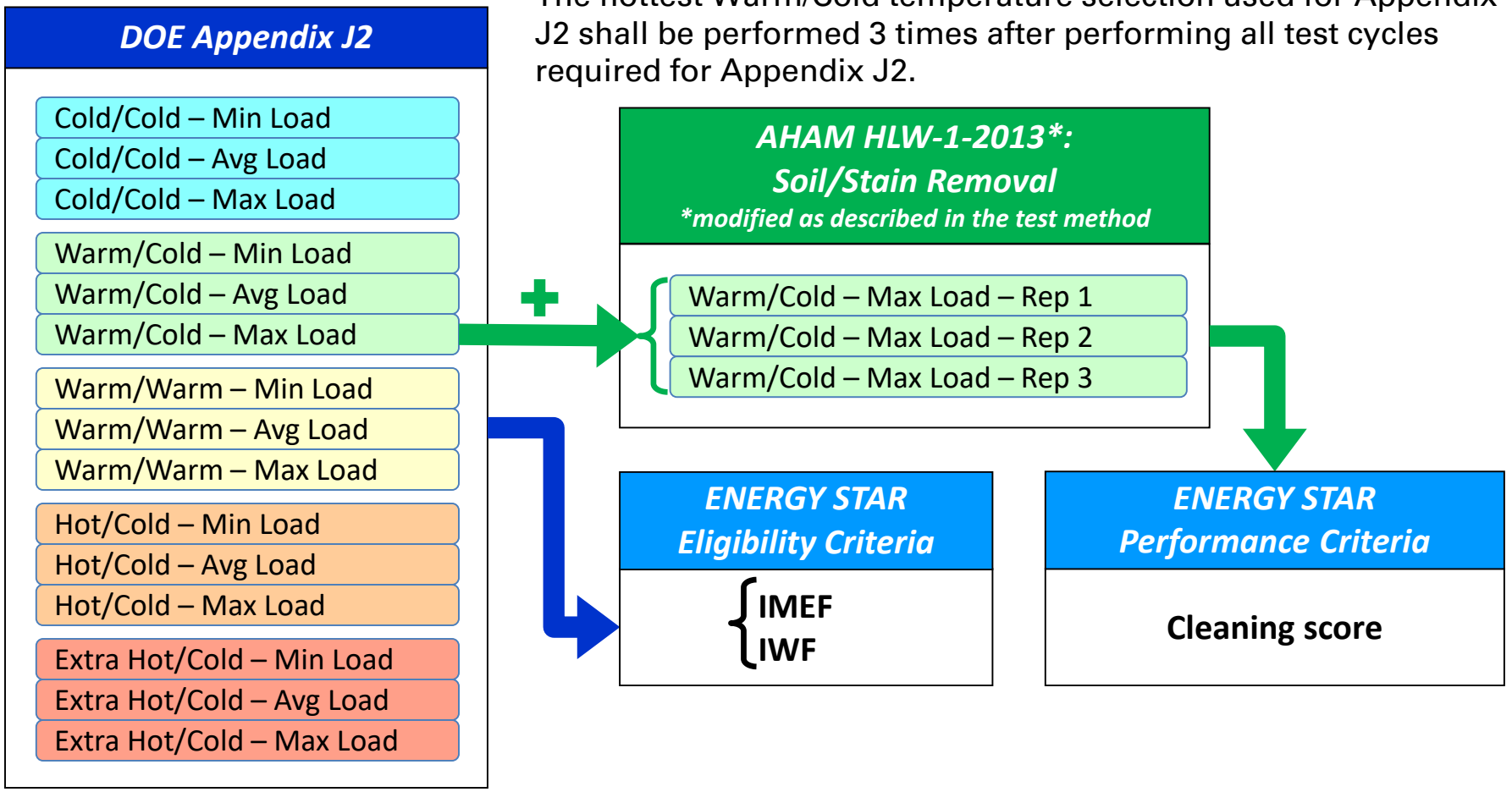
Cleaning Performance & Water Use



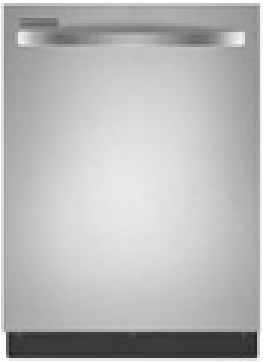
- Across a wide spectrum of sizes and energy/water efficiencies, there is no discernable relationship between energy/water performance and cleaning performance

Test Cycles for ENERGY STAR Test Method

The hottest Warm/Cold temperature selection used for Appendix J2 shall be performed 3 times after performing all test cycles required for Appendix J2.



Dishwashers



- **2019 Proposal:**
  - Maintain current criteria for Standard models
    - Annual Energy Use ≤ 240 kWh/yr; Water Use ≤ 3.2 Gallons/cycle
    - Minimum per cycle Cleaning Index of 70, for heavy, medium and light soil load cycles
      - Submit at the time of certification
      - Average cleaning index for all units in the sample
      - Not subject to verification testing

Dishwashers

- **Rationale:**
  - Product category introduced under 2015 ENERGY STAR Most Efficient
  - Currently 18 base models from 7 brands (Asko, Beko, Blomberg, Miele, Smeg, Summit, Viking) are on our Most Efficient list – meaning they have met the energy, water and cleaning criteria
    - Represents 8% of the market, with an increase from 12 to 18 Most Efficient base models in the past year
  - A dishwasher meeting the ENERGY STAR Most Efficient 2019 proposal saves 22% energy and 36% water compared to the federal minimum

Clothes Dryers

- **2019 Proposal:**
  - Maintain current criteria for all dryer product types
  - For the normal cycle with max dryness setting, the manufacturer shall test the dryer according to the provisions in the DOE test method, but where the drying temperature setting can be chosen independently of the program, it shall be set to the maximum

