



ENERGY STAR[®]

Residential Clothes Dryers

Draft 2 Version 1.0 Specification

Stakeholder Webinar
September 5, 2013

Agenda



Introduction – Welcome/Goals, Overview of Specification Development	Amanda Stevens, EPA
Clothes Dryer Draft 2, Version 1.0 – Presentation & Discussion	
<ul style="list-style-type: none">- Test Method Reference- Definitions- Product Classes, Efficiency Criteria- Certification Criteria Changes- Effective Date	Amanda Stevens, EPA Jessica Lyman, ICF International
<ul style="list-style-type: none">- “Connected” Functionality	Amanda Stevens, EPA Doug Frazee, ICF International
Ecova Discussion on additional California IOU Test Data	David Denkenberger, Ecova
Conclude & Next Steps	Amanda Stevens, EPA

Webinar Goals



1. Highlight proposed changes in the Draft 2, Version 1.0 specification.
2. Solicit stakeholder feedback on outstanding issues/questions identified.
3. Address stakeholder questions about process and/or changes.
4. Discuss next steps and timeline.

Specifications Development



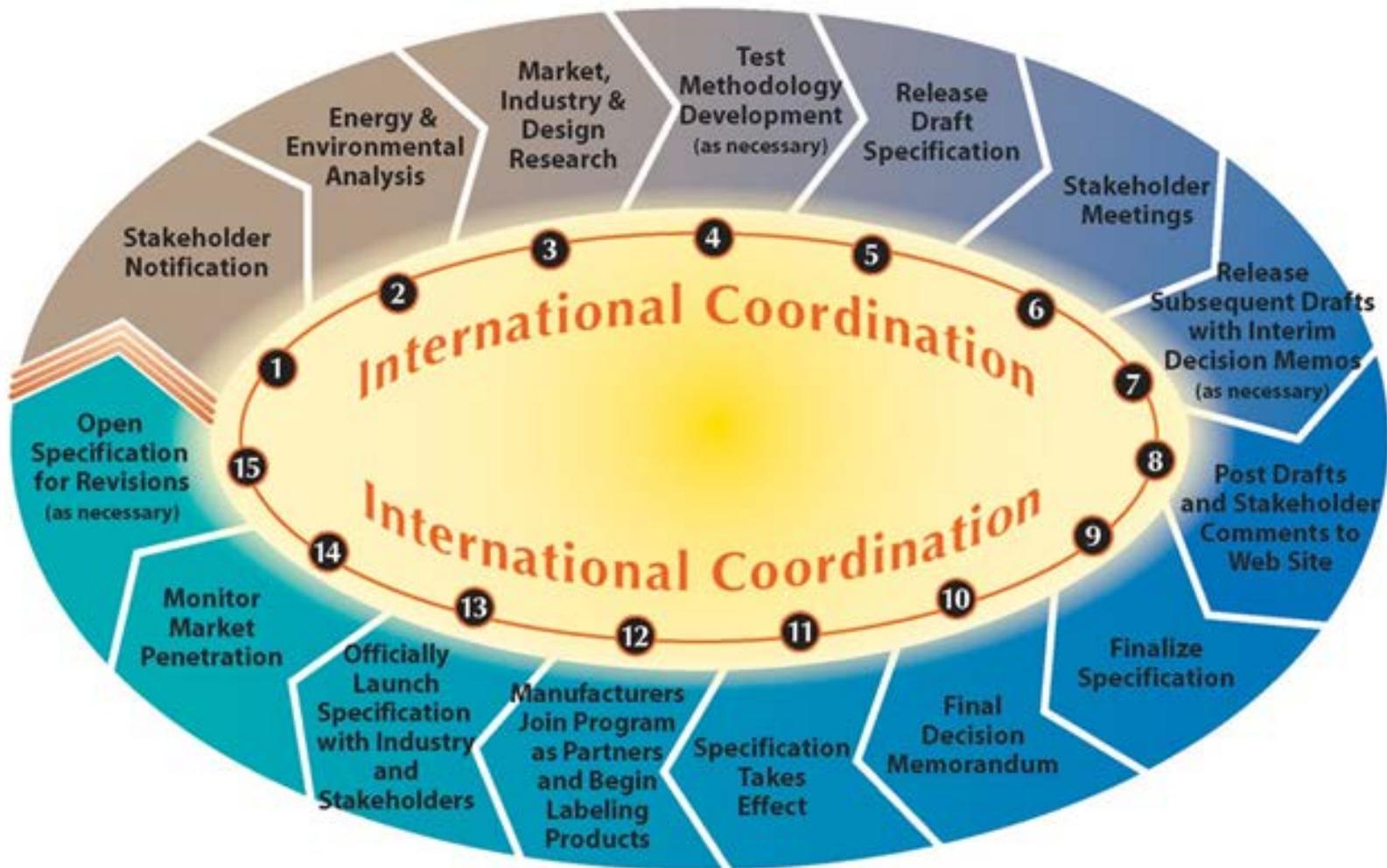
- EPA develops ENERGY STAR product specifications using a systematic process that relies on rigorous market, engineering and pollution savings analysis, and involvement from industry stakeholders.
- EPA uses a set of six key **Guiding Principles**

ENERGY STAR Guiding Principles



1. Significant energy savings
2. Product performance maintained or enhanced
3. Purchasers can recover investment in increased efficiency within a reasonable time period
4. Efficiency achieved through one or more technologies; qualifying products offered by more than one manufacturer
5. Energy consumption can be measured and verified with testing
6. Label provides meaningful differentiation

Specification Development Cycle



Specification Development



- When developing or revising a specification, EPA balances:
 - The need to keep pace with evolution among leading products and continue to effectively differentiate for consumers.
 - Timing of new Federal standards.
 - Production cycles, other factors important to the industry.
- Key elements of the stakeholder process:
 - Consistency, transparency, inclusiveness, responsiveness, and clarity.

