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Part II

Department of Energy

10 CFR Part 430

Energy Conservation Program: Energy Conservation Standards for Residential Clothes Dryers and Room Air Conditioners; Final Rule

DEPARTMENT OF ENERGY

10 CFR Part 430

[Docket Number EERE–2007–BT–STD–0010]

RIN 1904–AA89

Energy Conservation Program: Energy Conservation Standards for Residential Clothes Dryers and Room Air Conditioners

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Direct final rule.

SUMMARY: The Energy Policy and Conservation Act (EPCA) prescribes energy conservation standards for various consumer products and commercial and industrial equipment, including residential clothes dryers and room air conditioners. EPCA also requires the U.S. Department of Energy (DOE) to determine if amended standards for these products are technologically feasible and economically justified, and would save a significant amount of energy. In this direct final rule, DOE adopts amended energy conservation standards for residential clothes dryers and room air conditioners. A notice of proposed rulemaking that proposes identical energy efficiency standards is published elsewhere in today's **Federal Register**. If DOE receives adverse comment and determines that such comment may provide a reasonable basis for withdrawing the direct final rule, this final rule will be withdrawn and DOE will proceed with the proposed rule.

DATES: The final rule is effective on August 19, 2011 unless adverse comment is received by August 9, 2011. If adverse comments are received that DOE determines may provide a reasonable basis for withdrawal of the final rule, a timely withdrawal of this rule will be published in the **Federal Register**. If no such adverse comments are received, compliance with the standards in this final rule will be required on April 21, 2014.

ADDRESSES: Any comments submitted must identify the direct final rule for Energy Conservation Standards for Residential Clothes Dryers and Room Air Conditioners, and provide docket number EERE–2007–BT–STD–0010 and/or regulatory information number (RIN) number 1904–AA89. Comments may be submitted using any of the following methods:

1. *Federal eRulemaking Portal: http://www.regulations.gov.* Follow the instructions for submitting comments.

2. *E-mail: home_appliance2.rulemaking@ee.doe.gov.* Include the docket number and/or RIN in the subject line of the message.

3. *Mail:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121. If possible, please submit all items on a CD. It is not necessary to include printed copies.

4. *Hand Delivery/Courier:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC 20024. *Telephone:* (202) 586–2945. If possible, please submit all items on a CD. It is not necessary to include printed copies.

For detailed instructions on submitting comments and additional information on the rulemaking process, *see* section VII of this document (Public Participation).

Docket: The docket is available for review at regulations.gov, including **Federal Register** notices, framework documents, public meeting attendee lists and transcripts, comments, and other supporting documents/materials. All documents in the docket are listed in the regulations.gov index. Not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure. A link to the docket web page can be found at *http://www.regulations.gov*.

For further information on how to submit or review public comments or view hard copies of the docket in the Resource Room, contact Ms. Brenda Edwards at (202) 586–2945 or *e-mail: Brenda.Edwards@ee.doe.gov*.

FOR FURTHER INFORMATION CONTACT:

Stephen L. Witkowski, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121, (202) 586–7463, *e-mail: stephen.witkowski@ee.doe.gov*.

Ms. Elizabeth Kohl, U.S. Department of Energy, Office of General Counsel, GC–71, 1000 Independence Avenue, SW., Washington, DC 20585–0121, (202) 586–7796, *e-mail: Elizabeth.Kohl@hq.doe.gov*.

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I. Summary of the Direct Final Rule

A. The Energy Conservation Standard Levels

The Energy Policy and Conservation Act (42 U.S.C. 6291 *et seq.*; EPCA or the Act), as amended, provides that any amended energy conservation standard DOE prescribes for covered products, such as residential clothes dryers (clothes dryers) and room air conditioners, must be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, the amended standard must result in a significant conservation of energy. (42 U.S.C. 6295(o)(3)(B)) In accordance with these and other statutory provisions discussed in this notice, DOE adopts amended energy conservation standards for clothes dryers and room air conditioners as shown in Table I–1. The standards apply to all products listed in Table I–1 and manufactured in, or imported into, the United States on or after April 21, 2014.

TABLE I–1—AMENDED ENERGY CONSERVATION STANDARDS FOR RESIDENTIAL CLOTHES DRYERS AND ROOM AIR CONDITIONERS

Product class	Minimum CEF levels* *lb/kWh*
Residential Clothes Dryers	
1. Vented Electric, Standard (4.4 ft^3 or greater capacity)	3.73
2. Vented Electric, Compact (120 V) (less than 4.4 ft^3 capacity)	3.61
3. Vented Electric, Compact (240 V) (less than 4.4 ft^3 capacity)	3.27
4. Vented Gas	3.30
5. Ventless Electric, Compact (240 V) (less than 4.4 ft^3 capacity)	2.55
6. Ventless Electric Combination Washer/Dryer	2.08
Product class	**Minimum CEER levels** *Btu/Wh***
Room Air Conditioners	
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	11.0

Product class	Minimum CEER levels** *Btu/Wh*
2. Without reverse cycle, with louvered sides, and 6,000 to 7,999 Btu/h	11.0
3. Without reverse cycle, with louvered sides, and 8,000 to 13,999 Btu/h	10.9
4. Without reverse cycle, with louvered sides, and 14,000 to 19,999 Btu/h	10.7
5a. Without reverse cycle, with louvered sides, and 20,000 to 24,999 Btu/h	9.4
5b. Without reverse cycle, with louvered sides, and 25,000 Btu/h or more	9.0
6. Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	10.0
7. Without reverse cycle, without louvered sides, and 6,000 to 7,999 Btu/h	10.0
8a. Without reverse cycle, without louvered sides, and 8,000 to 10,999 Btu/h	9.6
8b. Without reverse cycle, without louvered sides, and 11,000 to 13,999 Btu/h	9.5
9. Without reverse cycle, without louvered sides, and 14,000 to 19,999 Btu/h	9.3
10. Without reverse cycle, without louvered sides, and 20,000 Btu/h or more	9.4
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	9.8
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	9.3
13. With reverse cycle, with louvered sides, and 20,000 Btu/h or more	9.3
14. With reverse cycle, without louvered sides, and 14,000 Btu/h or more	8.7
15. Casement-only	9.5
16. Casement-slider	10.4