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

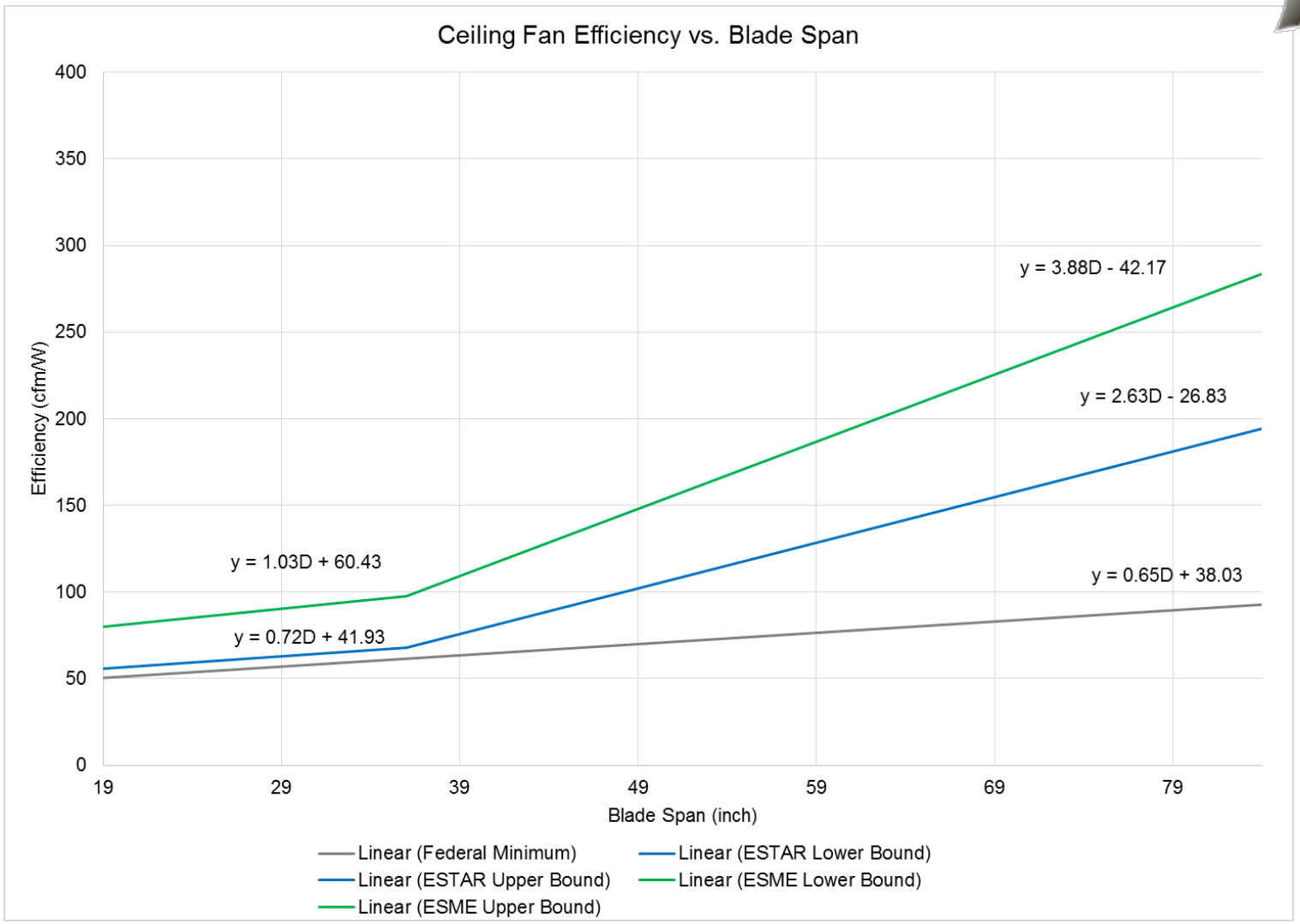
Clothes Dryers

- **Rationale:**
  - The number of dryers on the 2018 Most Efficient list with the max dry criteria grew steadily throughout the year
    - There are 11 base models from 6 brands (Asko, Beko, Blomberg, LG, Miele, Whirlpool) that meet the max dry cycle criteria, representing 5% of the market
  - Dryers that use heat pump or hybrid heat pump technologies are now identified on the QPL
    - EPA encourages partners to complete this optional field during certification allowing utilities to easily incentivize these technologies
  - A clothes dryer meeting the ENERGY STAR Most Efficient 2019 proposal saves 28% energy for standard-sized electric models, 30% energy for compact models, and 25% energy for gas models compared to the federal minimum

Ceiling Fans

- **2019 Proposal:** Maintain 2018 level (only in terms of ceiling fan efficiency metric):
  - Blade Span 19 ≤ 36 inches: Efficiency ≥ 1.03D + 60.43
  - Blade Span > 36 inches: Efficiency ≥ 3.88D – 42.17
- **Rationale:**
  - Big drop in ENERGY STAR models certified to V4.0 from V3.0
    - 400 models from 32 brands for V3.0
    - 36 models from 6 brands for Version 4.0
  - ESME level is still very stringent
  - Savings remain around 64%

Ceiling Fans



Ventilating Fans

- **2019 Proposal:** Maintain B/U room and in-line fans criteria; add sound level criteria for B/U room fans; add efficacy criteria for in-line fans tested with filters
  - Bathroom/Utility room fans
    - Efficacy at high speed (cfm/W): ≥10
    - Sound Level (Sones) ≤ 4.0 at 0.25 in w.g. for highest speed only
  - In-line fans
    - Efficacy at high speed (cfm/W): ≥ 5
    - Efficacy at high speed when tested with a filter 6≤MERV<13 (cfm/W): ≥ 4.7
    - Efficacy at high speed when tested with a filter MERV≥13 (cfm/W): ≥ 3.8

Ventilating Fans

- **Rationale**
  - Criteria for B/U room fans continue to represent an exclusive group of fans
    - Would rather focus on promoting good installed performance rather than increasing stringency of airflow efficacy
  - In-line vent fans with high speed airflow above 400 cfm are now meeting the criteria
  - High efficiency range hoods are gaining traction, but the market is still limited