Clothes Dryer Version 1.0 Specification Development



- EPA launched the clothes dryer specification development effort with a Program Launch letter in July 2012, noting:
 - High household penetration (nearly 80% of homes)
 - Clothes dryers are one of the largest end-use loads in U.S. homes for which there are no voluntary or mandatory labeling programs
 - The introduction of new high efficiency dryers to the marketplace
 - Large opportunity for greenhouse gas reductions
- Draft 1 provided for stakeholder review and comment in August 2012

Clothes Dryer Version 1.0 Specification Development



- This past June, EPA awarded the first clothes dryer with the 2013 Emerging Technology Award (ETA) for Advanced Clothes Dryers.
 - ETA recognition for Advanced Clothes Dryers extended through 2014
- In August 2013, DOE published an amended clothes dryer test procedure (which included a new Appendix D2).
- Draft 2 Version 1.0 specification was shared in August 2013; test procedure reference updated to Appendix D2.
 - Offers manufacturers with an additional avenue for demonstrating improved efficiency via automatic termination control that reduces waste energy at the end of the dry cycle

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V1.0 Test Method

- Test procedure reference was updated to the new DOE test method, which includes provisions for more accurately measuring effects of automatic cycle termination
 - Draft 1 stakeholder feedback encouraged ENERGY STAR to cite a test method that captures the effectiveness of automatic termination controls and better reflect real world energy consumption.
 - DOE published a new clothes dryer test procedure on July 31, 2013 (10 CFR 430 Appendix D2).
 - Offers the opportunity to more accurately assess the energy savings associated with automatic termination and therefore, enables ENERGY STAR program to offer more real-world based guidance to consumers.

V1.0 Test Method (cont'd)



- Appendix D2 advantages for ENERGY STAR labeling include:
 - Better reflects the way in which consumers use a clothes dryer
 - More accurately measures the energy consumption
 - Allows for greater differentiation in clothes dryer efficiency
 - Provides manufacturers with incentive to improve technology that senses when the load is “dry” (sensors and control algorithms)
- Manufacturers must use a single appendix for all representations, including ENERGY STAR verification and DOE certifications of compliance.
 - Manufacturers may elect to use the amended Appendix D2 early, but must show compliance with the January 1, 2015 energy conservation standards using this Appendix.
- EPA and DOE welcome stakeholder feedback on the updated test procedure reference.



Revisions to Definitions

- Definitions for Automatic Termination Control, Temperature Sensing Control, and Moisture Sensing Control were removed.
 - No longer applicable to ENERGY STAR certification.
- Combined Energy Factor (CEF) definition was updated to be identical to one in DOE's new test procedure (Appendix D2).
- For clarity, footnotes have been added to provide the Code of Federal Regulation (CFR) citation for a DOE definition.



Expanded Product Classes

- EPA expanded several product class descriptions to include ventless electric standard and compact 120V configurations.
 - Stakeholder feedback to the Draft 1 specification indicated high efficiency ventless dryers, already available in other markets, may be introduced in the U.S.
 - Inclusion avoids impeding potential market advancements for high efficiency ventless clothes dryer designs.
- The same efficiency criteria used for similarly configured vented dryers have been applied.
- EPA welcomes feedback on extending the criteria to these additional types of ventless dryers and the appropriateness of the levels proposed.

Revised Efficiency Criteria



- Revised energy efficiency (CEF) levels were developed using:
 - Units tested by DOE during the recent test procedure rulemaking
 - Test data in the CLASP 2013 report
 - Additional test data provided by several utilities in comments to EPA
 - Technical data in the DOE TSD and supplemental information shared by stakeholders in the spec development process
- Revised CEF criteria reflect estimated energy savings of:
 - 20% for standard size electric dryers
 - 21% for gas dryers, compact clothes dryers
- The baselines used (i.e., estimated energy use of conventional dryers in 2015) were developed by using an adjusted 2015 Federal standard, that takes into account the differences in calculated CEF values under the 2 test methods.

