



ENERGY STAR® Most Efficient 2016 Update and 2017 Criteria

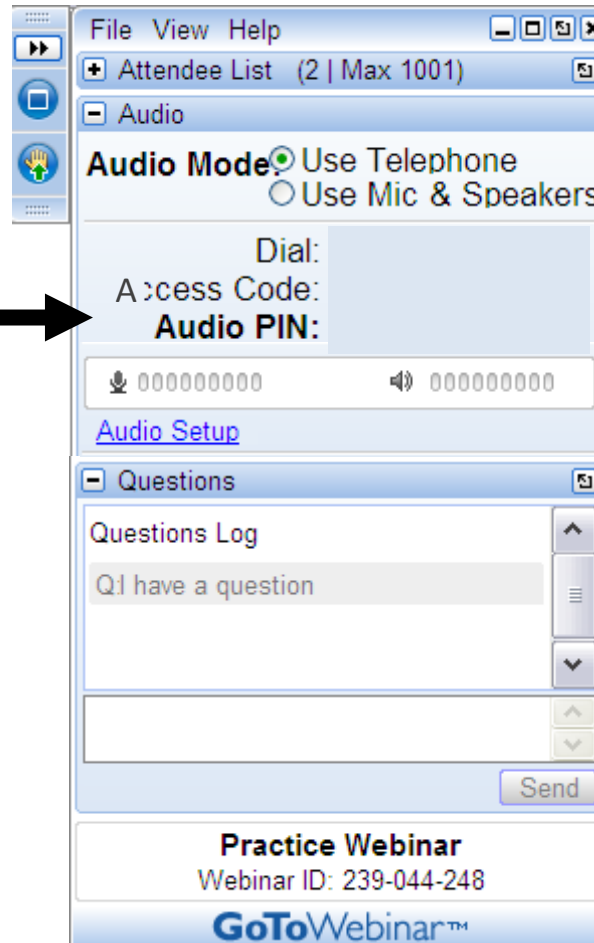
September 12, 2016

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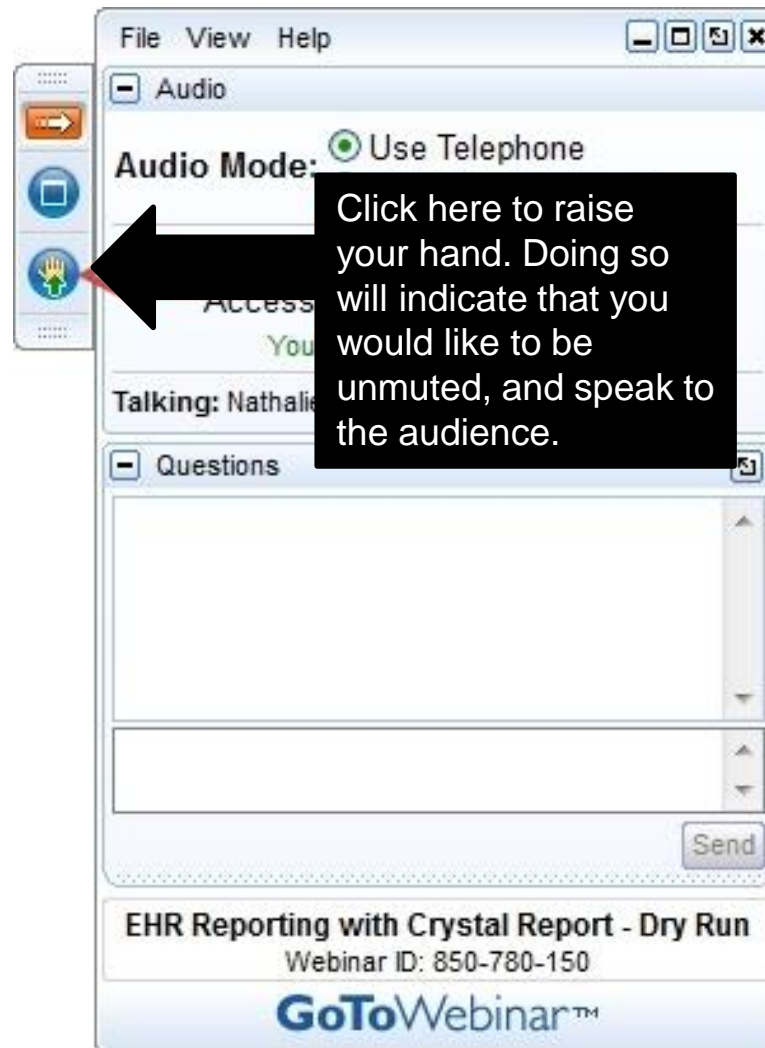
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ENERGY STAR Most Efficient