Fan Type	Savings
B/U Room	86%
In-line	44%

General HVAC Considerations

- **System Status and Messaging Criteria:** no change
  - These criteria, in addition to the applicable efficiency criteria, continue to distinguish leaders among HVAC products
- **Narrative Guide:** no change
  - 2016 updates have been helpful
- **Variable Capacity**
  - At least 2 capacity stages required starting 2017
  - Proposing requiring variable capacity 2019 (CAC/ASHP only)
  - Most recognized products already meet this requirement

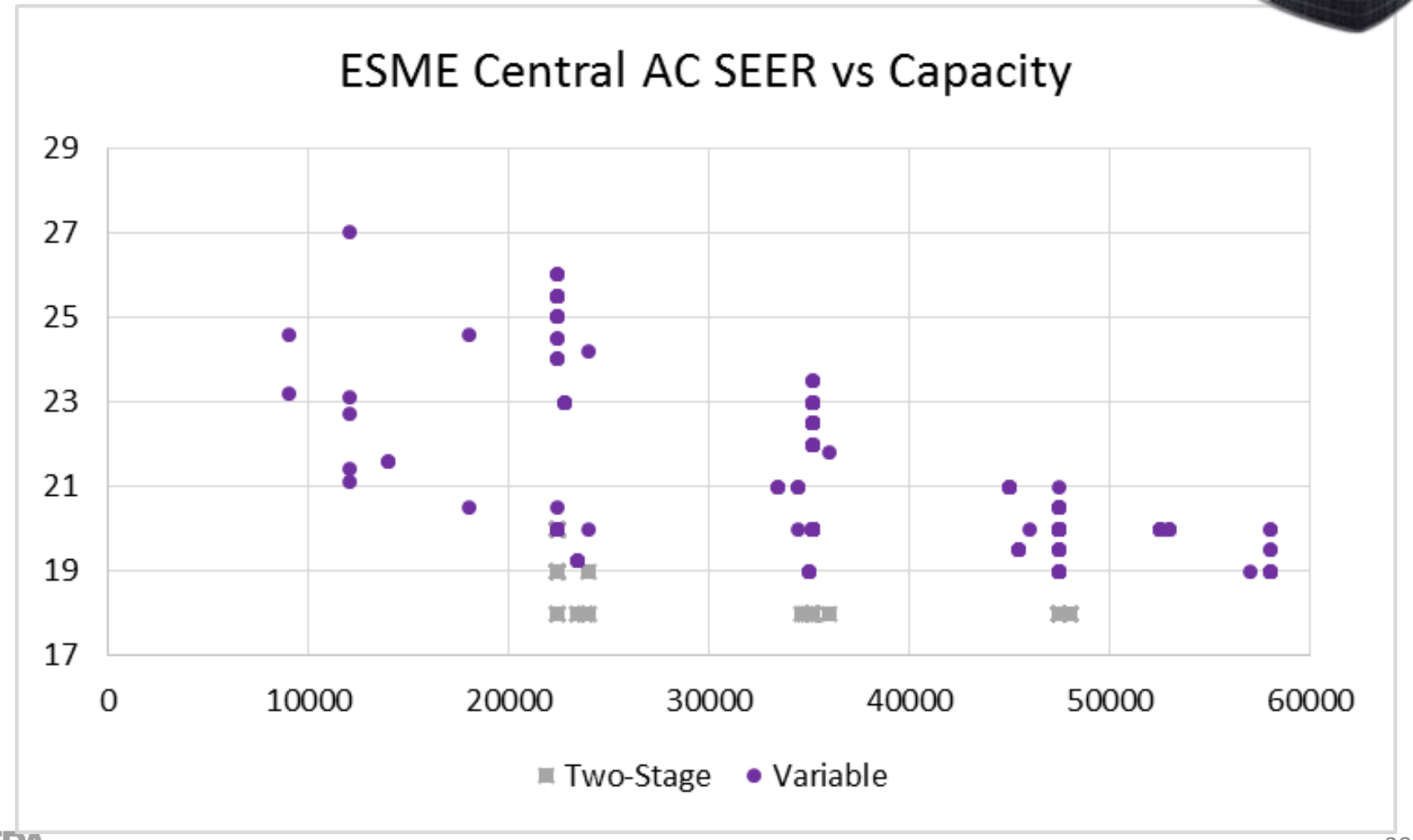
Ductless Split Air Conditioners and Heat Pumps

- **2019 Proposal:** Maintain current performance and system status and messaging criteria; require more than 3 capacity levels
  - 20 SEER; 12.5 EER; 10 HSPF (HSPF for heat pumps only)
  - Products must be able to provide heating and cooling (as applicable) at more than 3 capacity levels
- **Rationale:**
  - While rated performance requirements are not exclusive, the system status and messaging criteria are:
    - 1% of AC models and 1.2% of HP models are recognized among those in AHRI directory within scope

Centrally Ducted Air Conditioners and Heat Pumps

- **2019 Proposal:** Maintain current performance and system status and messaging criteria; require more than 3 capacity levels
- **Rationale:**
  - Current criteria continue to recognize a select group of extremely efficient products with features facilitating quality installation and maintenance
  - Percent of products recognized among those in the AHRI directory are appropriate:
    - Centrally ducted split and packaged air conditioners and heat pumps: much less than 1%
    - Geothermal Heat Pumps: less than 6%

Centrally Ducted Air Conditioners



Centrally Ducted Air Conditioners and Heat Pumps

System Type	SEER	EER	HSPF	COP
Split AC	18	13		
Split HP	18	12.5	9.6	
Packaged AC	16	12.0		
Packaged HP	16	12.0	8.2	
Closed Loop Water-to-Air GHP		17.1		3.6
Open Loop Water-to-Air GHP		21.1		4.1
Closed Loop Water-to-Water GHP		16.1		3.1
Open Loop Water-to-Water GHP		20.1		3.5
DGX		16.0		3.6

Savings for Air Conditioners and Heat Pumps

System Type	Savings (North)	Savings (South)
Split HP	22%	22%
Split AC	28%	22%
Packaged HP	10%	10%
Packaged AC	13%	13%
Ductless HP	25%	25%
Ductless AC	35%	30%

