Following is the Final Draft Version 1.0 product specification for ENERGY STAR certified residential clothes dryers. A product shall meet all of the identified required criteria to earn the ENERGY STAR.

1) Definitions: Below are the definitions of the relevant terms in this document. As noted below, definitions are identical with definitions in the DOE test procedure at 10 CFR 430, Subpart B, Appendix D2 or 10 CFR 430.2. When in conflict, the definitions in the Code of Federal Regulations (CFR) take precedence.

A. Electric Clothes Dryer\(^1\): A cabinet-like appliance designed to dry fabrics in a tumble-type drum with forced air circulation. The heat source is electricity and the drum and blower(s) are driven by an electric motor(s).

B. Gas Clothes Dryer\(^1\): A cabinet-like appliance designed to dry fabrics in a tumble-type drum with forced air circulation. The heat source is gas and the drum and blower(s) are driven by an electric motor(s).

C. Compact size Clothes Dryer\(^2\): A clothes dryer with a drum capacity of less than 4.4 cubic feet.

D. Standard size Clothes Dryer\(^2\): A clothes dryer with a drum capacity of 4.4 cubic feet or greater.

E. Conventional (Vented) Clothes Dryer\(^2\): A clothes dryer that exhausts the evaporated moisture from the cabinet.

F. Ventless Clothes Dryer\(^2\): A clothes dryer that uses a closed-loop system with an internal condenser to remove the evaporated moisture from the heated air. Moist air is not discharged from the cabinet.

G. Water-Cooled Ventless Clothes Dryer: A ventless clothes dryer that uses cold tap water for internal condenser cooling.

H. Commercial Clothes Dryer: An electric or gas clothes dryer that is designed for use in:

1. Applications in which the occupants of more than one household will be using the clothes dryer, such as multi-family housing common areas and coin laundries; or

2. Other commercial applications.

I. Combination All-in-One Washer-Dryer: A consumer product designed to clean and dry fabrics in a single drum, where a separate drying cycle uses electricity or gas as a heat source and forced air circulation.

J. Residential Clothes Washer with Optional Dry Cycle: A Residential Clothes Washer that has an optional add-on dry cycle, where drying is accomplished through use of electricity or gas as a heat source and forced air circulation; drying cannot be selected independently from a wash cycle.

K. Combined Energy Factor (CEF)\(^2\): The clothes dryer test load weight in pounds divided by the sum of the per cycle standby and off mode energy consumption and either the total per-cycle electric dryer energy consumption or the total per-cycle gas dryer energy consumption expressed in kilowatt hours (kWh).

\(^1\) 10 CFR 430 Subpart A, Section 430.2

\(^2\) 10 CFR 430 Subpart B, Appendix D2
L. **Basic Model**: Units of a given type of covered product (or class thereof) manufactured by one manufacturer, having the same primary energy source, and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency.

M. **Consumer Product**: Any article (other than an automobile, as defined in Section 501(1) of the Motor Vehicle Information Cost Savings Act) which: (1) in operation consumes, or is designed to consume, energy and (2) to any significant extent, is distributed in commerce for personal use or consumption by individuals.

**Note**: EPA has corrected the test method reference included in the introductory paragraph of Section 1, making it consistent with the other test method references in this document.

2) **Scope**:  
   
   A. **Included Products**: Products that meet the definition of an Electric Clothes Dryer or Gas Clothes Dryer, and the definition of a consumer product as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2B.

   B. **Excluded Products**: Commercial Clothes Dryers, Water-Cooled Ventless Clothes Dryer, Combination All-in-One Washer-Dryers, and Residential Clothes Washers with an Optional Dry Cycle as defined in Section 1 are not eligible for ENERGY STAR under this specification.

3) **Qualification Criteria**:  
   
   A. **Combined Energy Factor (CEF)**: CEF shall be greater than or equal to the Minimum CEF \( (CEF_{MIN}) \) as calculated per Equation 1.

   \[
   CEF_{MIN} = CEF_{BASE} - CEF_{Adder\_Connected}
   \]

   where,

   \( CEF_{BASE} \) is the base CEF, per Table 1

   \( CEF_{Adder\_Connected} \) is the CEF connected allowance, per Table 2

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3 10 CFR 430 Subpart A, Section 430.2. Note: Definition of consumer product has been abbreviated to be specific to clothes dryers by omitting the regulatory definition’s references to lighting and water.
Table 1: Base CEF