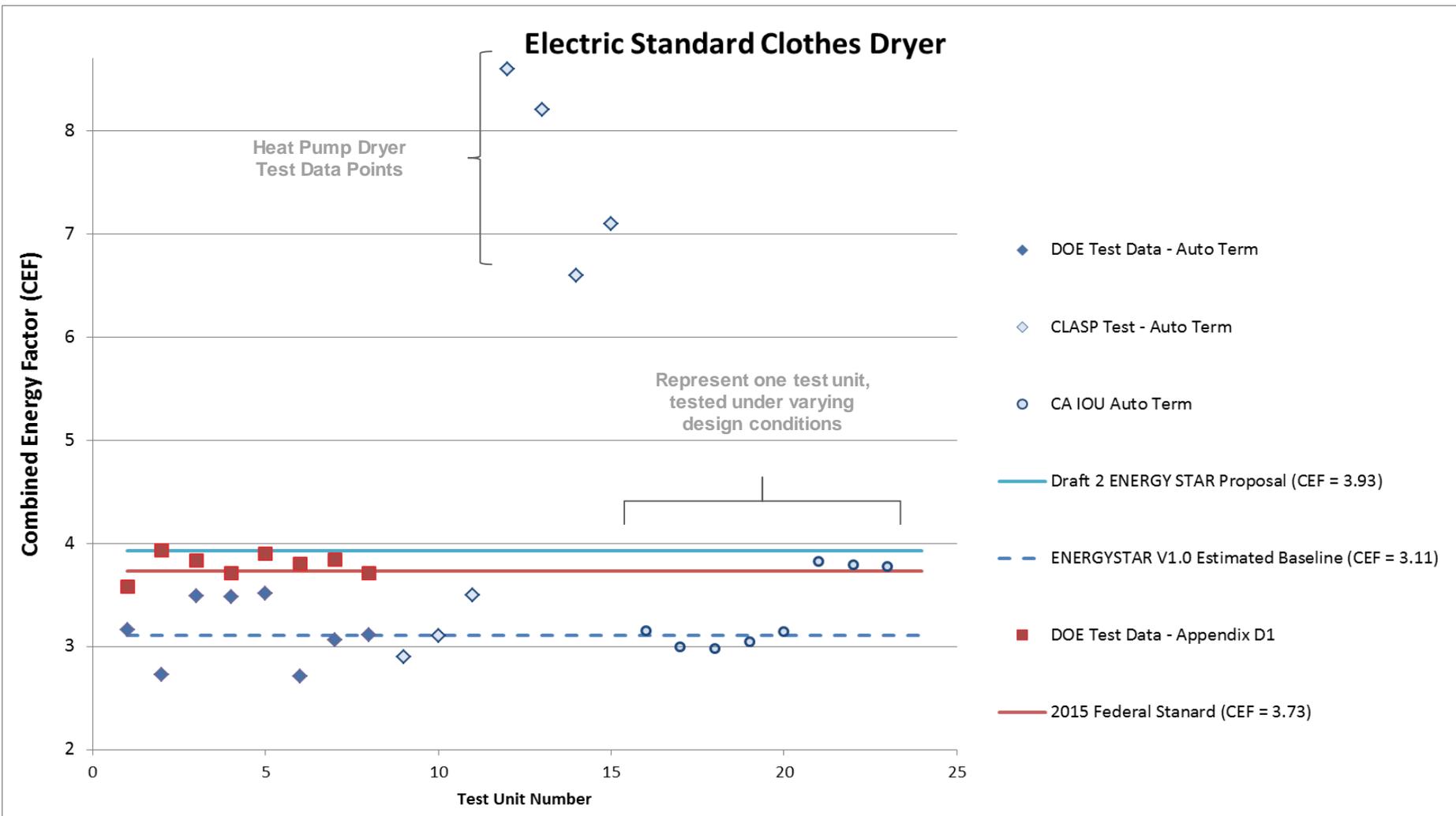
Data used to Develop Baseline



Product class	Test unit	DOE test procedure (Appendix D1)	Automatic cycle termination—DOE test load	
			CEF (lbs/kWh)	% Change
Vented Electric Standard	1	3.58	3.16	-11.6
	2	3.93	2.73	-30.6
	3	3.83	3.49	-9.1
	4	3.71	3.48	-6.1
	5	3.90	3.51	-10.0
	6	3.80	2.71	-28.7
	7	3.84	3.06	-20.2
	8	3.71	3.11	-16.1
	Avg	3.79	3.16	-16.6
Vented Electric Compact (240V)	9	3.53	3.32	-6.1
	10	3.56	2.27	-36.1
	Avg	3.54	2.79	-21.1
Vented Electric Compact (120V)	11	3.75	2.18	-41.9
Vented Gas	12	3.43	2.70	-21.3
	13	3.31	2.87	-13.3
	14	3.49	3.07	-12.0
	15	3.39	2.69	-20.5
	16	3.37	3.25	-3.5
	17	3.37	2.94	-12.7
	Avg	3.39	2.92	-13.9
Ventless Electric Compact (240V)	18	2.98	2.73	-8.4
Ventless Electric Combination Washer/Dryer	19	2.81	2.70	-3.9
	20	2.28	2.19 ¹	-3.9
	Avg	2.54	2.45	-3.9



Summary Plot of Electric Standard Clothes Dryer Data



Revised Efficiency Criteria



Product Category	CEFBASE
Vented Gas	3.48
Vented and Ventless Electric, Standard (4.4 cu-ft or greater capacity)	3.93
Vented and Ventless Electric, Compact (120V) (less than 4.4 cu-ft capacity)	3.80
Vented Electric, Compact (240V) (less than 4.4 cu-ft capacity)	3.45
Ventless Electric, Compact (240V) (less than 4.4 cu-ft capacity)	2.68

- 5% connected functionality allowance is retained in Draft 2
 - Products must be certified using final (TBD) ENERGY STAR test method to use allowance

Equation 1. Calculation of Minimum CEF

$$CEF_{MIN} = CEF_{BASE} - CEF_{Adder_Connected}$$

Connected Allowance	
Product Type	CEFAdder_Connected
All Electric Clothes Dryers	0.05 x CEFBASE

Efficient Design Options



- Improved automatic cycle termination (*sensors/controls*)
 - Recent DOE NOPR testing illustrated a wide 30% spread in reported CEF performance between the best and worst performing units.
 - In addition to the differentiation that already exists, testing the effectiveness of sensors provides the incentive for pursuing additional opportunities for improvement; initial assessment indicates energy savings of at least 11%.
- Modulation
 - Manufacturers have indicated 5-10% savings realistic for electric dryers; last DOE TSD noted 5% energy savings through heater replacement.
 - TIAX modulating gas dryer 10-25% energy savings, with savings varying by load size.
- Heat recovery
 - Draft 1 stakeholders submitted test data showing energy savings of 17% through modified heat exchanger
 - Inlet air preheating, exhaust recirculation