System Type	Savings
GHP: OL water to water	36%
GHP: CL water to water	28%
GHP: OL water to air	44%
GHP: CL water to air	36%
GHP: DGX	36%

Furnaces

- **2019 Proposal:** Maintain current performance and system status and messaging criteria
  - ≥ 97 AFUE
- **Rationale:**
  - AFUE requirement alone offers great differentiation of products and is aligned with CEE Tier 3
  - No technical difference between 97 and 98 AFUE
  - 1 % of models recognized among those in AHRI directory that are within scope

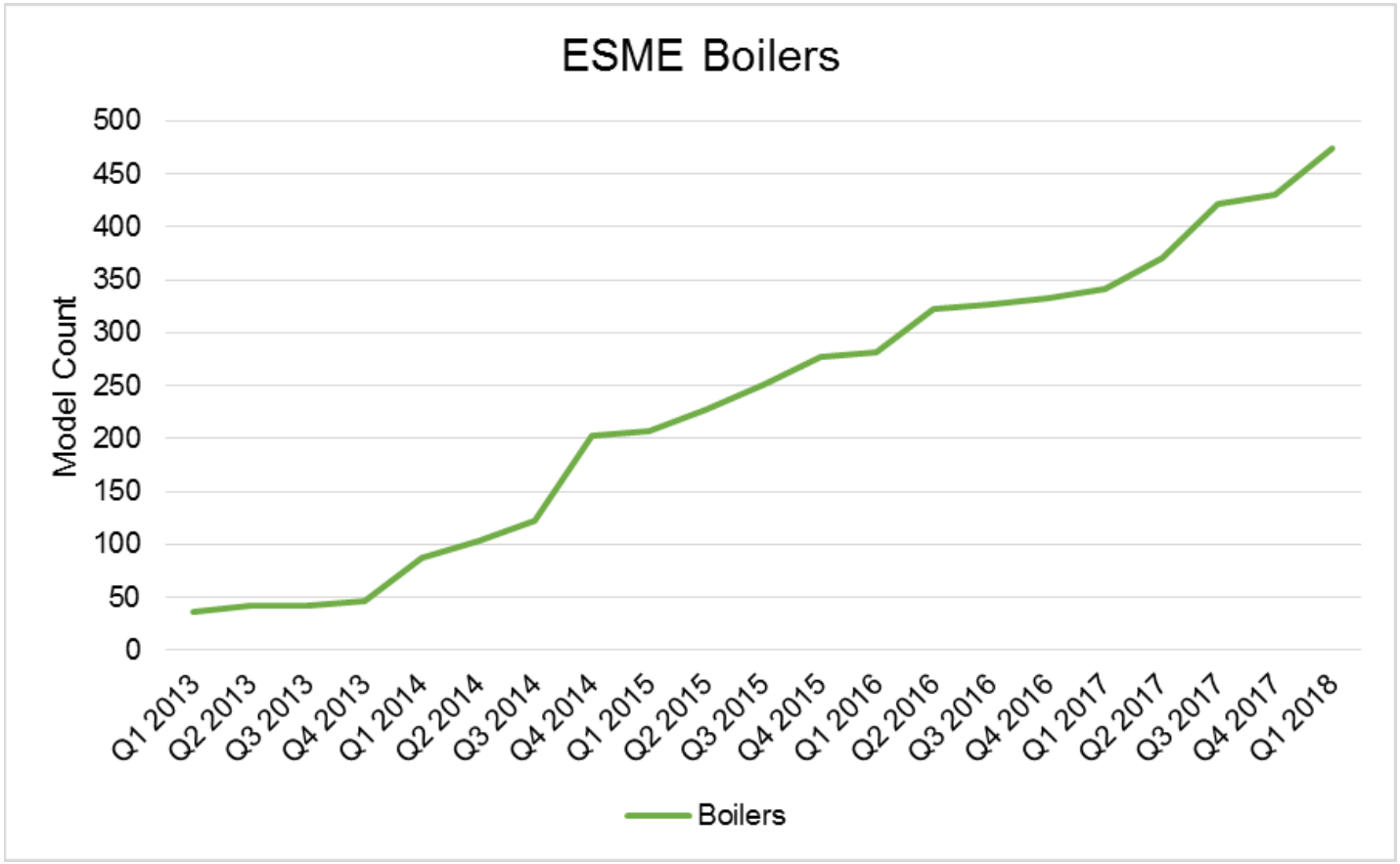
System Type	Savings
Gas	18%

Boilers

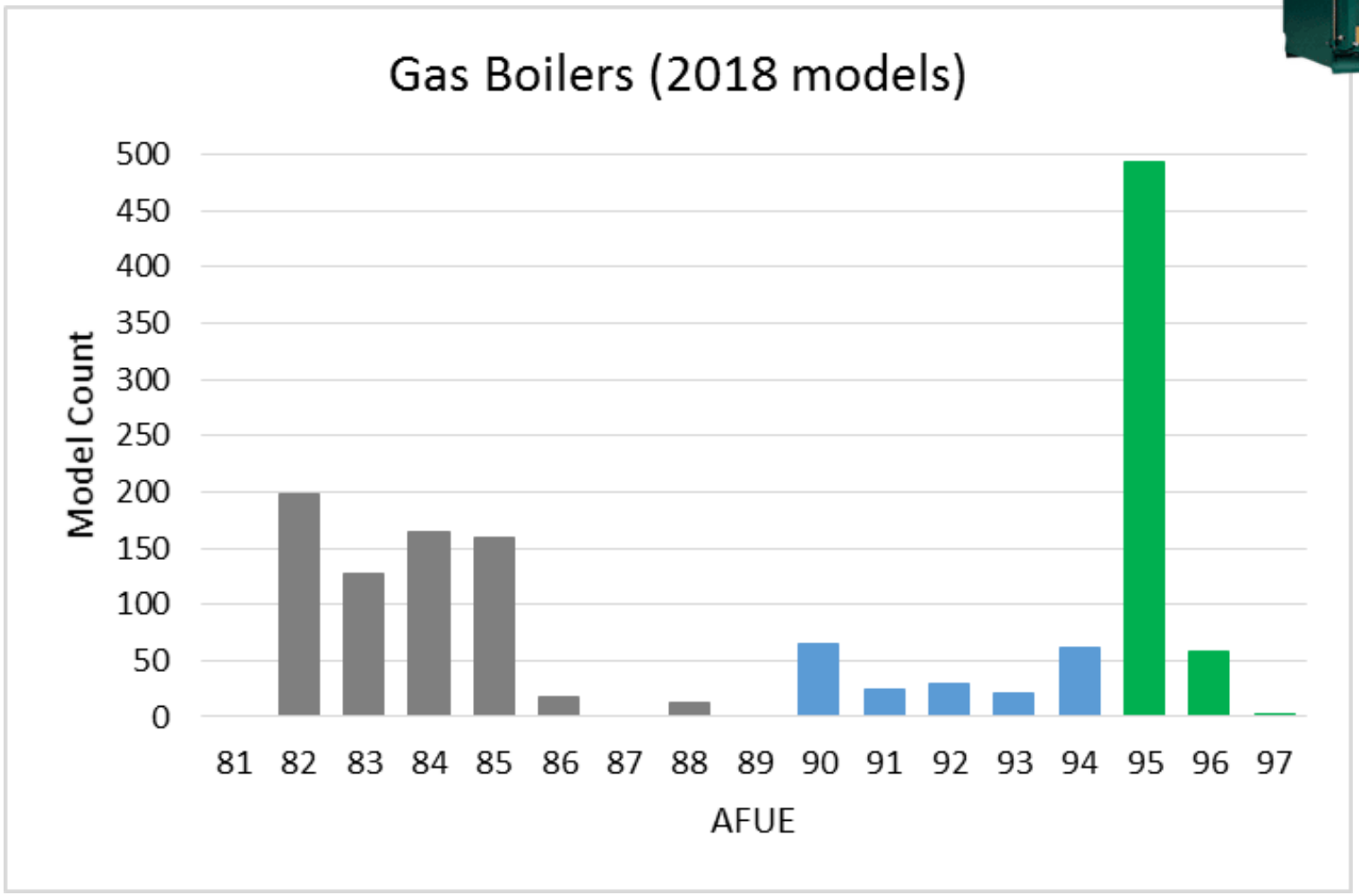
- **2019 Proposal:** Maintain current performance criteria
  - Gas Powered Boilers: ≥ 95 AFUE
  - Oil Powered Boilers: ≥ 90 AFUE
- **Rationale:**
  - Unable to find opportunities for additional distinctions
    - No technical difference between 95 and 96 AFUE
    - No obvious opportunity to improve installation through fault detection and diagnostic program
  - EPA to further explore multi-staging and proper installation and sizing