<table>
<thead>
<tr>
<th>Product Type</th>
<th>CEF&lt;sub&gt;BASE&lt;/sub&gt; (lbs/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vented Gas</td>
<td>3.48</td>
</tr>
<tr>
<td>Ventless or Vented Electric, Standard (4.4 cu-ft or greater capacity)</td>
<td>3.93</td>
</tr>
<tr>
<td>Ventless or Vented Electric, Compact (120V) (less than 4.4 cu-ft capacity)</td>
<td>3.80</td>
</tr>
<tr>
<td>Vented Electric, Compact (240V) (less than 4.4 cu-ft capacity)</td>
<td>3.45</td>
</tr>
<tr>
<td>Ventless Electric, Compact (240 V) (less than 4.4 cu-ft capacity)</td>
<td>2.68</td>
</tr>
</tbody>
</table>

Table 2: Connected Allowance

<table>
<thead>
<tr>
<th>Description</th>
<th>Product Type</th>
<th>CEF&lt;sub&gt;Adder_Connected&lt;/sub&gt;&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected</td>
<td>All Electric Dryer Types in Table 1&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.05 x CEF&lt;sub&gt;BASE&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

<sup>1</sup> Product must comply with all Section 4 criteria and be certified using the final and validated ENERGY STAR Clothes Dryers Test Method to Validate Demand Response to use the allowance.

<sup>2</sup> Calculated allowance shall be rounded down to the nearest hundredth before being applied in Equation 1.

B. **Cycle Time**: The elapsed time for the product to complete the test cycle, as measured by Section 5C, must be 80 minutes or less.

Note: The cycle setting(s) tested under Appendix D2 should be designed to deliver satisfactory user experience, such that settings providing equivalent or reduced energy use are encouraged across most loads and anticipated consumer savings and environmental benefits are realized.

C. **User Information Requirements**: Product shall be shipped with informational materials to notify consumers of the following:

a. The specific cycle and setting selections (cycle type, heat setting, default settings engaged, etc.) that the energy use rating of this dryer is based upon.

b. Guidance about cycles and settings that may use more or less energy than this one, such as “Choosing the “Energy Saver Mode” will save about (to be determined by manufacturer)% energy. Longer, low heat drying cycles tend to use less energy, as do less dry settings.”

**Note:**

**Energy Efficiency Requirements**

EPA has not made any changes to the energy efficiency criteria, expressed as combined energy factor (CEF), that were published in Draft 2. While some stakeholders recommended further strengthening efficiency requirements, EPA also received feedback from several stakeholders who relayed that meeting the proposed levels using the DOE test procedure located in Appendix D2 was feasible, but would be challenging. EPA believes the current levels will provide meaningful differentiation for consumers by helping them identify more energy efficient dryers. That said, the additional energy-efficiency performance data gathered through the Version 1.0 specification, especially for compact dryers where there has been more limited data, is expected to be valuable for further assessing new opportunities during the next specification revision.
Drying Time Requirement
So that efficiency gains are not made entirely at the expense of much longer drying cycles that consumers could find to be unacceptable, EPA has retained the maximum drying time requirement of 80 minutes that was proposed in the December 2013 Supplemental Proposal. A number of stakeholders supported the maximum drying time requirement. However, there was concern expressed about lack of data on what constitutes ‘acceptable’ drying time for consumers, which EPA has also acknowledged. Despite this, the Agency believes that including a drying time requirement is important at this stage as it reflects the program’s interest in ensuring that energy efficient products continue to meet consumer expectations for drying cycle length. Based on the test cycle times of products included in the ENERGY STAR Draft 2 data set and the subsequent manufacturer conversations regarding acceptable cycle lengths, EPA believes that the 80 minute time limitation will guard against excessive cycle lengths but will not preclude products with new energy savings technologies (e.g., heat pumps or hybrid heat pumps) from being eligible to earn the ENERGY STAR mark.

Removal of Test/Report for the ‘Fastest’ Mode
In the Supplemental Proposal, EPA proposed an additional test and report requirement for a manufacturer-defined ‘fastest cycle’ when tested using Appendix D2 (should it be different than the energy test mode already being tested under Appendix D2). EPA received feedback that this requirement would substantially increase test burden for vented clothes dryers. However, other stakeholders supported the proposal to test this mode, and urged the Agency to further consider requiring that additional cycles be tested for ENERGY STAR certification. Based on the feedback received, EPA has concerns that the value from proposed test/report requirement would not outweigh the added test burden. Accordingly, the reporting requirement has not been included in the Final Draft. Instead, EPA has added new explanatory language into Section 3.C of the Final Draft. This language makes clear the Agency’s intent that products provide consumers with a satisfactory experience in the tested mode so as to encourage continued use and consistently yield both savings and environmental benefit. EPA is also aware that efficiency organizations are pursuing plans that would involve more extensive testing of some clothes dryers in a variety of different modes/settings in test labs and field settings. These efforts may yield new information on the need or benefit from testing additional dryer modes that could be considered by EPA and stakeholders during a future specification revision.