- 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 Most Efficient is awarded to only the top performers



ENERGY STAR Most Efficient 2016

Update: Growing Recognized Products

Product Category	Models	ENERGY STAR Partners
Boilers	327	28
Ceiling Fans	113	16
Central Air Conditioners and Air Source Heat Pumps	53	4
Clothes Washers	81	6
Computer Monitors	99	4
Dishwashers	13	4
Furnaces	35	4
Geothermal Heat Pumps	383	7
Refrigerators-Freezers	288	28
Televisions	55	12
Ventilating Fans	141	10
Windows	453	48
Total	2041	131



ENERGY STAR Most Efficient 2016

Update: Growing Utility Collaboration

- Utility efficiency program sponsors: 34
 - Partners serve approximately 23 million residential customers, or nearly 58 million consumers.
 - Each features one or more product category and reflects diverse geographic spread nationally.
- ENERGY STAR Most Efficient website:
 - Now includes availability and price information to make it easier for consumers to locate and buy these models.
 - Currently available for clothes washers and refrigerators.
 - Available for dishwashers, monitors, ceiling fans and ventilating fans by the end of 2016.

ENERGY STAR Most Efficient 2016 Promotion

- Geo-targeted radio PSAs to reach relevant audiences and drive traffic to energystar.gov/moste efficient
- Targeted Scarborough “Super Greenie” audience via NPR in following markets / timeframes:
 - DC - June
 - Long Island - June
 - Vermont - September
- Featured energy efficiency programs promoting ENERGY STAR Most Efficient
- More than 1 million estimated impressions

The Year's Best of ENERGY STAR for Energy Efficiency and Innovation

Most Efficient 2016
www.energystar.gov

WHEN ONLY THE BEST WILL DO.

Looking for the ENERGY STAR label is a simple way to save you money and protect the environment. Now EPA introduces ENERGY STAR Most Efficient 2016, a new distinction that recognizes products that deliver cutting edge energy efficiency along with the latest in technological innovation. It is an award that truly represents the best of ENERGY STAR.



FEATURED UTILITY PARTNERS



Additional Partners Promoting ENERGY STAR Most Efficient Products





ENERGY STAR Most Efficient Categories in 2017

- Boilers
- Ceiling and Ventilating Fans
- CAC/ASHP
- Clothes Washers
- Computer Monitors
- Dishwashers
- **NEW: Dryers**
- Furnaces
- Geothermal Heat Pumps
- Refrigerator- Freezers
- Windows



Draft 2017 ENERGY STAR Most Efficient Recognition Criteria





Clothes Washers

- **2017 Proposal:**
 - Maintain current criteria
 - IMEF: 2.76
 - IWF: 3.2
 - Add reference under excluded products for Clothes Washers with Heated Drying Functionality
 - Continue to exclude small volume (1.6-2.5 cu-ft) washers
- **Rationale:**
 - Recognizes about 51 front and top-load standard washer models in a range of sizes (4.2-5.7 cu-ft)
 - Products promoted by 3 partners – Kenmore, LG, and Samsung
 - Significant energy and water savings: 33% less energy and 32% less water than a product meeting the 2015 federal standard (based on a front load model).



A scatter plot showing the relationship between IMEF (x-axis, 1 to 3.5) and IWF (y-axis, 0 to 9) for 2016/2017 Most Efficient Criteria. The plot includes data points for Front Load (blue circles) and Top Load (blue triangles). A solid red line at IWF ≈ 8.4 represents the Federal Standard - TL. A dashed red line at IWF ≈ 4.7 represents the Federal Standard - FL. A solid green line at IWF ≈ 3.2 represents the 2016/2017 Most Efficient Criteria. A vertical green line at IMEF ≈ 2.75 and a horizontal green line at IWF ≈ 3.2 define the Most Efficient region. Data points are categorized as Front Load meeting Most Efficient (orange circles) and Top Load meeting Most Efficient (orange triangles).