* CEF (Combined Energy Factor) is calculated as the clothes dryer test load weight in pounds divided by the sum of "active mode" per-cycle energy use and "inactive mode" per-cycle energy use in kWh.
** CEER (Combined Energy Efficiency Ratio) is calculated as capacity times active mode hours (equal to 750) divided by the sum of active mode annual energy use and inactive mode.

B. Benefits and Costs to Consumers

Table I–2 presents DOE's evaluation of the economic impacts of today's standards on consumers of clothes dryers and room air conditioners, as measured by the average life-cycle cost (LCC) savings and the median payback period. The average LCC savings are positive for all product classes of clothes dryers and room air conditioners for which consumers would be impacted by the standards.

TABLE I–2—IMPACTS OF TODAY'S STANDARDS ON CONSUMERS OF CLOTHES DRYERS AND ROOM AIR CONDITIONERS

Product class	Average LCC savings (2009$)	Median payback period (years)
Clothes Dryers		
Electric Standard	$14	5.3
Compact 120V	14	0.9
Compact 240V	8	0.9
Gas	2	11.7
Ventless 240V	* 0	* n/a
Ventless Combination Washer/Dryer	* 0	* n/a
Room Air Conditioners		
< 6,000 Btu/h, with Louvers	7	8.6
8,000–13,999 Btu/h, with Louvers	22	2.8
20,000–24,999 Btu/h, with Louvers	6	4.3
> 25,000 Btu/h, with Louvers	1	10.1
8,000–10,999 Btu/h, without Louvers	13	2.1
> 11,000 Btu/h, without Louvers	11	3.7

* Because the standard level is the same as the baseline efficiency level, no consumers are impacted and therefore calculation of a payback period is not applicable.

C. Impact on Manufacturers

The industry net present value (INPV) is the sum of the discounted cash flows to the industry from the base year through the end of the analysis period (2011 to 2043). Using a real discount rate of 7.2 percent, DOE estimates that the industry net present value (INPV) for manufacturers of clothes dryers is $1,003.6 million in 2009$. Under today's standards, DOE expects that manufacturers may lose 6.4 to 8.0 percent of their INPV, which is $64.5 to −$80.6 million. Additionally, based on DOE's interviews with the manufacturers of clothes dryers, DOE does not expect any plant closings or significant loss of employment.

For room air conditioners, DOE estimates that the INPV for manufacturers of room air conditioners is $956 million in 2009$ using a real discount rate of 7.2 percent. Under today's standards, DOE expects that manufacturers may lose 11.6 to 18.6 percent of their INPV, which is $111.3 to $177.6 million. Additionally, based on DOE's interviews with the manufacturers of room air conditioners, DOE does not expect any plant closings or significant loss of employment.

D. National Benefits

DOE's analyses indicate that today's standards would save a significant amount of energy over 30 years (2014–

2043)—an estimated 0.39 quads of cumulative energy for clothes dryers and 0.31 quads of cumulative energy for room air conditioners. The combined total, 0.70 quads, is equivalent to three-fourths of the estimated amount of energy used in 2008 to dry clothes in all U.S. homes. In addition, DOE expects the energy savings from today's standards to eliminate the need for approximately 0.98 gigawatts (GW) of generating capacity by 2043.

The cumulative national net present value (NPV) of total consumer costs and savings of today's standards in 2009$ ranges from $1.08 billion (at a 7-percent discount rate) to $3.01 billion (at a 3-percent discount rate) for clothes dryers, and from $0.57 billion (at a 7-percent discount rate) to $1.47 billion (at a 3-percent discount rate) for room air conditioners. This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs for products purchased in 2014–2043, discounted to 2011.

In addition, today's standards would have significant environmental benefits. The energy savings would result in cumulative greenhouse gas emission reductions of approximately 36.1 million metric tons (Mt) of carbon dioxide (CO_2) from 2014 to 2043. During this period, the standards would also result in emissions reductions [1] of approximately 29.3 thousand tons of nitrogen oxides (NO_X) and 0.073 ton of mercury (Hg).[2] DOE estimates that the net present monetary value of the CO_2 emissions reductions is between $170 and $2,654 million, expressed in 2009$ and discounted to 2011. DOE also estimates that the net present monetary value of the NO_X emissions reductions, expressed in 2009$ and discounted to 2011, is $4.3 to $43.8 million at a 7-percent discount rate, and $8.9 to $91.7 million at a 3-percent discount rate.[3]

The benefits and costs of today's standards can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value, expressed in 2009$, of the benefits from operating the product (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase costs, which is another way of representing consumer NPV, plus (2) the monetary value of the benefits of emission reductions, including CO_2 emission reductions.[4] The value of the CO_2 reductions is otherwise known as the Social Cost of Carbon (SCC), and is calculated using a range of values per metric ton of CO_2 developed by a recent interagency process. The monetary benefits of emissions reductions are reported in 2009$ so that they can be compared with the other costs and benefits in the same dollar units. The derivation of the SCC values is discussed in section IV.M.