Consumer Information on the Cycle/Setting Selections
In lieu of the test/report requirements, EPA is proposing to require that manufacturers provide consumer information, as a step towards improving consumer understanding of the energy use rating and awareness of the implications that cycle/setting selection will generally have on energy use. As part of the specification development process, EPA has reviewed manufacturer provided “Use and Care Guides” for clothes dryer products available in the market. This research has shown that clothes dryers are equipped with various consumer selectable operational modes, with simpler designs offering as few as 5 auto termination cycle selections to more advanced designs offering as many as 16 auto terminating cycle selections in addition to the timer dry settings. In addition, EPA noted that some manufacturer provided literature already provides “tips” or guidance on the best practices for minimizing energy consumption. EPA welcomes stakeholder feedback on the proposal to have manufacturer literature specify the cycle settings used to rate the product for ENERGY STAR certification and provide additional information intended to raise awareness among consumers on the impacts to energy use associated with cycle setting selections.
4) **Connected Product Criteria:**

The following optional connected criteria are applicable to Included Products, Section 2A, that meet the definition of an Electric Clothes Dryer.

**Note:** Informed by stakeholder comments, EPA has added the above language, clarifying that Connected Product Criteria are applicable only to electric clothes dryers, as defined in Section 2A.

**A. Connected Clothes Dryer System**

To be recognized as connected and to be eligible for the connected allowance, a “connected clothes dryer system” (Connected Clothes Dryer System, as shown in Figure 1) shall include the base appliance plus all elements (hardware, software) required to enable communication in response to consumer-authorized energy related commands (not including third-party remote management which may be made available solely at the discretion of the manufacturer). These elements may be resident inside or outside of the base appliance. This capability shall be supported through one or more means, as identified in section 4B2.

The specific design and implementation of the Connected Clothes Dryer System is at the manufacturer’s discretion provided it is interoperable with other devices via open communications protocol and enables economical consumer-authorized third party access to the functionalities provided for in sections 4D, 4F and 4G. The capabilities shall be supported through one or more means, as identified in section 4B2. A product that enables economical and direct, on-premises, open-standards based interconnection is the preferred option for meeting this requirement, but alternative approaches are also acceptable.

The product must continue to comply with the applicable product safety standards – the addition of the functionality described below shall not override existing safety protections and functions. The appliance must meet manufacturer’s internal minimum performance guidelines, e.g., drying performance.

**Figure 1.** Connected Clothes Dryer System Boundary – Illustrative Example

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*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.
B. Communications

1. Open Standards – Communication with entities outside the Connected Clothes Dryer System that enables connected functionality (sections 4D, 4F and 4G) must use, for all communication layers, the standards:
   - Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards, 4 and/or
   - Included in the NIST Smart Grid framework Tables 4.1 and 4.2, and/or
   - Adopted by the American National Standards Institute (ANSI) or another well-established international standards organization such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE) or Internet Engineering Task Force (IETF).

2. Communications Hardware Architecture – Communication with entities outside the Connected Clothes Dryer System that enables connected functionality (sections 4D through 4G) shall be enabled by any of the following means, according to the manufacturer’s preference:
   a. Built-in communication technology
   b. Manufacturer-specific external communication module(s) and/or device(s)
   c. Open standards-based communication port on the appliance combined with open standards-based communications module
   d. Open standards-based communication port(s) on the appliance in addition to a, b or c, above

   If option b or c is used, the communication module/device(s) must be easy for a consumer to install and shipped with the appliance, provided to the consumer at the time of sale, or provided to the consumer in a reasonable amount of time after the sale.

C. Open Access

To enable interconnection with the product, in addition to section 4B1 that requires open-standards, an interface specification, API or similar documentation shall be made available to interested parties that at a minimum, allows transmission, reception and interpretation of the following information:

- Energy Consumption Reporting specified in section 4D (must include accuracy, units and measurement interval);
- Operational Status, User Settings & Messages specified in section 4F (if transmitted via a communication link);
- Demand Response specified in section 4G.