Efficient Design Options (cont'd)



- Heat pump/hybrid heat pump
 - European heat pump dryers tested by CLASP demonstrated a 50% energy savings relative to a standard electric baseline dryer, 3.11 CEF
- Insulation, motor efficiency, air circulation
 - Improved sealing and insulation could achieve savings of 2-6%. Recent CA IOU testing suggested 2%.
 - Manufacturers cited split motor design or more efficient motors could account for 1-5% energy savings. Some manufacturers have said 1-2% gains could be achieved from air circulation.

Consumer Savings & Payback



Product Category	Per Unit Annual Energy Savings		Per-Unit Electricity Savings (\$)		Per-Unit Gas Savings (\$)		Per Unit Total Savings (\$)	
	kWh	MBtu	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
Vented Gas	30	0.54	3	41	5.75	69	9	110
Vented & Ventless Electric, Standard	160	-	18	217	-	-	18	217

Assumptions: Prices of \$0.113 per kWh and \$10.64 per MBtu were used to estimate per-unit cost savings, annually and over an average 12-year average clothes dryer lifetime (Appliance Magazine. U.S Appliance Industry: Market Value, Life Expectancy & Replacement Picture 2011).

- Currently little correlation in the market between efficiency performance (EF) and price.
- Using an estimated incremental cost of \$50, consumer payback would be in about 3 years for standard electric dryer.
 - Modestly longer (7 years estimated) for gas; but EPA believes it is important for the spec to cover gas dryers given their overall lower operating cost and carbon footprint during use.

National Savings



	Electricity (GWh/yr)	Gas (MBTU/yr)	Carbon Equivalent (Million lbs CO ₂ E/yr)	Cost Savings (Millions\$/yr)
Residential Clothes Dryers	267	211,264	435	32

Assumptions: Assumes ENERGY STAR market penetration of 35%, annual residential clothes dryer shipments of 5.8 million (based on 2012 Shipments from Appliance Magazine, March 2013).

Additional Changes in Draft 2

- Removal of Automatic Termination Criteria
 - Draft 1 proposed specific design/operational requirements
 - Incorporation of Appendix D2 test method in Draft 2 makes such requirements unnecessary, since the effectiveness of automatic cycle termination will be tested.
- Removal of Warranty Requirements
 - Draft 1 proposed minimum warranty requirements; there is precedence in the program for including in order to ensure performance is maintained with greater efficiency.
 - In light of stakeholder feedback and absent more specific data quality or longevity of more efficient dryers and their sub-components, warranty requirements have been omitted from the Draft 2 specification.
- EPA welcomes stakeholder feedback on the these changes in Draft 2.

Clothes Dryer Cycle Time

- Draft 2 includes a new reporting requirement for drying time.
 - Stakeholders had raised a variety of concerns with maximum drying time requirement that had been proposed in Draft 1.
 - Alternatively, in Draft 2, EPA is proposing that drying time be reported.
 - Initial step to gather consistent data on drying time and product type.
 - EPA is considering making this data available to consumers on the website, that enables them to consider both efficiency and duration of the drying cycle in a standardized way.
 - EPA welcomes feedback on this reporting requirement and on making this information available for consumers on the ENERGY STAR website.

Proposed Guidance for Reporting



- Length of drying cycle is determined by measuring the test cycle:
 - sections 3.3.2, Appendix D2, for automatic termination control dryers. Drying cycle time equals test cycle time.
 - sections 3.3.1, Appendix D2, for timer dryers. The following correction is applied to determine drying cycle time.
 - Correction is intended to account for the range of acceptable RMC values at the completion of the test cycle

$$t_{dry} = \left[\frac{55.5}{W_w - W_d} \right] * t$$

Where:

W_w = the moisture content of the wet test load as recorded in section 3.4.2 of 10 CFR 430, subpart B, appendix D2.

W_d = the moisture content of the dry test load as recorded in section 3.4.3 of 10 CFR 430, subpart B, appendix D2.

t = the measured test cycle time.



Version 1.0 Effective Date

- EPA anticipates finishing the Version 1.0 spec in early 2014, possibly sooner depending on the stakeholder comments received in September.
 - The Agency plans to identify a date by which there will be a selection of ENERGY STAR products on the market for consumers to choose from.
 - Next step will be to engage manufacturers to gather information on their timelines for testing products to the amended DOE test method and having products that meet the ENERGY STAR requirements on the market.
- EPA welcomes any feedback or discussion on the effective date for Version 1.0.