Dishwashers

- **2017 Proposal:**
 - Maintain current criteria
 - Compact Dishwashers excluded
 - Annual Energy Use ≤ 240 kWh/yr; Water Use ≤ 3.2 Gallons/cycle
 - Minimum per cycle Cleaning Index of 70, for heavy, medium and low cycles, as assessed under the ENERGY STAR Test Method for Determining Residential Dishwasher Cleaning Performance (Rev. Feb-2014)
 - 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 13 models from 4 brands (Beko, Blomberg, Samsung, Viking) are on our Most Efficient list – meaning they have met the energy, water and cleaning criteria
 - Represents small percentage of products on the QPL
 - There are 35 models from 11 brands that meet the energy and water criteria
 - EPA does not have info on whether they would meet the cleaning criteria
 - EPA encourages partners to submit cleaning data
 - A dishwasher meeting the ENERGY STAR Most Efficient 2017 proposal saves 22% energy and 36% water compared to the federal minimum.



Refrigerators

- **2017 Proposal:**

- Maintain current criteria

- **Rationale:**

- Energy savings of at least 15% relative to a model just meeting the Federal Standard
 - Currently there are 257 products from 28 ENERGY STAR Partners in a range of sizes (9.2-28 cu-ft) that meet the criteria
 - Of models on the market today this represents:
 - 24% of Top Mounts
 - 4% of Bottom Mounts
 - 1% of Side-by-Sides
 - Being promoted by 13 partners – Avanti, Bosch, Daewoo, Danby, Electrolux, Fisher & Paykel, Haier, Hanover, Insignia, LG, Liebherr, Samsung, and Summit





Clothes Dryers

- **2017 Proposal:**

Cycle Setting	Product Type	CEF _{BASE} (lbs/kWh)
Normal	Electric	≥ 4.30
	Gas	≥ 3.80
Most Energy Consuming	Electric	≥ 3.93
	Gas	≥ 3.48

- For the most energy consuming setting, the manufacturer shall test the dryer according to the provisions in the DOE test method, but using the cycle program that results in the greatest energy consumption.
- Commercial clothes dryers and water-cooled ventless clothes dryers excluded.



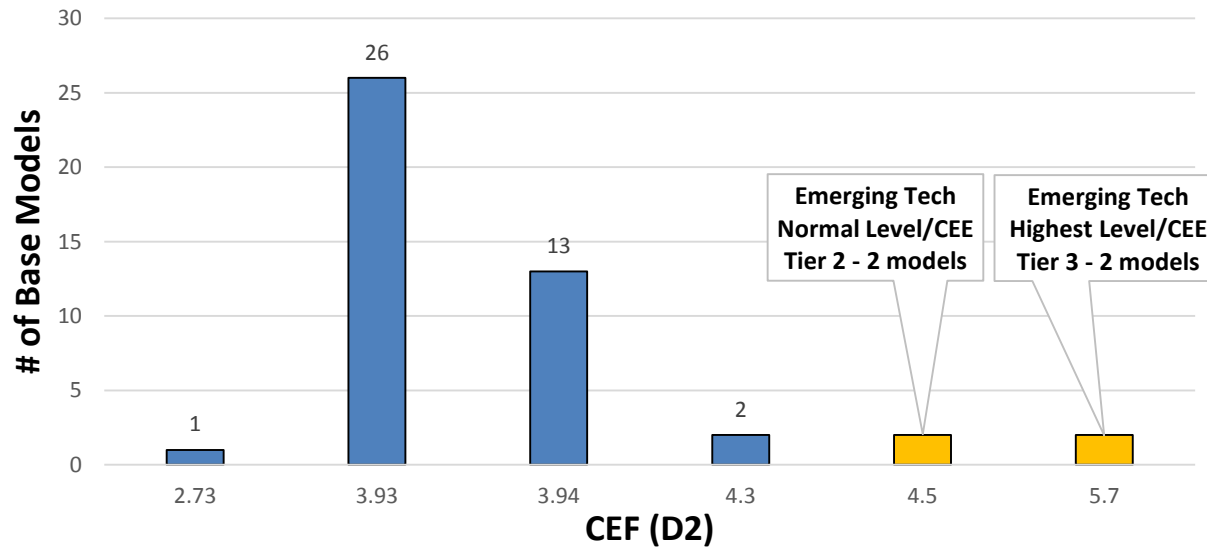
Clothes Dryers

- **Rationale:**
 - With the addition of the ENERGY STAR dryer category and the Emerging Tech Award for dryers, there is now ample room for recognizing top performers.
 - There are 22 models from 5 brands that meet the normal cycle setting criteria.
 - Efficiency levels for both the normal and most energy consuming settings, which will guard against consumers experiencing lower than expected performance.
 - A clothes dryer meeting the ENERGY STAR Most Efficient 2017 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.

