ENERGY STAR®
Clothes Dryers

Draft 1 Version 1.0 Specification
Stakeholder Webinar
September 12, 2012

EPA U.S. DEPARTMENT OF ENERGY

Learn more at energystar.gov

Agenda

Introduction – Welcome/Goals, ENERGY STAR Overview, Overview of Specification Development Process	Amanda Stevens, EPA
Clothes Dryers **Draft 1, Version 1.0 – Presentation & Discussion**	
- Definitions - Scope - Qualification Criteria	Sean Southard, ICF International
- "Connected" Functionality	Amanda Stevens, EPA Doug Frazee, ICF International
Conclude & Next Steps	Amanda Stevens, EPA

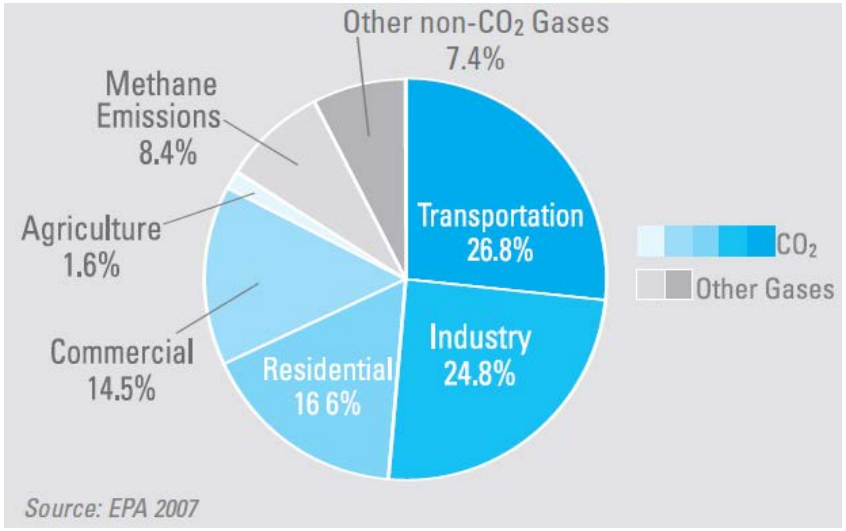
Introduction – Welcome/Goals, ENERGY STAR Overview, Overview of Specification Development Process	Amanda Stevens, EPA
Clothes Dryers **Draft 1, Version 1.0 – Presentation & Discussion**	
- Definitions - Scope - Qualification Criteria	Sean Southard, ICF International
- "Connected" Functionality	Amanda Stevens, EPA Doug Frazee, ICF International
Conclude & Next Steps	Amanda Stevens, EPA

Meeting Goals

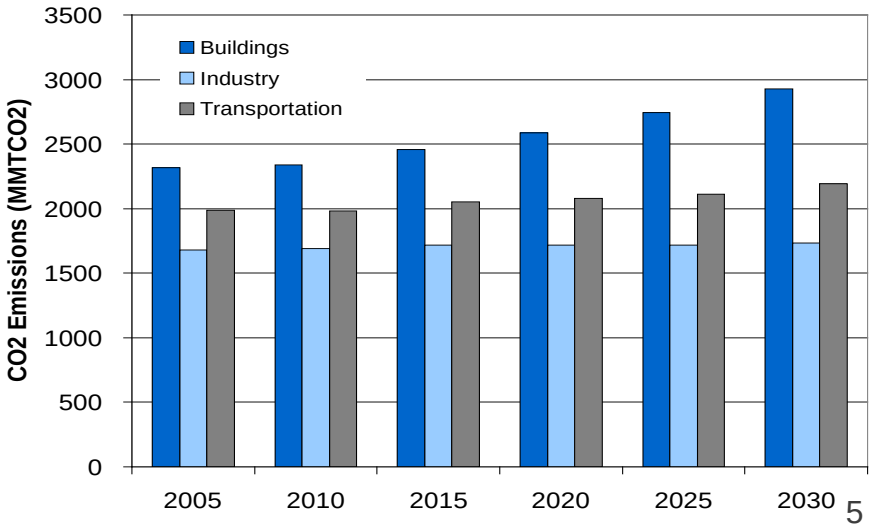
1. Provide an overview of the ENERGY STAR program, the specification development process and the opportunity with clothes dryers
2. Highlight proposals in the Draft 1 V1.0 specification
3. Solicit stakeholder feedback on issues/questions identified
4. Address stakeholder questions about process and/or proposals
5. Discuss next steps and timeline