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Overview of Draft 2 Version 1.0

Connected Functionality



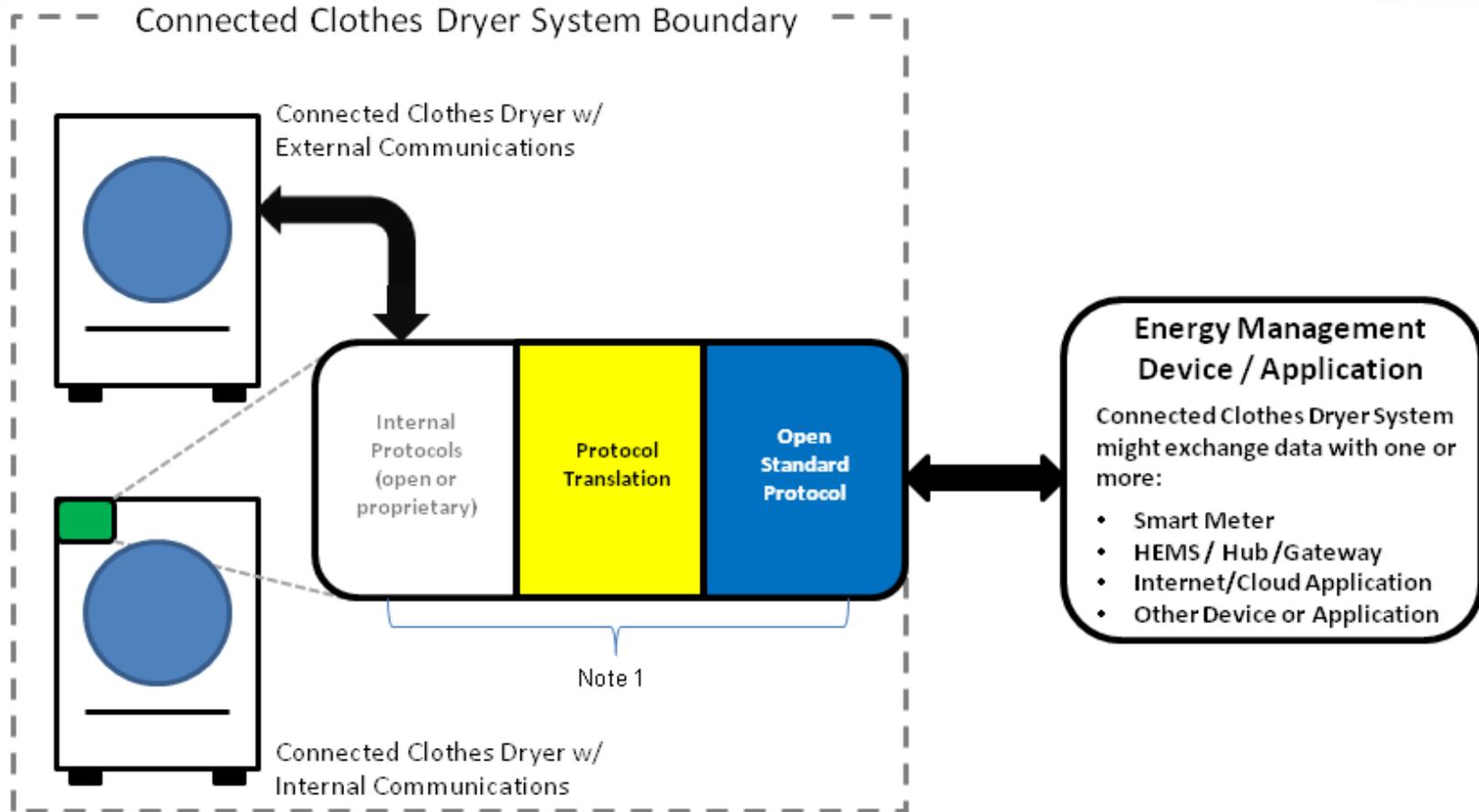
- EPA is seeking to help advance products with intelligent features in ways that deliver immediate consumer benefit and support a low-carbon electricity grid over the long term.
- Draft 2 introduces *optional* Connected criteria for residential clothes dryers:
 - Builds on the CF in the final Version 5.0 residential refrigerators and freezers (R/F) specification, recent feedback on clothes washer connected criteria, while looking to leverage opportunities unique to residential dryers.
 - Consumer has full control to override product's response to a signal from a utility requesting load reduction or deferral.
 - 5% allowance for ENERGY STAR electric dryers certified to these optional connected criteria, including using a future (TBD) ENERGY STAR test method to validate demand response.
 - EPA will flag clothes dryers on the ENERGY STAR website that are certified as meeting optional connected criteria.

Connected Clothes Dryer System



- Consistent with refrigerator/freezers, a diagram and associated text are included that define the connected clothes dryer system:
 - Includes required communications hardware and software.
 - Communications hardware may be built-in or external.
 - Open standards required for connection with external device(s) or application(s).
 - On-premises, open standards connectivity preferred, but alternate means are acceptable.
 - Open standards & open access for 3rd party remote management is not required.

Connected Clothes Dryer System



Note 1: Communication device(s), link(s) and/or processing that enables open standards-based communication between the Connected Clothes Dryer System and Energy Management Device/Application(s). These elements could be within the base appliance, and/or an external communication module, a hub/gateway, or in the Internet/cloud.

Communications & Open Access



- Aligns with communications criteria proposed for other home appliances:
 - Open standards:
 - In the NIST SGIP Catalog of Standards, or;
 - In the NIST Smart Grid Framework Table 4.1 or 4.2, or;
 - Adopted by ANSI or by a well recognized international SDO.
 - Communications hardware may be:
 - Built-in.
 - Proprietary external paired with module/device.
 - Open standards based port & module.
 - Open standards based port (no module) with one or more of the above.
 - Open Access – API available to interested parties for:
 - Energy Consumption Reporting
 - Operational Status, User Settings & Messages
 - Demand Response (DR)

Consumption Reporting, Remote Management



- The following elements also align with criteria proposed for other home appliances:
 - Energy consumption reporting allows implementation flexibility. API enables 3rd party access and includes reporting accuracy.
 - Remote management
 - Electric dryers, only
 - Is not subject to open standards or open access criteria and may be provided to 3rd parties at the discretion of the manufacturer.