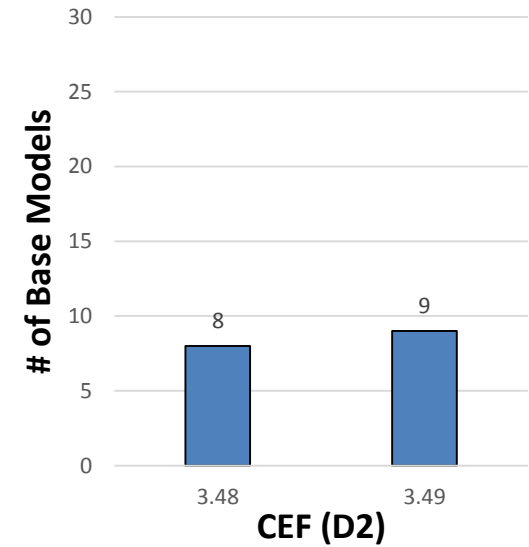


Distribution of ENERGY STAR Clothes Dryer Efficiency

Electric Clothes Dryers



Gas Clothes Dryers





Ceiling Fans

- **2017 Proposal:** Tighten criteria and express using new DOE test method:
 - Efficiency as per 10CFR430 Subpart B Appendix U (cfm/W): $\geq 3.88D - 42.17$, where D is the fan diameter in inches
 - In recognition that these criteria will be in effect before the compliance date of the new metric, fans may also be recognized with High Speed Efficiency as per ENERGY STAR Test Method (cfm/W) ≥ 300
- **Rationale:**
 - The new Federal test method and metric for ceiling fan efficiency has a compliance date in early 2017
 - Expansion of models with DC motors provides significant opportunity to highlight an even more distinguished group of performers
 - Proposed criteria highlights fans with aerodynamically designed blades as well as DC brushless motors
 - Products meeting the proposed criteria use about 1/3 the power (fan and lighting) of conventional fans