System Type	Savings
Gas	14%
Oil	7%

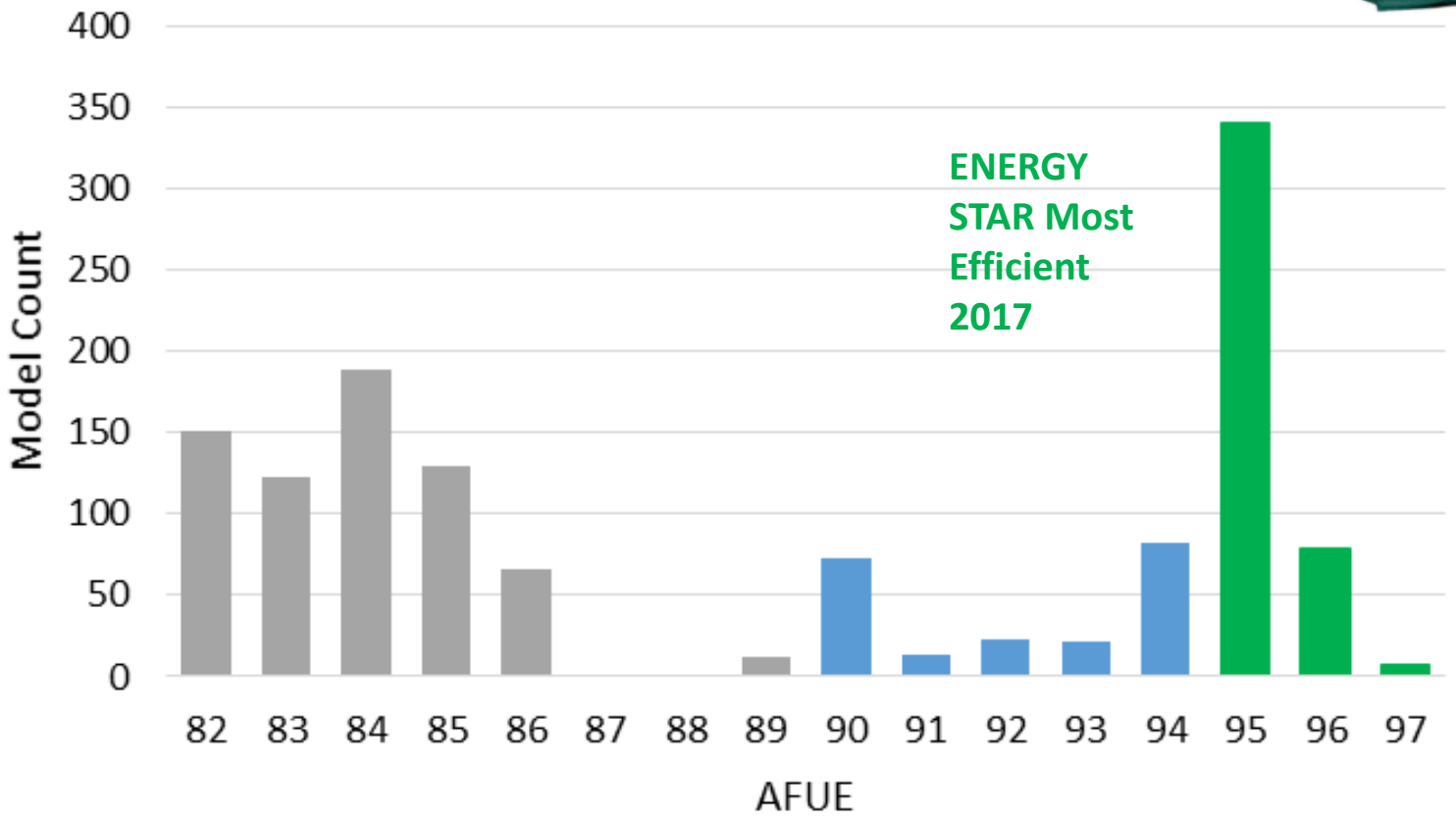
Gas Boilers


ESME Boilers
Model Count
500
450
400
350
300
250
200
150
100
50
0
Q1 2013
Q2 2013
Q3 2013
Q4 2013
Q1 2014
Q2 2014
Q3 2014
Q4 2014
Q1 2015
Q2 2015
Q3 2015
Q4 2015
Q1 2016
Q2 2016
Q3 2016
Q4 2016
Q1 2017
Q2 2017
Q3 2017
Q4 2017
Q1 2018
Boilers

Gas Boilers


Gas Boilers (2018 models)
Model Count
500
450
400
350
300
250
200
150
100
50
0
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
AFUE

Gas Boilers


400
350
300
250
200
150
100
50
0
Model Count
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
AFUE
ENERGY STAR Most Efficient 2017

Dehumidifiers

- **2019 Proposal:** Maintain current performance criteria; provide nearly equivalent IEF (to accommodate V5.0, once available for certification)
  - < 75 pints/day EF criteria unchanged (complies using representations based on Appendix X)
    - Stand Alone: ≥ 2.20
    - Whole House: ≥ 2.30
  - 50.00 or less pints/day portable and 8 ft^3 or less whole-home IEF criteria (complies using representations based on Appendix X1)
    - Portable, product capacity ≤ 25 pints/day: ≥ 1.57
    - Portable, product capacity 25.01 to 50.00 pints/day: ≥ 1.80
    - Whole Home: ≥ 2.09