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4 http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes
D. Energy Consumption Reporting

In order to enable simple, actionable energy use feedback to consumers and consumer authorized energy use reporting to 3rd parties, the product shall be capable of transmitting energy consumption data via a communication link to energy management systems and other consumer authorized devices, services, or applications. This data shall be representative of the product’s interval energy consumption. It is recommended that data be reported in watt-hours for intervals of 15 minutes or less, however, representative data may also be reported in alternate units and intervals as specified in the product manufacturer’s interface specification or API detailed in section 4C.

The product may also provide energy use feedback to the consumer on the product itself. On-product feedback, if provided, may be in units and format chosen by the manufacturer (e.g., $/month).

E. Remote Management

The product shall be capable of receiving and responding to consumer authorized remote requests (not including third-party remote management which may be made available solely at the discretion of the manufacturer), via a communication link, similar to consumer controllable functions on the product. The product is not required to respond to remote requests that would compromise performance and/or product safety as determined by the product manufacturer.

F. Operational Status, User Settings & Messages

1. The product shall be capable of providing the following information to energy management systems and other consumer authorized devices, services or applications via a communication link:

   • Operational / Demand Response status (e.g., off/standby, cycle in process, delay appliance load, temporary appliance load reduction).

2. The product shall be capable of providing the following information on the product and/or to energy management systems and other consumer authorized devices, services or applications via communication link:

   • At least two types of messages relevant to the energy consumption of the product. For example, messages for clothes dryers might address performance issue such as a clogged lint filter or report of energy consumption that is outside the product’s normal range.

Note: Consistent with changes made in this section for the Version 7.0 Clothes Washer specification, EPA has incorporated minor changes into this draft, by suggesting that dryers be able to report only two basic states - whether they are in a lower power state (e.g., off or standby) or a cycle is running. Given the limited information available as to exactly what data elements will be most valuable, EPA removed the suggestion that a product also report when it is in a delay start mode. EPA may consider integrating greater specificity into future specification updates. The Agency welcomes feedback from manufacturers and utilities as to how more detailed operation status reporting could improve a utility’s ability to implement a demand response program for appliances.

G. Demand Response

The product shall have the capability to receive, interpret and act upon consumer-authorized signals by automatically adjusting its operation depending on both the signal’s contents and settings from consumers. At a minimum, the product shall be capable of providing the following for all cycle and setting combinations:

1. Delay Appliance Load Capability: The capability of the product to respond to a signal in accordance with consumer settings, except as permitted below, by delaying the start of an operating cycle beyond the delay period.

   a. Default settings –The product shall ship with default settings that enable a response in accordance with 4G1 for at least 3 hours.
b. Consumer override – The consumer shall be able to override the product’s Delay Appliance Load response before or during a delay period.

c. The product shall be able to provide at least one Delay Appliance Load response per consumer initiated operating cycle, but is not required to provide more than three Delay Appliance Load responses in a rolling 24-hour period.

2. Temporary Appliance Load Reduction Capability: The capability of the product to respond to a signal by providing load reduction for a short time period, typically 10 minutes. Upon receipt of signal and in accordance with consumer settings, except as permitted below, the product shall restrict its average power draw during the load reduction period to no more than 20% relative to the baseline average power draw defined in the ENERGY STAR Clothes Dryer Test Method to Validate Demand Response.

   a. Default settings - The product shall ship with default settings that enable a response in accordance with 4G2 for a time period of at least 10 minutes.

   b. Consumer override – The consumer shall be able to override the product’s Temporary Appliance Load Reduction response before or during a load reduction period.

   c. The product shall be able to provide at least one Temporary Appliance Load Reduction response during each consumer initiated operating cycle.

Note: EPA has incorporated several minor edits and clarifications to the Section 4.G, including:

- New language in the first paragraph of 4.G to clarify the Agency’s intent that a connected clothes dryer should be able to respond to a signal to shift or temporarily reduce load for all dryer load cycles/settings.

- Non-substantive updates to the some Delay Appliance Load (DAL) capability language to provide consistency with the final Version 7.0 Clothes Washers specification.

- Consistent with the finalized DAL language for clothes washers, revised criteria require a clothes dryer to delay the start of each cycle, but does not require the product to be able to delay load more than three times in a rolling 24 hour period.

- Correcting an error in Draft 2 to specify that a connected clothes dryer limit its power draw to no more than 20% relative to the baseline as part of a Temporary Appliance Load Reduction (TALR), rather than the 80% that had been included in the Draft 2.