What is ENERGY STAR

- Started in 1992; voluntary program
- GOAL: Reduce greenhouse gas (GHG) emissions through large win-win-win opportunities with today's energy efficient technologies and practices.
- Provide credible information to buyers
- Work with the marketplace to capitalize on motivations of individuals



Projected GHG Emissions from Key Sectors through 2030



Source: AEO 2008

65+ Product Categories Are Covered by ENERGY STAR in the US

Lighting
CFLs
SSL
Integral LED lamps
Residential light fixtures

Home Envelope
Roof products
Windows/Doors

Heating & Cooling
Central AC
Heat pumps
Boilers
Furnaces
Ceiling fans
Room AC
Ventilating fans
Water Heaters

Office Equipment
Computers
Monitors
Printers
Copiers
Scanners
Fax machines
Multi-function Devices
Servers
UPS

Commercial Food Service
Dishwashers
Refrigerators
Freezers
Ice Machines
Fryers
Steamers
Hot Cabinets
Griddles
Ovens
Vending machines

Appliances & Other
Clothes washers
Dishwashers
Refrigerators
Dehumidifiers
Air cleaners
Water coolers
Pool Pumps

Home Electronics
Battery chargers
Cordless phones
TV
Set Top boxes
Home audio

ENERGY STAR Guiding Principles

- ENERGY STAR criteria are designed to balance a varied set of objectives, including:
  - Significant energy and/or water savings
  - Product performance maintained or enhanced
  - Purchasers can recover investment in increased efficiency within a reasonable time period
  - Efficiency achieved can through one or more technologies; qualifying products offered by more than one manufacturer
  - Energy/water consumption can be measured and verified with testing
  - Label provides meaningful differentiation

Specification Development Cycle

EPA U.S. DEPARTMENT OF ENERGY

Program Updates

- On September 30, 2009, the EPA and DOE signed a memorandum of understanding (MOU) designed to enhance and strengthen the ENERGY STAR program

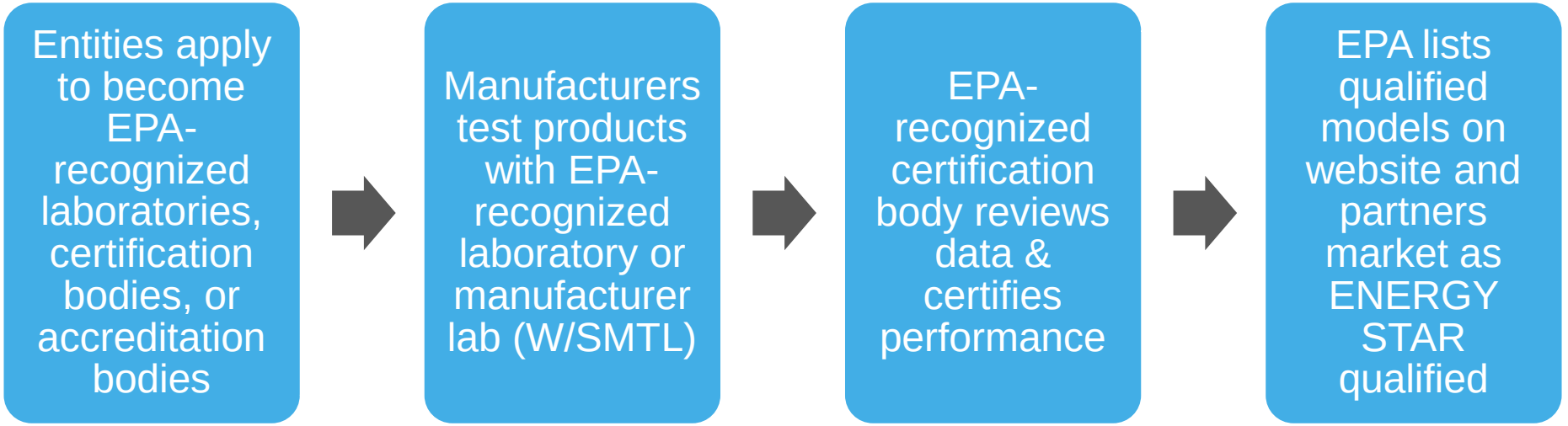
EPA: Brand Manager	DOE: Technical Support
• New Products • Performance Levels • Marketing & Outreach • Product Database • Monitoring & Verification	• Test Methods • Metrics • Monitoring & Verification

- MOU trigger for specification reviews

  "For appliances and other product categories with longer-lived product models, specifications will be reviewed for a possible revision at a **minimum of every three years** or once the market share for ENERGY STAR qualifying products reaches **about 35%**." Source: www.energystar.gov/mou.