Although adding the value of consumer savings to the values of emission reductions provides a valuable perspective, two issues should be considered. First, the national operating cost savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use quite different timeframes for analysis. The national operating cost savings is measured for the lifetime of products shipped in 2014–2043. The SCC values, on the other hand, reflect the present value of future climate-related impacts resulting from the emission of one metric ton of carbon dioxide in each year. These impacts continue well beyond 2100.

Table I–3 shows the annualized values for the clothes dryer standards. Using a 7-percent discount rate and the SCC value of $22.1/ton in 2010 (in 2009$), the cost of the standards for clothes dryers in today's rule is $52.3 million per year in increased equipment costs, while the annualized benefits are $139.1 million per year in reduced equipment operating costs, $25.0 million in CO_2 reductions, and $0.9 million in reduced NO_X emissions. In this case, the net benefit amounts to $112.7 million per year. DOE has calculated that the annualized increased equipment cost can range from $50.5 to $66.6 million per year depending on assumptions and modeling of equipment price trends. The high end of this range corresponds to a constant real equipment price trend. Using the central estimate of energy-related benefits, DOE estimates that calculated net benefits can range from $98.4 to $114.5 million per year.

Using a 3-percent discount rate and the SCC value of $22.1/ton in 2010 (in 2009$), the cost of the standards for clothes dryers in today's rule is $55.4 million per year in increased equipment costs, while the benefits are $209.1 million per year in reduced operating costs, $25.0 million in CO_2 reductions, and $1.4 million in reduced NO_X emissions. In this case, the net benefit amounts to $180.1 million per year. DOE has calculated that the annualized increased equipment cost can range from $53.1 to $73.5 million per year depending on assumptions and modeling of equipment price trends. The high end of this range corresponds to a constant real equipment price trend. Using the central estimate of energy-related benefits, DOE estimates that calculated net benefits can range from $162.0 to $182.4 million per year.

Table I–4 shows the annualized values for the room air conditioner standards. Using a 7-percent discount rate and the SCC value of $22.1/ton in 2010 (in 2009$), the cost of the standards for room air conditioners in today's rule is $107.7 million per year in increased equipment costs, while the annualized benefits are $153.7 million per year in reduced equipment operating costs, $19.5 million in CO_2 reductions, and $0.999 million in reduced NO_X emissions. In this case, the net benefit amounts to $66.4 million per year.

DOE has calculated that the annualized increased equipment cost can range from $105.7 to $136.6 million per year depending on assumptions and modeling of equipment price trends. The high end of this range corresponds to a constant real equipment price trend. Using the central estimate of energy-related benefits, DOE estimates that calculated net benefits can range from $37.5 to $68.4 million per year.

Using a 3-percent discount rate and the SCC value of $22.1/ton in 2010 (in

[1] DOE calculates emissions reductions relative to the most recent version of the *Annual Energy Outlook* (*AEO*) Reference case forecast. As noted in section 15.2.4 of TSD chapter 15, this forecast accounts for regulatory emissions reductions through 2008, including the Clean Air Interstate Rule (CAIR, 70 FR 25162 (May 12, 2005)), but not the Clean Air Mercury Rule (CAMR, 70 FR 28606 (May 18, 2005)). Subsequent regulations, including the currently proposed CAIR replacement rule, the Clean Air Transport Rule (75 FR 45210 (Aug. 2, 2010)), do not appear in the forecast.

[2] Results for NO_X and Hg are presented in short tons. One short ton equals 2000 lbs.

[3] DOE is aware of multiple agency efforts to determine the appropriate range of values used in evaluating the potential economic benefits of reduced Hg emissions. DOE has decided to await further guidance regarding consistent valuation and reporting of Hg emissions before it once again monetizes Hg emissions reductions in its rulemakings.

[4] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in 2011, the year used for discounting the NPV of total consumer costs and savings, for the time-series of costs and benefits using discount rates of three and seven percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates, as shown in Table I.3. From the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in 2011, that yields the same present value. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and benefits from which the annualized values were determined would be a steady stream of payments.

2009$), the cost of the standards for room air conditioners in today's rule is $111.0 million per year in increased equipment costs, while the benefits are $186.2 million per year in reduced operating costs, $19.5 million in CO_2 reductions, and $1.20 million in reduced NO_X emissions. In this case, the net benefit amounts to $95.9 million per year DOE has calculated that the range in the annualized increased equipment cost can range from $108.0 to $146.0 million per year depending on assumptions and modeling of equipment price trends. The high end of this range corresponds to a constant real equipment price trend. Using the central estimate of energy-related benefits, DOE estimates that calculated net benefits can range from $60.9 to $98.9 million per year.

TABLE I–3—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS (TSL 4) FOR CLOTHES DRYERS SOLD IN 2014–2043

	Discount rate	Monetized *(million 2009$ year)*		
		Primary estimate *	Low estimate *	High estimate *
Benefits				
Operating Cost Savings	7%	139.1	120.6	158.3
	3%	209.1	177.4	241.3
CO_2 Reduction at $4.9/t **	5%	6.0	6.0	6.0
CO_2 Reduction at $22.1/t **	3%	25.0	25.0	25.0
CO_2 Reduction at $36.3/t **	2.5%	39.8	39.8	39.8
CO_2 Reduction at $67.1/t **	3%	76.0	76.0	76.0
NO_X Reduction at $2,519/ton **	7%	0.9	0.9	0.9
	3%	1.4	1.4	1.4
Total†	7% plus CO_2 range	146.1 to 216.1	127.6 to 197.6	165.3 to 235.3
	7%	165.0	146.5	184.3
	3%	235.4	203.7	267.6
	3% plus CO_2 range	216.5 to 286.5	184.8 to 254.8	248.7 to 318.7
Costs				
Incremental Product Costs#	7%	52.3	66.6	50.5
	3%	55.4	73.5	53.1
Net Benefits				
Total†	7% plus CO_2 range	93.7 to 163.7	61.0 to 131.0	114.8 to 184.8
	7%	112.7	79.9	133.8
	3%	180.1	130.2	214.5
	3% plus CO_2 range	161.1 to 231.1	111.3 to 181.3	195.6 to 265.6