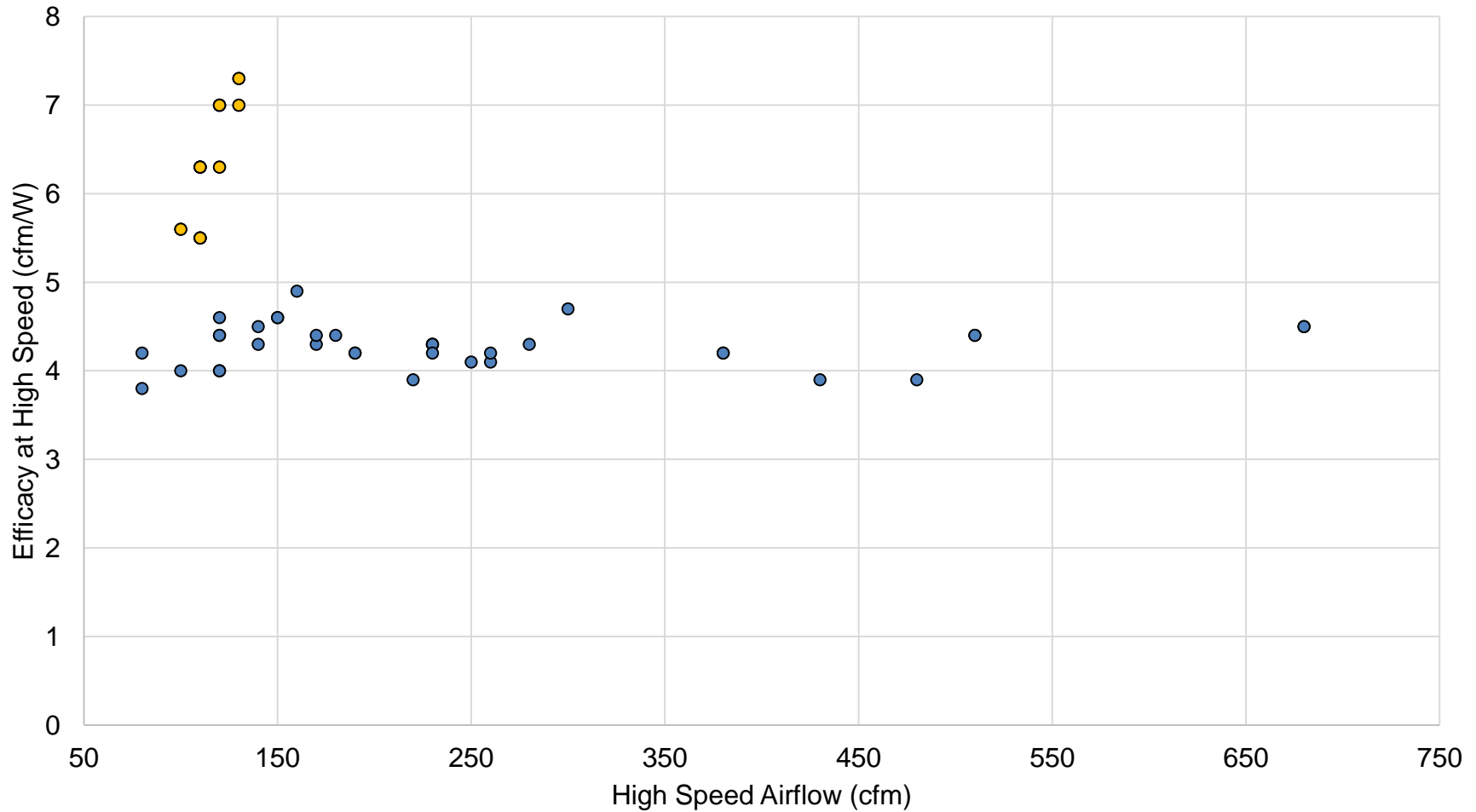


Ventilating Fans



- **2017 Proposal:** Maintain current requirements; add in line fans
 - Bathroom/Utility room fans: Efficacy at high speed (cfm/W): ≥ 10
 - In line fans: Efficacy at high speed (cfm/W): ≥ 5
- **Rationale**
 - ESME 2016 criteria for bath fans continue to represent an exclusive group of fans. A group of higher efficiency in line fans have emerged that use a more efficient type of AC motor, providing the opportunity to recognize them.
 - The proposed in line fan criteria recognizes 6.5% of models on the HVI directory from 4 brands
 - Airflow savings with these requirement are around 85%, lighting savings 70%.
 - No indication of new, highly efficient technologies for range hoods at this time

In-Line fans



● ENERGY STAR In-line Fan ● In-line Fan meets ESME 2017



System Status and Messaging Criteria

- **2017 Proposal:** Maintain current criteria
- **Rationale:**
 - These criteria, in addition to the applicable efficiency criteria, continue to distinguish leaders among HVAC products
 - Fault history on alphanumeric display (on unit, thermostat, diagnostic tool, etc.)
 - Messages to residents in plain text, at least filter check and need for technician service; on thermostat or equivalent
 - Automatic setup requirement
 - Manufacturers responded robustly to new requirements implemented in 2015
- In 2016, similar requirements were implemented for ductless split products



Ductless Split Air Conditioners and Heat Pumps

- **2017 Proposal:** Maintain current performance and system status and messaging criteria; added variable capacity requirement
 - 20 SEER; 12.5 EER; 10 HSPF (for heat pumps only)
 - Products must be able to provide heating and cooling (as applicable) at two or more capacity levels
- **Rationale:**
 - While rated performance requirements are not exclusive, with the addition of system status and messaging criteria, 2.2% of AC models and 2.1% of HP models recognized among those in AHRI directory within scope
 - Requirement for variable or stepped capacity will not eliminate any currently recognized ductless models from the list



Centrally Ducted Air Conditioners and Heat Pumps

- **2017 Proposal:** Maintain current performance and system status and messaging criteria; add variable capacity requirement
- **Rationale:**
 - Adjustable capacity delivers superior performance while also saving energy by somewhat compensating for oversizing. Only one currently recognized product is fixed capacity
 - 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: much less than 1%
 - Geothermal Heat Pumps: 5.9%
 - The somewhat higher proportion of GHPs reflects that GHPs as a category align well with intention of ENERGY STAR Most Efficient
 - A review of the ENERGY STAR GHP specification in 2016 did not show an opportunity for revision



Centrally Ducted Air Conditioners and Heat Pumps

Product 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	2015/16 Savings (North)	2015/16 Savings (South)
Split HP	22%	22%
Split AC	28%	22%
Packaged HP	8%	8%
Packaged AC	13%	13%
Ductless HP	25%	25%
Ductless AC	35%	30%
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