ENERGY STAR's Third-Party Certification Process

January 2011: ENERGY STAR Labeled Products Program moved from self certification to third party certification.



Details available at www.energystar.gov/3rdpartycert

Drivers for Covering Clothes Dryers

- One of the largest end-use loads in U.S. homes for which there are no voluntary or mandatory labeling programs
- High household penetration (nearly 80% of homes)
- New, higher efficiency clothes dryer technology has been introduced in some markets
  - Example: heat pump technology has the potential to reduce CO_2 emissions by over 30% relative to standard electric models
  - Draft 1 proposal specifies10-13% energy savings relative to standard models, leading to an estimated annual saving of 93 GWh and 72,000 MBtu at 25% market penetration in the first year
- Building collaboration between efficiency groups, manufacturers, retailers and government around high efficiency clothes dryers
  - Research and testing by the efficiency community over the last few years
  - Super Efficient Dryer Initiative (SEDI) formed in 2010
  - 2012 ENERGY STAR Emerging Technology Award for Advanced Clothes Dryers

Overview of Draft 1, Version 1.0

- Scope
- Minimum energy efficiency requirements (CEF)
- Maximum drying time requirement
- Automatic termination criteria
- Minimum warranty requirements
- “Connected” functionality (optional)

Introduction – Welcome/Goals, ENERGY STAR Overview, Overview of Specification Development Process	Amanda Stevens, EPA
Clothes Dryers **Draft 1, Version 1.0 – Presentation & Discussion**	
- Definitions - Scope - Qualification Criteria	Sean Southard, ICF International
- "Connected" Functionality	Amanda Stevens, EPA Doug Frazee, ICF International
Test Method	Ashley Armstrong, DOE
Conclude & Next Steps	Amanda Stevens, EPA

Definitions

- Where available, EPA has incorporate definitions that are identical with the definitions in DOE appliance standards program
  - Definition of Combined Energy Factor (CEF) is consistent with Section 4.8 of DOE clothes dryer test procedure (Appendix D1)

- EPA has included definitions for several product types not covered under Version 1.0:
  - Combination All-in-One Washer-Dryer and Residential Clothes Washer with Optional Dry Cycle
    - Definitions from the Clothes Washer Version 6.0 specification were used
  - EPA is unaware of existing industry definitions for Commercial Clothes Dryers and Water-Cooled Ventless Clothes Dryers
    - Proposed definition for a commercial clothes dryer leverages the approach used in the V6.0 commercial clothes washer definition
    - Proposed definition for a water-cooled ventless clothes dryer based on the product's technical characteristics

Scope

- Products meeting the definition of Electric or Gas Clothes Dryer are proposed to be included in the V1.0 scope

- EPA is proposing to exclude:
  - *Commercial Clothes Dryers*, due to lack of data on available efficiency data on commercial clothes dryers
  - *Water-Cooled Ventless Clothes Dryer*, given the large amount of water use associated with dry cycle and lack of products found on US market
  - *Combination All-in-One Washer-Dryers & Residential Clothes Washers with an Optional Dry Cycle*, which have been addressed in the Clothes Washer specification

Combined Energy Factor (CEF) Proposed Criteria

Product Type	CEF_{BASE}
Vented Gas	3.67
Vented Electric, Standard	4.29
Vented Electric, Compact (240 V)	3.76
Vented Electric, Compact (120 V)	4.15
Ventless Electric, Compact (240 V)	2.93

- Equation 1 calculates the minimum CEF, with a 5% allowance for electric dryers with connected functionality:

Equation 1. Calculation of Minimum CEF

$$CEF_{MIN} = CEF_{BASE} - CEF_{Adder\_Connected}$$

Note: Products must be qualified using the final and validated ENERGY STAR test method to use the allowance.

Measuring CEF

- Specification references the latest DOE clothes dryer test procedure found in 10 CFR Part 430, Appendix D1
  - Energy efficiency is expressed using CEF performance metric
  - Referencing this test method will enable EPA to maintain Version 1.0 specification through January 1, 2015 when manufacturers are required to use Appendix D1 to comply with new standards
  - Appendix D1 contains updates to testing conditions that better reflect current usage patterns; also allows for testing of ventless dryers

CEF Criteria Cont'd

- Proposed CEF levels were developed using the 2015 DOE standards as baseline
  - Electric Dryers - 13% reduction in energy consumption
  - Gas - 10% reduction in energy consumption
    - Modestly lower for gas because certain cost-effective technology options cannot be used in gas dryers

- Minimum CEF requirements were developed through research/discussions with manufacturers and efficiency organizations that have helped to further define technologically-feasible and cost-effective options for improving dryer energy efficiency