* The primary, low, and high estimates utilize forecasts of energy prices and housing starts from the AEO2010 Reference case, Low Economic Growth case, and High Economic Growth case, respectively. Low estimate corresponds to the low net benefit estimate and uses the zero real price trend sensitivity for equipment prices, and the high estimate corresponds to the high net benefit estimate and utilizes the high technological learning rate sensitivity for the equipment price trend.

** The CO_2 values represent global values (in 2009$) of the social cost of CO_2 emissions in 2010 under several scenarios. The values of $4.9, $22.1, and $36.3 per metric ton are the averages of SCC distributions calculated using 5-percent, 3-percent, and 2.5-percent discount rates, respectively. The value of $67.1 per ton represents the 95th percentile of the SCC distribution calculated using a 3-percent discount rate. The value for NO_X (in 2009$) is the average of the low and high values used in DOE's analysis.

† Total benefits for both the 3-percent and 7-percent cases are derived using the SCC value calculated at a 3-percent discount rate, which is $22.1/ton in 2010 (in 2007$). In the rows labeled as "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

TABLE I–4—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS (TSL 4) FOR ROOM AIR CONDITIONERS SOLD IN 2014–2043

	Discount rate	Monetized (*million 2009$/year*)		
		Primary estimate *	Low estimate *	High estimate *
Benefits				
Operating Cost Savings	7%	153.7	145.1	161.9
	3%	186.2	174.2	197.3
CO_2 Reduction at $4.9/t **	5%	5.0	5.0	5.0
CO_2 Reduction at $22.1/t **	3%	19.5	19.5	19.5
CO_2 Reduction at $36.3/t **	2.5%	30.7	30.7	30.7
CO_2 Reduction at $67.1/t **	3%	59.4	59.4	59.4
NO_X Reduction at $2,519/ton **	7%	0.999	0.999	0.999
	3%	1.197	1.197	1.197
Total †	7% plus CO_2 range	159.6 to 214.0	151.1 to 205.5	167.9 to 222.3
	7%	174.1	165.5	182.4
	3%	206.8	194.9	218.0
	3% plus CO_2 range	192.3 to 246.7	180.4 to 234.8	203.5 to 257.9

TABLE I–4—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS (TSL 4) FOR ROOM AIR CONDITIONERS SOLD IN 2014–2043—Continued

	Discount rate	Monetized (*million 2009$/year*)		
		Primary estimate *	Low estimate *	High estimate *
Costs				
Incremental Product Costs	7% 3%	107.7 111.0	136.6 146.0	105.7 108.0
Net Benefits				
Total†	7% plus CO_2 range 7% 3% 3% plus CO_2 range	51.9 to 106.3 66.4 95.9 81.4 to 135.8	43.4 to 97.8 28.9 48.9 34.4 to 88.8	62.2 to 116.6 76.7 110.0 95.5 to 149.9

* The primary, low, and high estimates utilize forecasts of energy prices and housing starts from the AEO2010 Reference case, Low Economic Growth case, and High Economic Growth case, respectively. Low estimate corresponds to the low net benefit estimate and uses the zero real price trend sensitivity for equipment prices, while the high estimate corresponds to the high net benefit estimate and utilizes the high technological learning rate sensitivity for the equipment price trend.

** The CO_2 values represent global values (in 2009$) of the social cost of CO_2 emissions in 2010 under several scenarios. The values of $4.9, $22.1, and $36.3 per metric ton are the averages of SCC distributions calculated using 5-percent, 3-percent, and 2.5-percent discount rates, respectively. The value of $67.1 per ton represents the 95th percentile of the SCC distribution calculated using a 3-percent discount rate. The value for NO_X (in 2009$) is the average of the low and high values used in DOE's analysis.

† Total benefits for both the 3-percent and 7-percent cases are derived using the SCC value calculated at a 3-percent discount rate, which is $22.1/ton in 2010 (in 2009$). In the rows labeled as "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

E. Conclusion

Based on the analyses culminating in this final rule, DOE found the benefits to the nation of the standards (energy savings, consumer LCC savings, national NPV increase, and emission reductions) outweigh the burdens (loss of INPV and LCC increases for some users of these products). DOE has concluded that the standards represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in significant conservation of energy. DOE further notes that clothes dryers and room air conditioners achieving these standard levels are already commercially available.

II. Introduction

A. Authority

Title III of EPCA sets forth a variety of provisions designed to improve energy efficiency. Part B of title III (42 U.S.C. 6291–6309) provides for the Energy Conservation Program for Consumer Products other than Automobiles.[5] The program covers consumer products and certain commercial equipment (referred to hereafter as "covered products"), including clothes dryers and room air conditioners (42 U.S.C. 6292(a)(2) and (8)), and the Act prescribes energy conservation standards for certain clothes dryers (42 U.S.C. 6295(g)(3)) and for room air conditioners (42 U.S.C. 6295(c)(1)). EPCA further directs DOE to conduct two cycles of rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(c)(2) and (g)(4)) As explained in further detail in section II.C, "Background," this rulemaking represents the second round of amendments to both the clothes dryer and room air conditioner standards.