Operational Status, User Settings & Messages



- At least two types of energy-related messages required, for example:
 - Performance issues
 - Energy consumption that is outside the product's normal range
- In addition to reporting of DR status, Draft 2 proposes adding consumer-authorized reporting of operational status (e.g. off, standby, delay start, cycle in process).
 - Considered important for products that are not continuously operated such that load-balancing entities can understand availability of dispatch-able load.

Operational Status Reporting (Cont'd)



- Stakeholder feedback on similar criteria proposed for clothes washers – one comment requested further clarity may be needed in regards to the level of reporting detail needed by utilities.
- In Draft 2, EPA has listed the following examples of operational states:
 - off, standby, delay start and cycle in process.
- EPA is seeking stakeholder feedback:
 - Would more detail be needed or helpful for utilities as they evaluate appliances' DR functionality or run appliance DR programs?
 - If so, what detail?
 - Should cycle in progress reporting also include remaining cycle time? Should delay start reporting also include information as to when the cycle will start?
 - How will consumer privacy be managed and protected?
 - Are there other reporting details that would be helpful?

Demand Response



- Proposed DR capabilities for clothes dryers were informed by the recommended definition of smart clothes dryer included in the AHAM / efficiency advocate petition to ENERGY STAR.
 - Delay Appliance Load Capability
 - Temporary Appliance Load Capability

Note: EPA will clarify that DR criteria will be required only for electric clothes dryers.
- DR criteria does not explicitly address price responsiveness.
 - Stakeholders have indicated that price responsiveness may be implemented using ENERGY STAR DR capabilities.
 - Further, discussions have indicated that the importance of price responsiveness is already well recognized by utilities and the appliance industry.

Demand Response (cont'd)

- Clothes Dryer Delay Appliance Load (DAL) Capability
 - Cycle start moved outside of delay period
 - Defaults:
 - 3-hour minimum response.
 - Capable of responding at least 1x per consumer initiated operating cycle
 - Consumer override – before or during delay period

Demand Response (cont'd)

- Clothes Dryer Temporary Appliance Load Reduction (TALR) Capability
 - Restricts average power draw during the load reduction period to no more than ~~80%~~20% of the average power draw
 - **Note:** The Draft 2 specification document contained an error; 80% should instead be 20%.
 - Defaults:
 - 10 minute minimum response period
 - Capable of responding at least 2x per consumer initiated operating cycle
 - Consumer override – before or during delay period

Demand Response (Cont'd)

- EPA is seeking feedback on:
 - Minimum DR durations proposed;
 - whether it is necessary to continue to specify a minimum response and if so, whether the proposal (e.g., x-times per operating cycle) is the preferred way to structure; and
 - Whether there is opportunity for dryers to provide additional DR without impacting consumer expectations
 - Are there other performance considerations that should be considered?

Verification of Connected Functionality



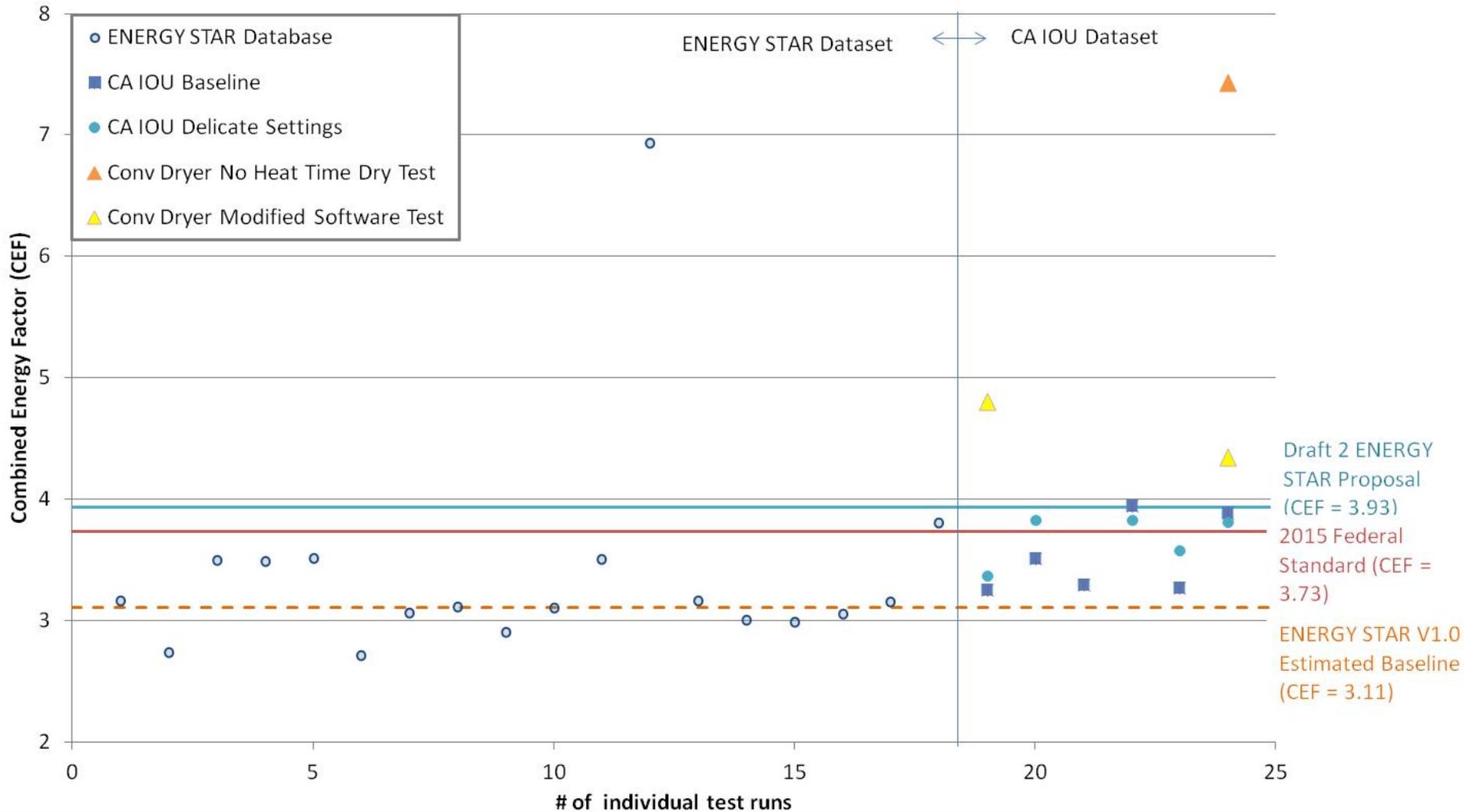
- Compliance with connected functionality will be through examination of the product and/or product documentation.
- Additionally, DR functionality will be certified using a TBD ENERGY STAR test method
 - DOE is planning to develop a test that will validate the DR capabilities of a residential clothes dryer, to be referenced in the V1.0 specification.
 - DOE is initiating this effort now and will be contacting manufacturers to obtain products for testing or to witness testing in manufacturer labs.
 - Products must be certified using this new ENERGY STAR test method in order to be eligible for the 5% allowance .