- **2017 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 within scope

Type	Savings
Gas	18%



Boilers

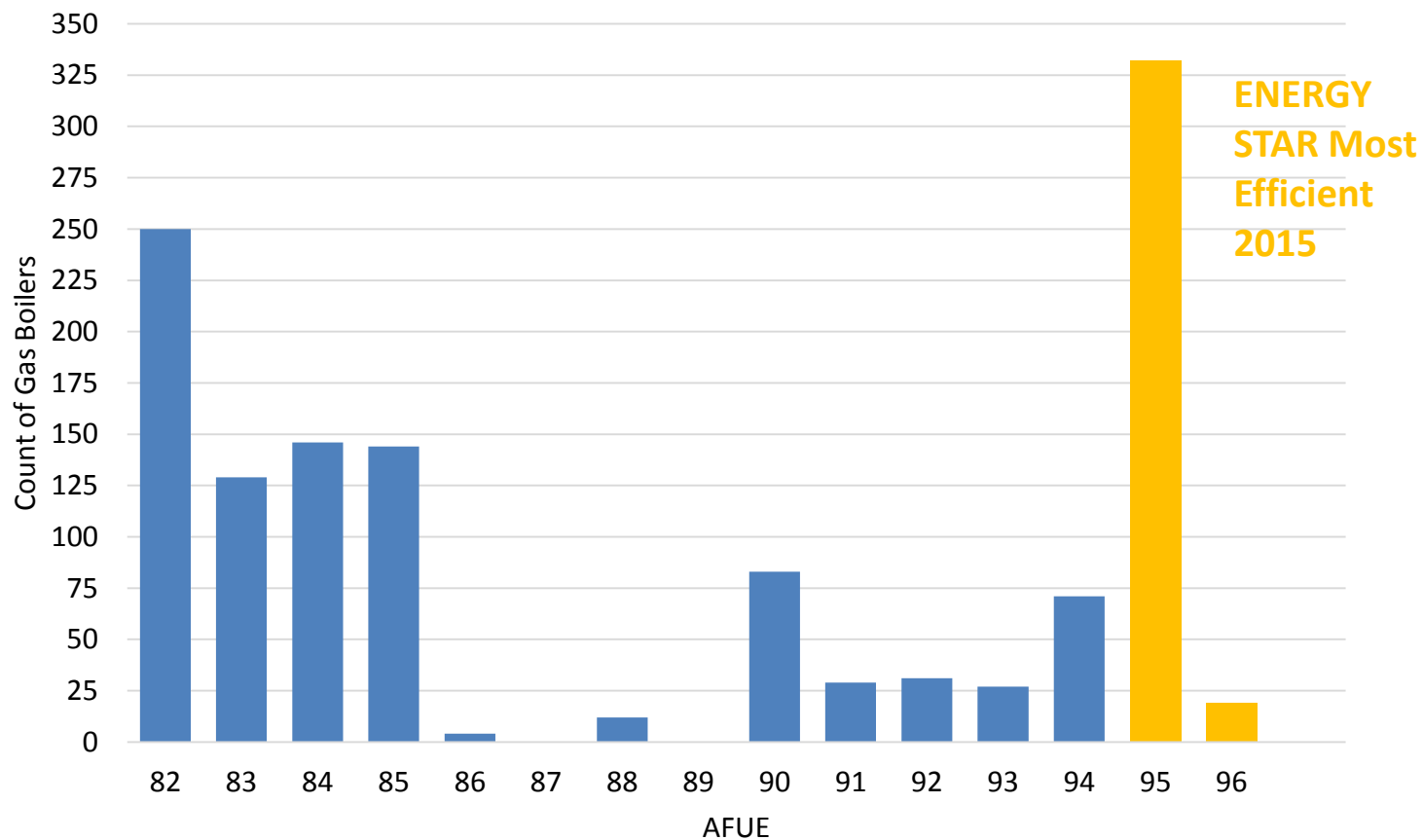


- **2017 Proposal:** Maintain current performance criteria
 - Gas Powered Boilers: ≥ 95 AFUE
 - Oil Powered Boilers: ≥ 90 AFUE
- **Rationale:**
 - Unable to find opportunities for additional distinctions
 - No technical difference between 95 and 96 AFUE
 - No obvious opportunity to improve installation through fault detection and diagnostic program
 - Watching development of uniform test method for idle loss for boilers that also deliver hot water