DOE notes that this rulemaking is one of the required agency actions in the consolidated Consent Decree in *State of New York, et al.* v. *Bodman et al.,* 05 Civ. 7807 (LAP), and *Natural Resources Defense Council, et al.* v. *Bodman, et al.,* 05 Civ. 7808 (LAP), DOE is required to complete a final rule for amended energy conservation standards for room air conditioners and clothes dryers that must be sent to the **Federal Register** by June 30, 2011.

Under the Act, DOE's energy conservation program for covered products consists essentially of four parts: (1) Testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. The Federal Trade Commission (FTC) is responsible for labeling, and DOE implements the remainder of the program. The Act authorizes DOE, subject to certain criteria and conditions, to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6293) Manufacturers of covered products must use the DOE test procedure as the basis for certifying to DOE that their products comply with applicable energy conservation standards adopted under EPCA and for representing the efficiency of those products. (42 U.S.C. 6293(c) and 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted under EPCA. *Id.* The test procedures for clothes dryers and room air conditioners appear at title 10 Code of Federal Regulations (CFR) part 430, subpart B, appendices D and F, respectively.

EPCA provides criteria for prescribing amended standards for covered products. As indicated above, any amended standard for a covered product must be designed to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Furthermore, EPCA precludes DOE from adopting any standard that would not result in significant conservation of energy. (42 U.S.C. 6295(o)(3)) EPCA also provides that, in determining whether a standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i)) DOE must do so after receiving comments on the proposed standard and by considering, to the greatest extent practicable, the following seven factors:

1. The economic impact of the standard on manufacturers and consumers of the products subject to the standard;

2. The savings in operating costs throughout the estimated average life of the covered products in the type (or

[5] For editorial reasons, upon codification in the U.S. Code, Part B was re-designated Part A.

class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the imposition of the standard;

3. The total projected amount of energy savings likely to result directly from the imposition of the standard;

4. Any lessening of the utility or the performance of the covered products likely to result from the imposition of the standard;

5. The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the imposition of the standard;

6. The need for national energy conservation; and

7. Other factors the Secretary considers relevant. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

The Energy Independence and Security Act of 2007 (EISA 2007; Public Law 110–140) amended EPCA, in relevant part, to grant DOE authority to issue a final rule (hereinafter referred to as a "direct final rule") establishing an energy conservation standard on receipt of a statement submitted jointly by interested persons that are fairly representative of relevant points of view (including representatives of manufacturers of covered products, States, and efficiency advocates) as determined by the Secretary, that contains recommendations with respect to an energy conservation standard that are in accordance with the provisions of 42 U.S.C. 6295(o). A notice of proposed rulemaking (NOPR) that proposes an identical energy efficiency standard must be published simultaneously with the final rule, and DOE must provide a public comment period of at least 110 days on this proposal. 42 U.S.C. 6295(p)(4). Not later than 120 days after issuance of the direct final rule, if one or more adverse comments or an alternative joint recommendation are received relating to the direct final rule, the Secretary must determine whether the comments or alternative recommendation may provide a reasonable basis for withdrawal under 42 U.S.C. 6295(o) or other applicable law. If the Secretary makes such a determination, DOE must withdraw the direct final rule and proceed with the simultaneously published notice of proposed rulemaking. DOE must publish in the **Federal Register** the reason why the direct final rule was withdrawn. *Id.*

The Consent Decree in *State of New York, et al.* v. *Bodman et al.,* described above, defines a "final rule" to have the same meaning as in 42 U.S.C. 6295(p)(4) and defines "final action" as a final decision by DOE. As this direct final rule is issued under authority at 42 U.S.C. 6295(p)(4) and constitutes a final decision by DOE which becomes legally effective 120 days after issuance, absent an adverse comment that leads the Secretary to withdraw the direct final rule, DOE asserts that issuance of this direct final rule on or before the date required by the court constitutes compliance with the Consent Decree in *State of New York, et al.* v. *Bodman et al.*

Furthermore, EPCA contains what is commonly known as an "anti-backsliding" provision, which mandates that the Secretary not prescribe any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6295(o)(1)) Also, the Secretary may not prescribe a new standard if interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States of any covered product type (or class) with performance characteristics, features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States. (42 U.S.C. 6295(o)(4))

EPCA also establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy savings during the first year that the consumer will receive as a result of the standard, as calculated under the applicable test procedure. 42 U.S.C. 6295(o)(2)(B)(iii)

EPCA requires DOE to specify a different standard level than that which applies generally to a type or class of products for any group of covered products that have the same function or intended use if DOE determines that products within such group (A) consume a different kind of energy from that consumed by other covered products within such type (or class); or (B) have a capacity or other performance-related feature which other products within such type (or class) do not have and such feature justifies a higher or lower standard. (42 U.S.C. 6295(q)(1)) In determining whether a performance-related feature justifies such a different standard for a group of products, DOE must consider such factors as the utility to the consumer of the feature and other factors DOE deems appropriate. *Id.* Any rule prescribing such a standard must include an explanation of the basis on which such higher or lower level was established. (42 U.S.C. 6295(q)(2))

Federal energy conservation requirements for covered products generally supersede state laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297 (a)–(c)) DOE can, however, grant waivers of Federal preemption for particular state laws or regulations, in accordance with the procedures and other provisions of section 327(d) of the Act. (42 U.S.C. 6297(d))