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Additional Data from CA IOUs/NEEA



Electric Standard Clothes Dryer



CA IOU discussion



- Simple software changes and relabeling of modes can allow conventional dryers to be very efficient, but slow drying
- Consumers may not use this mode very frequently, so we believe an ENERGY STAR dryer should save energy in all modes
- One way of achieving this is having a CEF specification line rising with drying time and testing in multiple modes

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Anticipated Timeline for Version 1.0 Spec Development



August 5, 2013	Draft 2, Version 1.0 Specification Released
September 5, 2013	Stakeholder Webinar (Today)
September 13 20 , 2013	Comment Period Closes on Draft 2 Specification
October 6 & 7-9, 2013	Clothes Dryer Summit, ENERGY STAR Annual Products Partner Meeting (New Orleans)
November/December 2013	**Final Draft Specification Distributed and Comment Period
January 2014	Final Version 1.0 Specification Released

- ** Depending on the stakeholder feedback received on the Draft 2, a Draft 3 proposal may also be issued which would impact the anticipated schedule.
- Please submit written comments **by September 13~~20~~, 2013**, to

Questions/Discussion

Contacts



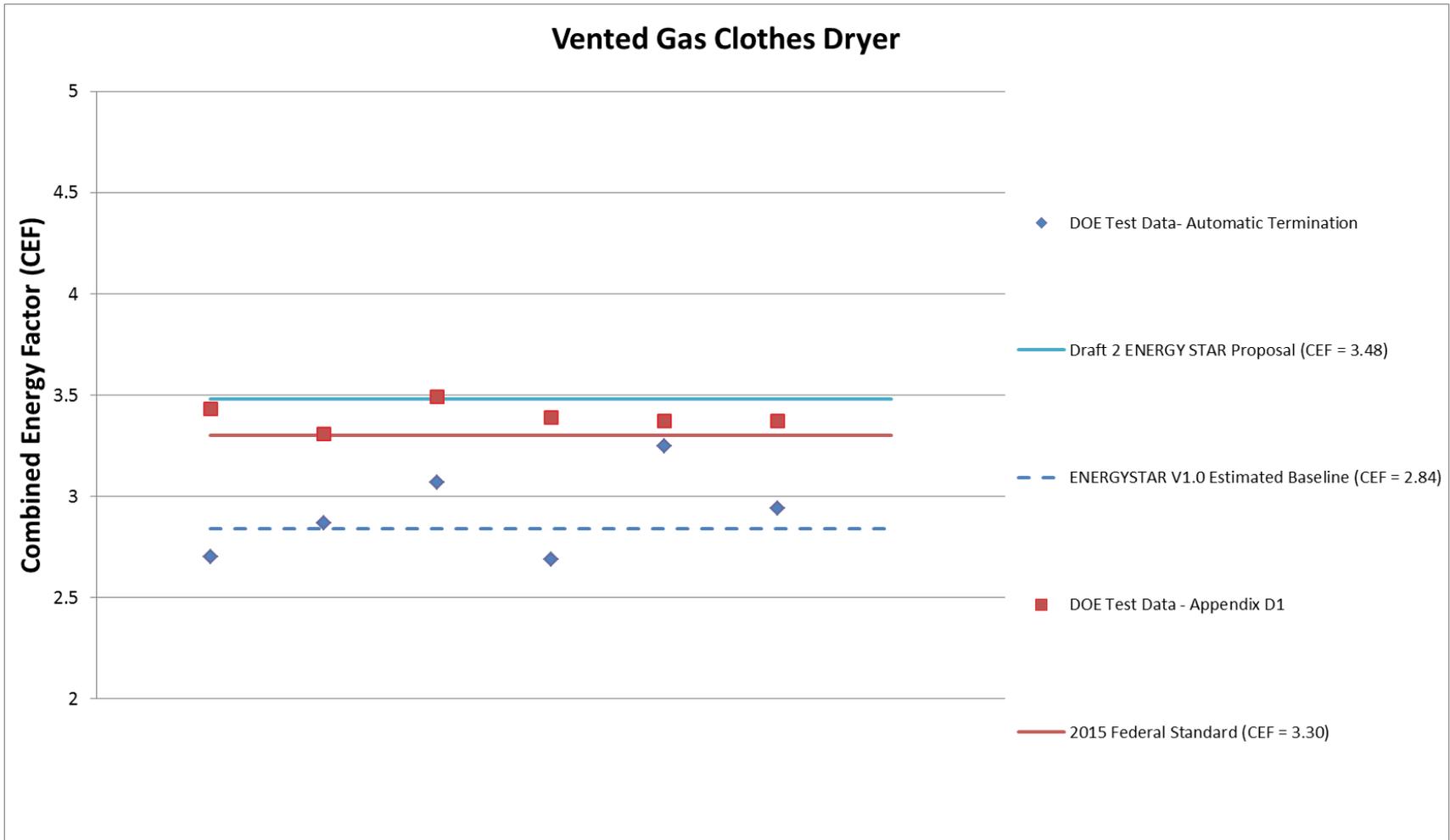
Spec Development:

- Amanda Stevens, US EPA
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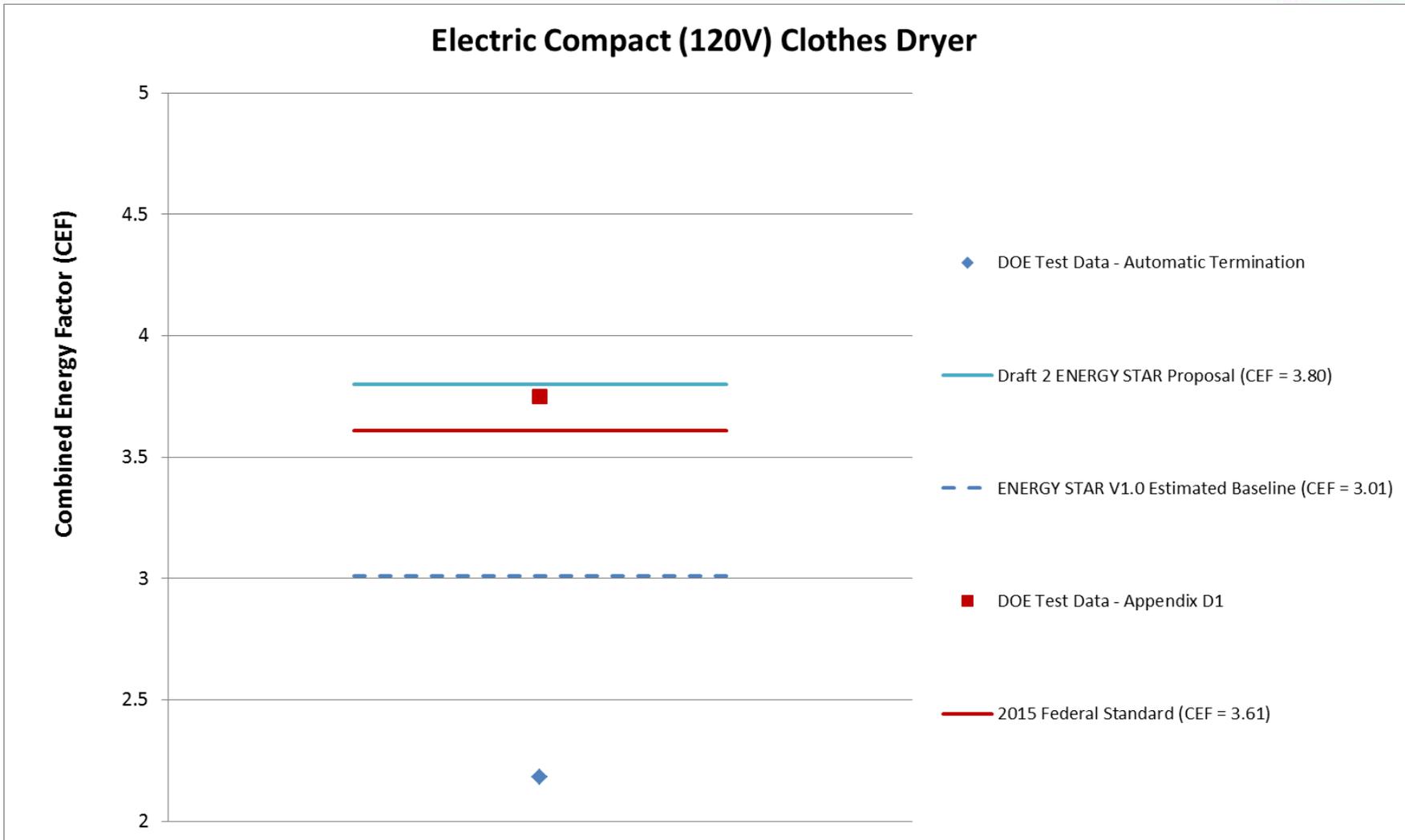
Test Method:

- Ashley Armstrong, US DOE
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Vented Gas Clothes Dryer Dataset



Electric Compact Clothes Dryer (120V) Dataset



Electric Compact Clothes Dryer (240V) Dataset