Product	Savings
Boilers	19%



Gas Boilers





Computer Monitors



- **2017 Proposal:**
 - Maintain same level of stringency from ENERGY STAR Most Efficient 2016 for Most Efficient 2017 with one change **to cap resolution allowance at 5MP**
- **Rationale:**
 - ENERGY STAR Most Efficient 2016 models represent 4.7% of current market; though the monitor market moves more slowly than it does for TVs, with July 2016 specification change to Version 7.0, we expect to see more efficient models entering the market, especially high res UHD (8MP) models
 - Resolution cap to address disproportionate number of large, high resolution models currently able to meet Most Efficient 2016 levels and reward high resolution models that deliver resolution with lower power. With cap, 3.4% of market meets Most Efficient 2017 proposal.
 - Dataset updated July 2016:
 - 1207 unique computer monitors from 34 manufacturers in dataset



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:

$$E_{TEC\ MAX} = 6.13 \times r + 55 \times \tanh(0.003 \times [A - 59] + 0.01) + 5.0$$

Where:

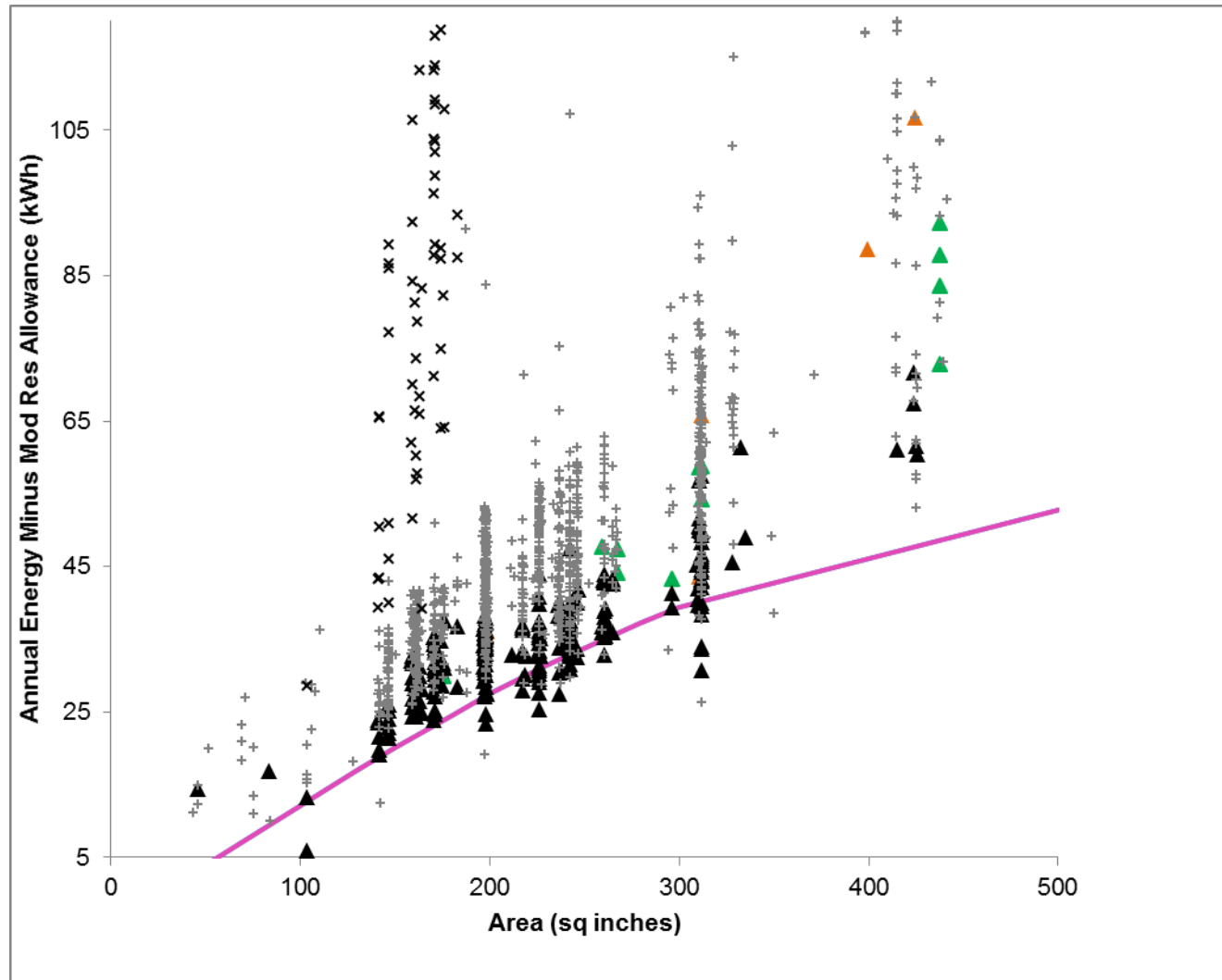
A = viewable screen area in square inches; \tanh = hyperbolic tangent function; and