EPCA also requires that energy conservation standards address standby mode and off mode energy use. Specifically, when DOE adopts a standard for a covered product after July 1, 2010 it must, if justified by the criteria for adoption of standards in section 325(o) of EPCA, incorporate standby mode and off mode energy use into the standard, if feasible, or adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)) As set forth below, the standards for clothes dryers and room air conditioners at 10 CFR 430.32 (h) and (b) are minimum energy factors (EF) and minimum energy efficiency ratios (EER), respectively. Neither of these metrics incorporates standby or off mode energy use, with the limited exception that the EF in appendix D addresses the energy use of pilot lights in gas clothes dryers. (DOE notes that standing pilot lights were prohibited by EPCA for products manufactured after January 1, 1988. As a result, the final amended test procedure, published on January 6, 2011, eliminates measurement of the energy use of such pilot lights. Similarly, DOE does not incorporate the energy use of pilot lights in the metric for gas clothes dryers established in this final rule.) By contrast, the standard levels DOE considered in this direct final rule are expressed in terms of the "combined energy factor" (CEF) for clothes dryers and the "combined energy efficiency ratio" (CEER) for room air conditioners, and each of these metrics incorporates energy use in all modes, including the standby and off modes. DOE uses these metrics in the standards it adopts in this direct final rule.

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011 (76 FR 3281, Jan. 21, 2011). EO 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) Propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

We emphasize as well that Executive Order 13563 requires agencies "to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible." In its guidance, the Office of Information and Regulatory Affairs has emphasized that such techniques may include "identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes." For the reasons stated in the preamble, DOE believes that today's direct final rule is consistent with these principles, including that, to the extent permitted by law, agencies adopt a regulation only upon a reasoned determination that its benefits justify its costs and select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits.

Consistent with EO 13563, and the range of impacts analyzed in this rulemaking, the energy efficiency standard adopted herein by DOE achieves maximum net benefits.

B. Background

1. Current Standards

In a final rule published on May 14, 1991, DOE prescribed the current Federal energy conservation standards for clothes dryers manufactured on or after May 14, 1994. 56 FR 22250. This rule completed the first of the two rulemakings required under 42 U.S.C. 6295(g)(4) to consider amending the standards for clothes dryers. The current standards consist of four minimum EFs, expressed in pounds of clothing load (lb) per kilowatt-hour (kWh), one for gas dryers and one each for three different types of electric dryers. 10 CFR 430.32(h). These standards are set forth in Table II.1 below.

TABLE II.1—RESIDENTIAL CLOTHES DRYER CURRENT ENERGY CONSERVATION STANDARDS

Product class	EF *lb/kWh*
Electric, Standard (4.4 cubic feet (ft^3) or greater capacity)	3.01
Electric, Compact (120 V) (less than 4.4 ft^3 capacity)	3.13
Electric, Compact (240 V) (less than 4.4 ft^3 capacity)	2.90
Gas	2.67

In a final rule published on September 24, 1997, DOE prescribed the current Federal energy conservation standards for room air conditioners manufactured on or after October 1, 2000. 62 FR 50122. This rule completed the first of the two rulemakings required under 42 U.S.C. 6295(c)(2) to consider amending the standards for room air conditioners. The current standards consist of minimum EERs, expressed as cooling capacity in British thermal units (Btu) per hour (h) divided by electrical input power in watts (W), that vary depending on the size of the room air conditioner, whether it has louvered sides and a heating cycle, and whether it is for casement installations. 10 CFR 430.32(b). These standards are set forth in Table II.2 below.

TABLE II.2—ROOM AIR CONDITIONER CURRENT ENERGY CONSERVATION STANDARDS

Product class	EER *Btu/Wh*
Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	9.7
Without reverse cycle, with louvered sides, and 6,000 to 7,999 Btu/h	9.7
Without reverse cycle, with louvered sides, and 8,000 to 13,999 Btu/h	9.8
Without reverse cycle, with louvered sides, and 14,000 to 19,999 Btu/h	9.7
Without reverse cycle, with louvered sides, and 20,000 Btu/h or more	8.5
Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	9.0
Without reverse cycle, without louvered sides, and 6,000 to 7,999 Btu/h	9.0
Without reverse cycle, without louvered sides, and 8,000 to 13,999 Btu/h	8.5
Without reverse cycle, without louvered sides, and 14,000 to 19,999 Btu/h	8.5
Without reverse cycle, without louvered sides, and 20,000 Btu/h or more	8.5
With reverse cycle, with louvered sides, and less than 20,000 Btu/h	9.0
With reverse cycle, without louvered sides, and less than 14,000 Btu/h	8.5
With reverse cycle, with louvered sides, and 20,000 Btu/h or more	8.5
With reverse cycle, without louvered sides, and 14,000 Btu/h or more	8.0
Casement-Only	8.7
Casement-Slider	9.5

2. History of Standards Rulemaking for Residential Clothes Dryers and Room Air Conditioners

EPCA prescribes energy conservation standards for clothes dryers and for room air conditioners, consisting of a requirement that gas clothes dryers manufactured after January 1, 1988 not be equipped with constant burning pilots and performance standards (minimum EER levels) for room air conditioners. (42 U.S.C. 6295(c)(1) and (g)(3)) These amendments also required, for both products, that DOE conduct two cycles of rulemakings to determine whether to amend these standards. (42 U.S.C. 6295(c)(2) and (g)(4)) As indicated above, DOE completed the first of these rulemaking cycles for clothes dryers in 1991, by adopting performance standards for gas and electric products. DOE completed the first of these rulemaking cycles for room air conditioners in 1997 by adopting amended minimum EER levels.