Dehumidifiers

- **Rationale:**
  - 4% of models currently meet ESME level
  - Larger sizes (> 50 pints/day and > 8 ft^3 case volume) not included: compelling Most Efficient levels not available and few manufacturers offer models

Product Type	Savings
Stand Alone	23%
Whole-home	26%

Version 5 vs. ENERGY STAR Most Efficient 2019

- Proposed criteria for ENERGY STAR Most Efficient 2019 Dehumidifiers are equal to V5 proposed levels
- ESME 2019 applies to products sold in 2019
- Version 5 will take effect late in 2019, for products manufactured after that point
- Summer 2019 sales: manufactured before effective date of version 5 → these levels will remain a significant step up
- Expect higher levels for ENERGY STAR Most Efficient 2020

Computer Monitors

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:

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

Where:

A = viewable screen area in square inches;

r = Total Native Resolution in megapixels up to 5.0 megapixels total. Products with >5.0 megapixels Total Native Resolution can receive a maximum r of 5 megapixels; and

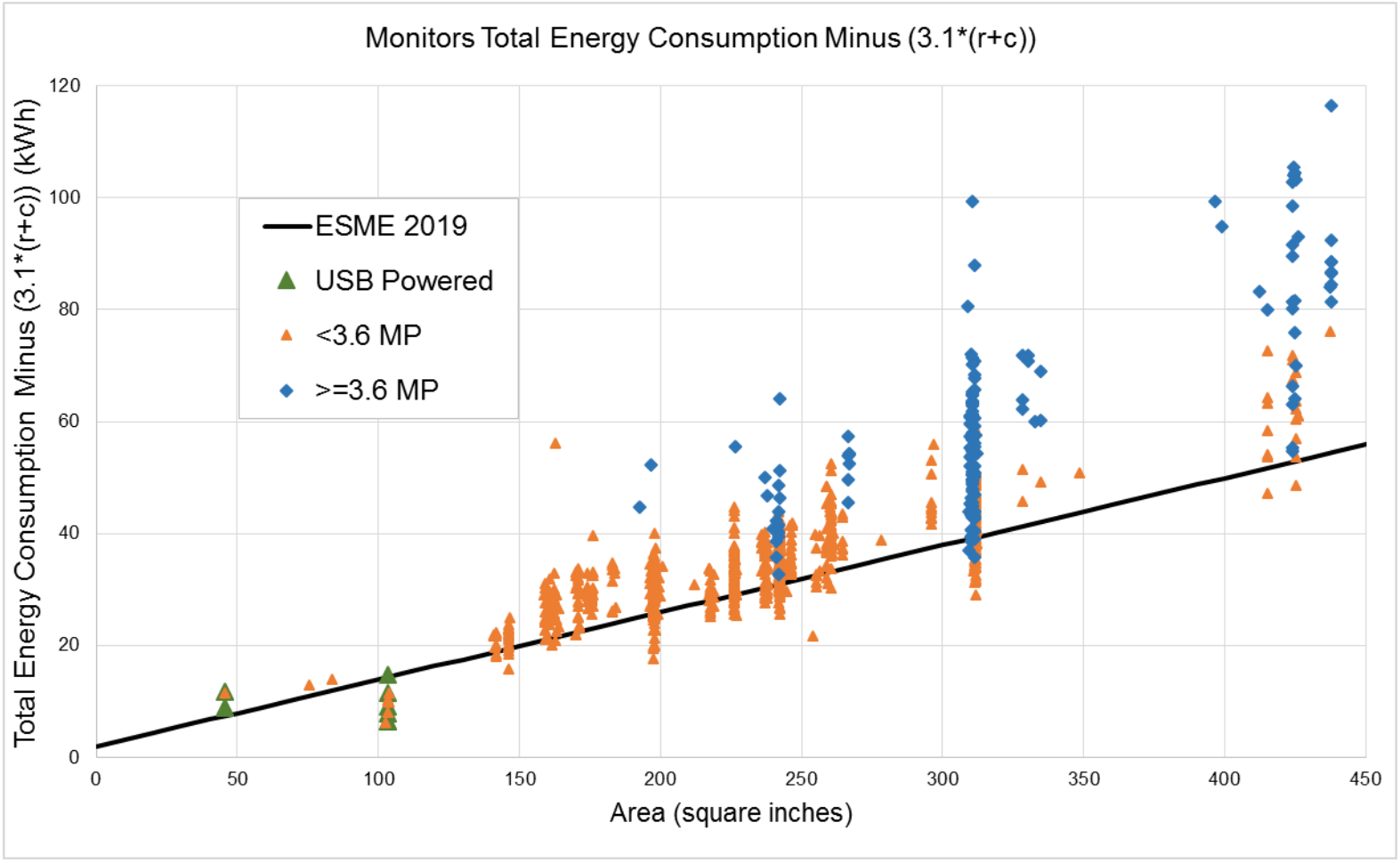
C=	1.9	A < 180 in^2
	2.7	if 180 in^2 ≤ A < 220 in^2
	2	if A ≥ 220 in^2