CEF Criteria Cont'd

- Technology options that could be used to meet proposed Draft 1 levels:
  - Modulation technology (at least 5-10% savings, possibly more)
  - Heat recovery/recirculation (2-15% savings)
  - Fan/motor efficiency improvements (at least 1% savings)
  - Dryer control or drum upgrades (1-10% savings)
- Heat pump/hybrid heat pump technology can offer even greater savings (20-60% or more); EPA does not anticipate it would be necessary to meet proposed Draft 1 levels
- EPA anticipates a range of models could be available and cost-effective at these efficiency levels starting next year

Per-Unit Energy Use & Savings

Product Type	Annual or Lifetime	Baseline – Electricity Use (kWh)	Baseline – Gas Use (Therms)	Electricity Savings (kWh)	Gas Savings (Therms)
Electric (Standard)	Annual	641	N/A	83	N/A
	Lifetime	10,258	N/A	1,334	N/A
Gas	Annual	30	24	3	2
	Lifetime	477	379	48	38

Assumptions: The 2015 DOE Federal Standards were used as the baseline for savings calculations. Assumes 283 cycles per year and an average lifetime of 16 years.

- Savings estimates are likely conservative, they do not account for:
  - The additional energy needed to dry-real world loads (i.e., varying fabric types, load composition, cloth thickness) – estimated to be about 35% based on NRDC 2011 study
  - HVAC effects (where applicable)
  - Savings associated with proposed auto termination criteria
- EPA will factor in relevant findings from recent field studies, as they become available

Cost Savings/Payback Period

Product Type	Annual or Lifetime	Cost Savings
Electric (Standard)	Annual	$10
	Lifetime	$153
Gas	Annual	$3
	Lifetime	$46
Assumptions: Electricity price of $0.115 per kWh and gas price of $1.079 per therms.		

- Assuming a baseline dryer uses about 35% more energy (NRDC 2011), annual savings increase to $13 (electric) and $4 (gas)
- Based on conversations with stakeholders, EPA is estimating the price premium for electric dryers that can meet the Draft 1 CEF levels would be about $50
  - Payback period of ~ 3.8-5 years

Drying Time

- Consistent with EPA's Guiding Principles, EPA is proposing a maximum trying time requirement to ensure efficient dryers also meet consumers' expectations for performance.
  - Dryers (as tested in the DOE test) would need to complete cycle in ≤ 50 minutes
  - In developing this requirement, EPA considered:
    - Average time to complete DOE test cycle (NRDC 2011): 30 minutes for standard electric and gas, 50 minutes for ventless, 60 minutes for European heat pump
    - High efficiency clothes washer wash cycles range from 45-85 minutes (Consumer' reports test)
- EPA's intention is to help assure that consumer's expectations for drying time are met when they use and ENERGY STAR clothes dryer, while also providing a pathway for advanced dryer technologies (e.g., heat pump or hybrid heat pump), to qualify

Automatic Termination

- EPA is proposing that dryers be equipped with automatic termination control using both moisture and temperature sensing controls (verified by product inspection and/or product documentation)
  - EPA research indicates most dryers on market have temperature sensing control; an estimated 20-25% have moisture sensing controls
  - Manufacturers and Consumers Reports have indicated that moisture sensing do a better job at sensing when a load is dry than temperature sensing. This maximizes energy savings by reducing over-drying
  - Further innovation also possible with moisture sensors – i.e., location optimization

Automatic Termination Cont'd

- EPA is also proposing that timed drying cycles, if used, shall be limited to a max cycle time of 15 minutes
  - Some stakeholders have suggested that a significant portion of users may still use the timed drying out of habit, despite the presence of automatic termination
  - Timed drying can lead to over-drying as well as greater wear/tear on clothing
- The proposed criteria allows for mid-cycle adjustment, such that total cycle time exceeds 15 minutes (may be implemented as administrator-only functionality)
  - Mid-cycle adjustment included for testing purposes. DOE clothes dryer test procedure requires the use of a timed dry cycle

Warranty

- EPA includes warranty/lifetime requirements in specifications for a range of ENERGY STAR product categories (lighting, roofing, water heaters, etc.) when there are:
  - Quality/performance issues
  - New/emerging technologies
- For clothes dryers, after reviewing appliance manufacturer warranties on appliances sold in the US, EPA is proposing:
  - 3 years parts warranty on any control board (microprocesor)
  - 5 years parts warranty on any sealed system (compressor, condenser, evaporator, and all connecting tubing)
  - To be verified by product inspection and/or product documentation
- Minimum warranty requirements can help to increase consumer confidence in new energy-saving dryer technologies