DOE initiated this rulemaking on October 9, 2007 by publishing a notice announcing the availability of the framework document, the "Energy Conservation Standards Rulemaking Framework Document for Residential Clothes Dryers and Room Air Conditioners." In this notice, DOE also announced a public meeting and requested public comment on the matters raised in the framework document. 72 FR 57254 (October 9, 2007). The framework document describes the procedural and analytical approaches that DOE anticipated using to evaluate energy conservation standards for clothes dryers and room air conditioners, and identified various issues to be resolved in conducting this rulemaking. The framework document is available at *http://www1.eere.energy.gov/buildings/appliance_standards/.*

DOE held the public meeting on October 24, 2007 to present the contents of the framework document, describe the analyses it planned to conduct during the rulemaking, seek comments from interested parties on these subjects, and, in general, inform interested parties about, and facilitate their involvement in, the rulemaking. Interested parties discussed the following major issues at the public meeting: test procedure revisions; product classes; technology options; approaches to the engineering, life-cycle cost, payback period and national impact analyses; efficiency levels analyzed in the engineering analysis; and the approach for estimating typical energy consumption. At the meeting and during the period for commenting on the framework document, DOE received many comments that helped it identify and resolve issues involved in this rulemaking.

DOE then gathered additional information and performed preliminary analyses to help develop potential energy conservation standards for clothes dryers and room air conditioners. This process culminated in DOE's announcement of the availability of its preliminary technical support document (preliminary TSD) and another public meeting to discuss and receive comments on the following matters: the product classes DOE planned to analyze; the analytical framework, models, and tools that DOE was using to evaluate standards; the results of the preliminary analyses performed by DOE; and potential standard levels that DOE could consider. 75 FR 7987 (Feb. 23, 2010) (the February 2010 notice). DOE also invited written comments on the preliminary analysis. *Id.* (The preliminary TSD is available at *http://www1.eere.energy.gov/buildings/appliance_standards/residential/preliminary_analysis_tsd.html.*) DOE also stated its interest in receiving views concerning other relevant issues that participants believe would affect energy conservation standards for clothes dryers or room air conditioners. *Id.* at 7990.

The preliminary TSD provided an overview of the activities DOE undertook in developing standards for clothes dryers and room air conditioners, and discussed the comments DOE received in response to the framework document. It also described the analytical framework that DOE uses in this rulemaking, including a description of the methodology, the analytical tools, and the relationships among the various analyses that are part of the rulemaking. The preliminary TSD presented and described in detail each analysis DOE performed, including descriptions of inputs, sources, methodologies, and results. These analyses were as follows:

- A *market and technology assessment* addressed the scope of this rulemaking, identified the potential classes for clothes dryers and room air conditioners, characterized the markets for these products, and reviewed techniques and approaches for improving their efficiency.
- A *screening analysis* reviewed technology options to improve the efficiency of clothes dryers and room air conditioners, and weighed these options against DOE's four prescribed screening criteria.
- An *engineering analysis* estimated the manufacturer selling prices (MSPs) associated with more energy-efficient clothes dryers and room air conditioners.
- An *energy use analysis* estimated the annual energy use of clothes dryers and room air conditioners.
- A *markups analysis* converted estimated MSPs derived from the engineering analysis to consumer prices.
- A *life-cycle cost analysis* calculated, for individual consumers, the discounted savings in operating costs throughout the estimated average life of each product, compared to any increase in installed costs likely to result directly from the imposition of a given standard.
- A *payback period (PBP) analysis* estimated the amount of time it takes individual consumers to recover the higher purchase expense of more energy efficient products through lower operating costs.
- A *shipments analysis* estimated shipments of clothes dryers and room air conditioners over the time period examined in the analysis, and was used in performing the national impact analysis (NIA).
- A *national impact analysis* assessed the national energy savings (NES), and the national net present value of total consumer costs and savings, expected to result from specific, potential energy conservation standards for clothes dryers and room air conditioners. and
- A *preliminary manufacturer impact analysis* (MIA) took the initial steps in evaluating the effects on manufacturers of new amended energy conservation standards.

The public meeting announced in the February 2010 notice took place on March 16, 2010. At this meeting, DOE presented the methodologies and results of the analyses set forth in the preliminary TSD. Major topics discussed at the meeting included test procedure revisions; product classes (including ventless clothes dryers); integrated efficiency levels; the use of alternate refrigerants in room air conditioners; engineering analysis tools; mark-ups; field energy consumption; life-cycle cost inputs; efficiency distribution forecasts; national impact analysis inputs; and trial standard level selection criteria. DOE also discussed plans for conducting the NOPR analyses. The comments received since publication of the February 2010 notice, including those received at the March 2010 public meeting, have contributed to DOE's proposed resolution of the issues in this rulemaking. This direct final rule responds to the issues raised in the comments received.

3. Consensus Agreement for Residential Clothes Dryers and Room Air Conditioners

In response to the preliminary analysis, DOE received the "Agreement on Minimum Federal Efficiency Standards, Smart Appliances, Federal Incentives and Related Matters for Specified Appliances" (the "Joint Petition"), a comment submitted by groups representing manufacturers (the Association of Home Appliance Manufacturers (AHAM), Whirlpool Corporation (Whirlpool), General Electric Company (GE), Electrolux, LG Electronics, Inc. (LG), BSH Home Appliances (BSH), Alliance Laundry Systems (ALS), Viking Range, Sub-Zero Wolf, Friedrich A/C, U-Line, Samsung, Sharp Electronics, Miele, Heat Controller, AGA Marvel, Brown Stove, Haier, Fagor America, Airwell Group, Arcelik, Fisher & Paykel, Scotsman Ice, Indesit, Kuppersbusch, Kelon, and DeLonghi); energy and environmental advocates (American Council for an Energy Efficient Economy (ACEEE), Appliance Standards Awareness Project (ASAP), Natural Resources Defense Council (NRDC), Alliance to Save Energy (ASE), Alliance for Water Efficiency (AWE), Northwest Power and Conservation Council (NPCC), and Northeast Energy Efficiency Partnerships (NEEP)); and consumer groups (Consumer Federation of America (CFA) and the National Consumer Law Center (NCLC)) (collectively, the "Joint Petitioners"). This collective set of comments, which DOE refers to in this notice as the "Joint Petition" 1B [6] or "Consensus Agreement" recommends specific energy conservation standards for residential clothes dryers and room air conditioners that, in the commenters' view, would satisfy the EPCA requirements in 42 U.S.C. 6295(o). DOE has considered the recommended energy conservation standards in today's final rule.