Computer Monitors

- **Rationale:**
  - EPA proposes to maintain the existing ENERGY STAR Most Efficient 2018 criteria for 2019 with one minor revision:
    - Apply the resolution allowance to the total resolution instead of capping the allowance at 5 megapixels
    - Data show the average resolution of models earning ENERGY STAR Most Efficient recognition is lower than that of ENERGY STAR models
    - EPA intends to recognize higher resolution monitors as ENERGY STAR Most Efficient with this change
  - 2019 criteria recognize 14% of models in the current V7.0 dataset

Screen Area	Total Monitors in Dataset (V7)	# Meeting ESME 2019	% of V7 Meeting ESME 2019
A < 180 in^2	126	18	14%
if 180 in^2 ≤ A < 220 in^2	176	28	16%
if A ≥ 220 in^2	584	74	13%
All	**886**	**120**	**14%**

Computer Monitors



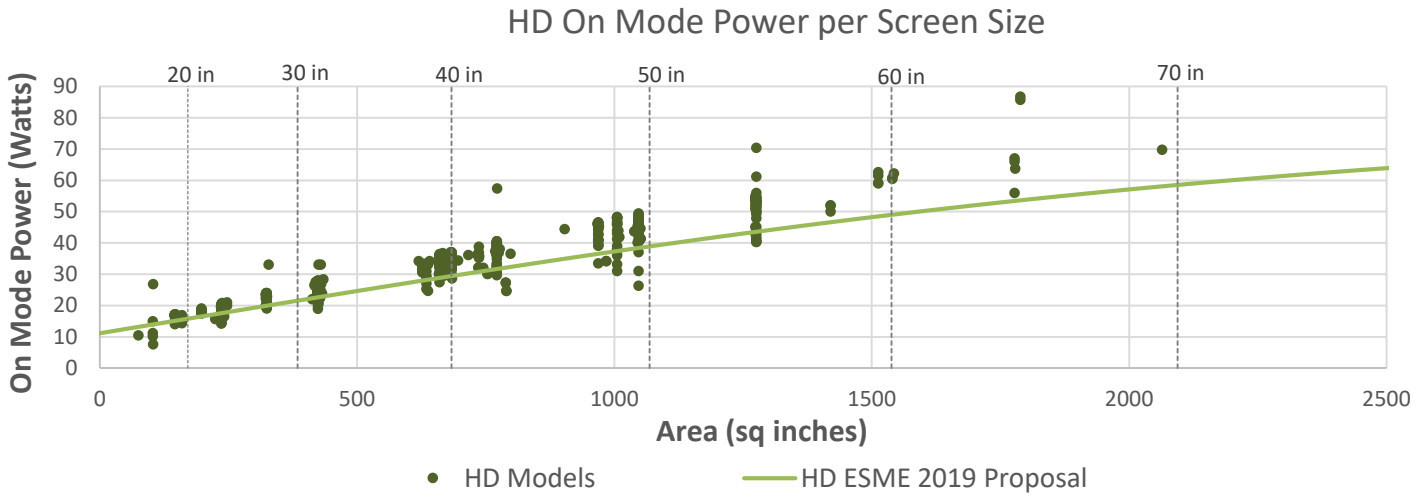
Televisions

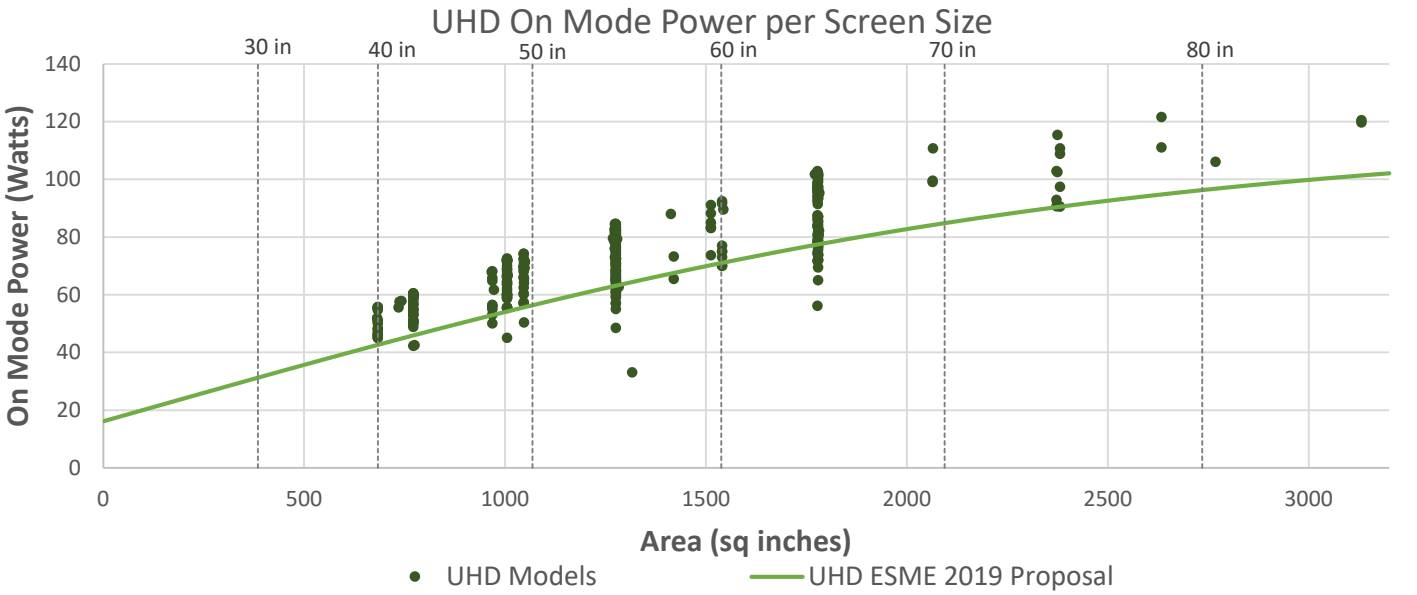
- ESME for TVs was discontinued in 2017 and 2018 as EPA developed the Version 8.0 specification to address the persistence of energy saving features
- **2019 Proposal:** ENERGY STAR Most Efficient for TVs is being reintroduced in 2019
  - Products must be certified to the Version 8.0 Program Requirements
  - The On Mode Power shall be less than or equal to the sum of the maximum allowable On Mode Power consumption and high resolution allowance:
    - $P_{ON_MAX} = 66 \times \tanh(0.000412\ [A - 140] + 0.014) + 14$
    - And an allowance for UHD models (P_{HR})
      - $P_{ON} \leq\ P_{ON_MAX} + P_{HR}$
      - $P_{HR} = 0.45 \times P_{ON_MAX}$