- Modifying the TALR response baseline to reference the baseline cycle or cycles that will be defined in the future ENERGY STAR test method. EPA agrees with stakeholder feedback that the product should restrict its power use relative to its use over the entire cycle, rather than the baseline during only the 10 minute period.

- Revised language requiring a dryer provide one TALR response per operating cycle instead of two, in response to stakeholder concern that multiple TALR requests could reduce dryer efficiencies (heat that is lost when the drum cools) and may impact performance, i.e., increase wear and tear on clothing. EPA does not have data on the performance impacts. Reducing heat and extending drying cycle length may also increase efficiency. Consider stakeholder concern, EPA has reduced the requirement to one TALR response.

H. Information to Consumers

If additional modules, devices, services and/or infrastructure are part of the configuration required to activate the product’s communications capabilities, prominent labels or other forms of consumer notifications with instructions shall be displayed at the point of purchase and in the product literature. These shall provide specific information on what consumers must do to activate these capabilities (e.g. “This product has Wi-Fi capability and requires Internet connectivity and a wireless router to enable...”
interconnection with an Energy Management System, and/or with other external devices, systems or applications.

5) Test Requirements:

A. One of the following sampling plans shall be used to test energy performance for qualification to ENERGY STAR:

1. A representative unit shall be selected for testing based on the definition for Basic Model provided in Section 1 above; or

2. Units shall be selected for CEF testing per the sampling requirements defined in 10 CFR § 429.21, which references 10 CFR § 429.11.

B. When testing the energy efficiency of clothes dryers, the following test method shall be used to determining ENERGY STAR qualification:

<table>
<thead>
<tr>
<th>Table 3: Test Method for ENERGY STAR Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENERGY STAR Requirement</strong></td>
</tr>
<tr>
<td>Clothes Dryers</td>
</tr>
</tbody>
</table>

¹ And in accordance with any applicable DOE issued test procedure guidance, listed here: [http://www1.eere.energy.gov/guidance/default.aspx?pid=2&spid=1](http://www1.eere.energy.gov/guidance/default.aspx?pid=2&spid=1)

Note: EPA has retained the Appendix D2 test method reference for Version 1.0 specification. Many stakeholders, including utilities, efficiency organizations, and a manufacturer strongly support referencing this test, confirming that it would provide more accurate energy use and relative energy-efficiency comparisons of clothes dryers. A number of stakeholders have also relayed that use of Appendix D2 is essential for future utility sponsored rebate programs. EPA continues to believe the potential for consumer confusion is likely to be small, while the benefits from measuring and rewarding products with more effective automatic termination controls are large.

C. The length of the drying cycle shall be determined, as required by Section 3B, by measuring the test cycle time, \( t \), for the drying test cycle specified in sections 3.3.1 and 3.3.2 of Appendix D2 for timer dryers and automatic termination control dryers, respectively, using a timer accurate to within 2 seconds.

For timer dryers, the following correction shall be applied to determine the drying cycle time:

\[
t_{\text{dry}} = \left[ \frac{55.5}{(W_w - W_d)} \right] \times t
\]

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.

For automatic termination dryers, the drying cycle time equals the test cycle time.

D. Compliance with connected functionality, as specified in Section 4, shall be through examination of product and/or product documentation. In addition, demand response functionality shall be certified using the ENERGY STAR Clothes Dryers Test Method to Validate Demand Response (Ref TBD) in order to be eligible for the connected allowance.
Note: EPA and DOE did not receive any comments on the proposed method of measuring the duration of a clothes dryer operating cycle under the Appendix D2 test method. Therefore, no changes have been made to the method for measuring cycle duration.

As noted in Draft 2, DOE plans to develop a test method to validate the DR capabilities of residential clothes dryers that will be referenced in this specification. DOE’s test method development will be dependent upon working with manufacturers to obtain products for connected testing. DOE is initiating this effort now and anticipates contacting manufacturers to obtain products for testing or working with them to witness connected product testing in the near term. This test is anticipated to be a separate, add-on test method. Products would need to be certified using this final and validated ENERGY STAR test method to use the proposed allowance.

6) Effective Date: The ENERGY STAR Clothes Dryer specification shall take effect on January 1, 2015. Any product model with a date of manufacture on or after this date shall meet this specification to earn the ENERGY STAR. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.

Note: As noted in the Supplemental Proposal, the effective date for Version 1.0 specification would be January 1, 2015.

7) Future Specification Revisions: EPA reserves the right to change the specification should federal requirements, technological and/or market changes affect its usefulness to consumers, industry or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that ENERGY STAR qualification is not automatically granted for the life of a product model.