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, for a resolution allowance (6.13 × r) of 30.65 kilowatt-hours**

*no allowances for enhanced performance, ABC, occupancy sensors, or additional sleep functions

ENERGY STAR Monitors Dataset Overview and Most Efficient 2017 Proposal





Screen Size	# of Models	ESME 2016 #	ESME 2016 %	ESME 2017 Proposal #	ESME 2017 Proposal %
20 inches & under	260	3	1.2%	3	1.2%
20 to 23 inches	333	12	3.6%	12	3.6%
> 23 inches	614	42	6.8%	26	4.2%
ALL	1207	57	4.7%	41	3.4%

With resolution cap, fewer UHD models >23 inches pass. All other pass rates remain the same.



Energy Savings (kWh per year)

Screen Size	All (kWh/year)	ESME 2017 Prop Avg (kWh/year)	ESME 2017 Prop Savings in kWh/year
20 inches & under	39.1	30.9	8.2
20 to 23 inches	55.6	39.7	15.9
> 23 inches	80.3	48.4	31.9
ALL	63.9	44.3	19.6

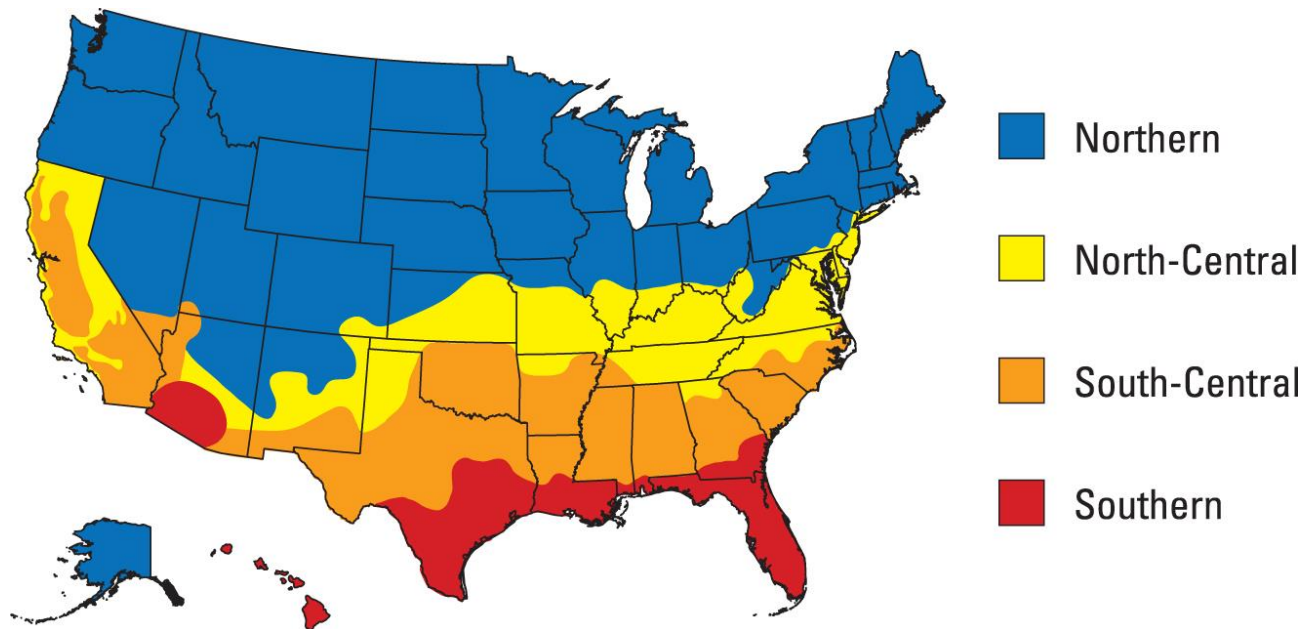


Residential Windows

- **2017 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
 - 46 manufacturers
 - 446 product lines (thousands of product options)
- **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 2017 criteria in early October 2016
- Products will be recognized as ENERGY STAR Most Efficient 2017 beginning January 1, 2017



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Thank you for your participation today.