Where:

- P_{ON} *is the On Mode Power in watts;*
- P_{ON_MAX} *is the maximum allowable On Mode Power consumption in watts;*
- P_{HR} *is the high resolution On Mode Power Allowance in watts;*
- *A is the viewable screen area of the product in square inches; and*
- *tanh is the hyperbolic tangent function.*

Televisions ESME 2019 Proposal for HD and UHD





Televisions Most Efficient 2019 Annual Savings

- **Rationale:**
  - EPA estimates that the 2019 proposal will capture the top 10% of models that can meet the Version 8.0 specification

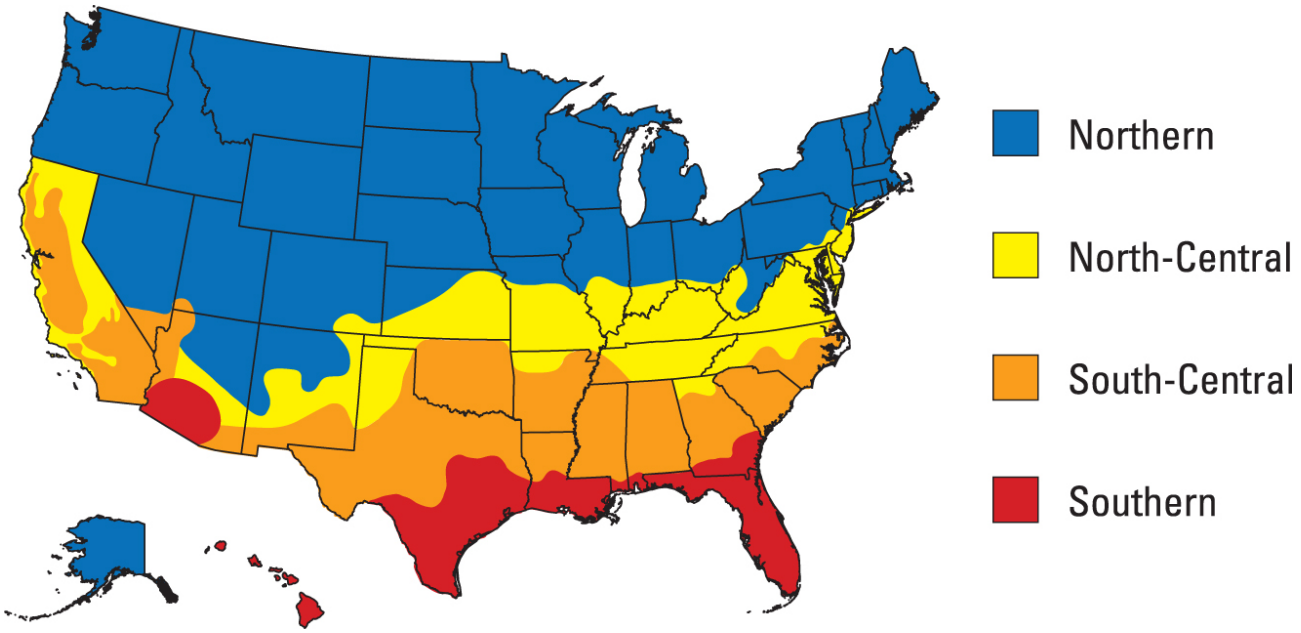
Area (sq. inches)	ESME 2019 % Energy Savings over V7.0
<650	18%
650-900	23%
900-1200	23%
>1200	17%
All	**22%**

Residential Windows

- **2019 Proposal:**
  - Maintain current U-factor and SHGC criteria (No change)
  - NAFS certification still required to help ensure products can support heavier IGUs (Performance Grade ≥ 15)
  - Residential window products only (No doors, skylights, or TDDs)
  - Meaningful savings and improved comfort
  - Verification testing required!
- **Rationale:**
  - Products with performance significantly higher than ENERGY STAR minimum criteria are widely available; but still a relatively small slice of total market
    - 40 manufacturers
    - 419 product lines (of thousands of ENERGY STAR certified product lines available)
- **Future:**
  - EPA and DOE are continuing discussions towards the development of an ENERGY STAR Most Efficient dynamic window products specification

Residential Windows

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



Next Steps

- EPA will finalize the 2019 criteria in September 2018
- Products will be recognized as ENERGY STAR Most Efficient 2019 beginning January 1, 2019

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Thank you for your participation today.