Introduction – Welcome/Goals, ENERGY STAR Overview, Overview of Specification Development Process	Amanda Stevens, EPA
Clothes Dryers **Draft 1, Version 1.0 – Presentation & Discussion**	
- Definitions - Scope - Qualification Criteria	Sean Southard, ICF International
- "Connected" Functionality	Amanda Stevens, EPA Doug Frazee, ICF International
Conclude & Next Steps	Amanda Stevens, EPA

Approaching Connected

- EPA, through the ENERGY STAR program, has long encouraged development of “intelligence” in products, while enabling emissions reductions that persist over the long-term
  - Deep sleep in set-top boxes
  - Power management for monitors
- EPA sees opportunity to apply the ENERGY STAR program’s longstanding commitment to the consumer as various aspects of “smart grid” are extended to end-use products
  - Consumer value is longstanding brand promise
    - Connected functionality can also deliver near term convenience and energy savings features, e.g.,
      - enhanced energy awareness – product level energy consumption
      - messages/alerts relevant to the product’s energy consumption
      - remote management capability

Connected in Draft 1

- Demand savings for electric dryers could be significant given they have a typical power draw of 5kW during the drying cycle
- In Draft 1, EPA has included a temporary placeholder for connected criteria
  - EPA plans to propose connected criteria that enable both near-term consumer benefits plus longer-term grid benefits associated with smart grid interconnection, building from:
    - Refrigerator/Freezer connected criteria (currently being vetted in a stakeholder process)
    - Clothes dryer demand response functionality specified in 2010 *Joint Petition on Smart Appliances*
- Connected functionality is optional – not required for ENERGY STAR qualification
- EPA is proposing a 5% incentive for electric dryers with connected functionality towards the minimum base CEF, to help jump-start the market

Feedback on Connected Opportunities for Dryers

- To support development of connected criteria for clothes dryers, EPA is interested in stakeholder feedback on:
  - Since usage time may be flexible, is price awareness of particular importance?
  - Should the product encourage usage during favorable price periods?
  - If so, how can these be best expressed in the specification?

Verification of Connected Functionality

- Compliance with connected functionality specified in Section 4 (currently TBD), would be through examination of product and/or product documentation.
- Additionally, DR functionality would be certified using TBD ENERGY STAR test method
  - DOE plans to develop test method
    - Dependent upon product availability for validation testing
  - Products must be certified using test method in order to be eligible for allowance

Introduction – Welcome/Goals, ENERGY STAR Overview, Overview of Specification Development Process	Amanda Stevens, EPA
Clothes Dryers **Draft 1, Version 1.0 – Presentation & Discussion**	
- Definitions - Scope - Qualification Criteria	Sean Southard, ICF International
- "Connected" Functionality	Amanda Stevens, EPA Doug Frazee, ICF International
Conclude & Next Steps	Amanda Stevens, EPA

Anticipated Timeline for Version 1.0 Specification

July 17, 2012	ENERGY STAR Clothes Dryers Program Launch
August 28, 2012	Draft 1, Version 1.0 Specification Released
September 12, 2012	Today's Stakeholder Webinar
October 5, 2012 *(note – extended 1 week)*	Comment Period Closes on Draft 1 Specification
November/December 2012	2nd Draft Specification Distributed, Stakeholder Webinar or Meeting, and Comment Period
February/March 2013	Final Draft Specification Distributed and Comment Period
April 2013	Final V1.0 Specification Released and Effective

- EPA welcomes all partner and stakeholder comments by **October 5, 2012**
- Comments should be submitted in writing to appliances@energystar.gov

Future Specification Revisions

- New minimum efficiency standards for dryers become effective Jan. 1, 2015
  - EPA has referenced the amended DOE test method (Appendix D1) and has used the 2015 standards as a baseline, so that a new clothes dryer specification is not necessarily needed due to the amended standards/test procedure.
- EPA is interested in stakeholder feedback on possible future clothes dryer savings opportunities:
  - Commercial clothes dryers
  - Eco-mode
  - HVAC effects and further research/modeling
  - Additional performance considerations, i.e., fabric care

Questions?

Contacts

Specification Development:

- Amanda Stevens, US EPA
  Stevens.Amanda@epamail.epa.gov
- Sean Southard, ICF International
  sean.southard@icfi.com
- Doug Frazee, ICF International
  douglas.frazee@icfi.com
- appliances@energystar.gov

Test Procedure Development:

- Ashley Armstrong, US DOE
  Ashley.Armstrong@ee.doe.gov