After careful consideration of the joint comment containing a consensus recommendation for amended energy conservation standards for clothes dryers and room air conditioners, the Secretary has determined that this "Consensus Agreement" has been submitted by interested persons who are fairly representative of relevant points of view on this matter. Congress provided some guidance within the statute itself by specifying that representatives of manufacturers of covered products, States, and efficiency advocates are relevant parties to any consensus recommendation. (42 U.S.C. 6295(p)(4)(A)) As delineated above, the Consensus Agreement was signed and submitted by a broad cross-section of the manufacturers who produce the subject products, their trade associations, and environmental, energy-efficiency and consumer advocacy organizations. Although States were not signatories to the Consensus Agreement, they did not express any opposition to it. Moreover, DOE does not read the statute as requiring absolute agreement among all interested parties before the Department may proceed with issuance of a direct final rule. By explicit language of the statute, the Secretary has discretion to determine when a joint recommendation for an energy or water conservation standard has met the requirement for representativeness (*i.e.,* "as determined by the Secretary"). Accordingly, DOE will consider each consensus recommendation on a case-by-case basis to determine whether the submission has been made by interested persons fairly representative of relevant points of view.

Pursuant to 42 U.S.C. 6295(p)(4), the Secretary must also determine whether a jointly-submitted recommendation for an energy or water conservation standard is in accordance with 42 U.S.C. 6295(o) or 42 U.S.C. 6313(a)(6)(B), as applicable. This determination is exactly the type of analysis which DOE conducts whenever it considers potential energy conservation standards pursuant to EPCA. DOE applies the same principles to any consensus recommendations it may receive to satisfy its statutory obligation to ensure that any energy conservation standard that it adopts achieves the maximum improvement in energy efficiency that is technologically feasible and economically justified and will result in significant conservation of energy, Upon review, the Secretary determined that the Consensus Agreement submitted in the instant rulemaking comports with the standard-setting criteria set forth under 42 U.S.C. 6295(o). Accordingly, the consensus agreement levels were included as TSL 4 in today's rule for both clothes dryers and room air conditioners, the details of which are discussed at relevant places throughout this document.

In sum, as the relevant criteria under 42 U.S.C. 6295(p)(4) have been satisfied, the Secretary has determined that it is appropriate to adopt amended energy conservation standards for clothes dryers and room air conditioners through this direct final rule

As required by the same statutory provision, DOE is also simultaneously publishing a NOPR which proposes the identical standard levels contained in this direct final rule with a 110-day public comment period. DOE will consider whether any comment received during this comment period is sufficiently "adverse" as to provide a reasonable basis for withdrawal of the direct final rule and continuation of this rulemaking under the NOPR. Typical of other rulemakings, it is the substance, rather than the quantity, of comments that will ultimately determine whether a direct final rule will be withdrawn. To this end, the substance of any adverse comment(s) received will be weighed against the anticipated benefits of the Consensus Agreement and the likelihood that further consideration of the comment(s) would change the results of the rulemaking. DOE notes that to the extent an adverse comment had been previously raised and addressed in the rulemaking proceeding, such a submission will not typically provide a basis for withdrawal of a direct final rule.

III. General Discussion

A. Test Procedures

As noted above, DOE's test procedures for clothes dryers and room air conditioners appear at 10 CFR part 430, subpart B, appendices D and F, respectively. Moreover, EPCA requires DOE to amend its test procedures for all covered products, including those for clothes dryers and room air conditioners, to include measurement of standby mode and off mode energy consumption, except where current test procedures fully address such energy consumption or such a procedure is technically infeasible. (42 U.S.C. 6295(gg)(2)) Because the clothes dryer and room air conditioner test procedures previously covered such energy use only as to pilot lights in gas dryers (as noted above, the final test procedure rule eliminates the measurement of this energy use given the statutory prohibition), on December 1, 2008 DOE issued a NOPR in which it proposed revisions of these test procedures to fully address standby and off mode energy use and sought comment on those revisions. 73 FR 74639 (Dec. 9, 2008) (TP NOPR). DOE also held a public meeting on December 17, 2008 to receive oral comments.

DOE subsequently issued a supplemental NOPR (SNOPR) in that rulemaking, in which it (1) addressed comments received in response to the TP NOPR; (2) proposed adoption of certain definitions and calculation

[6] DOE Docket No. EERE–2007–BT–STD–0010, Comment 35. DOE considered the Joint Petitioners comments to supersede earlier comments by the listed parties regarding issues subsequently discussed in the Joint Petition.

methods for standby and off mode energy use; and (3) proposed several amendments to the clothes dryer and room air conditioner test procedures concerning the active modes of these products. 75 FR 37594 (June 29, 2010) (TP SNOPR). For air conditioners, these proposed amendments would update references to industry test standards. *Id.* at 37598. For clothes dryers, DOE proposed to amend its test procedures for the active mode by adopting methods that would allow the testing of ventless products and would more accurately account for automatic cycle termination. *Id.* at 35798, 35799. DOE also proposed amendments to reflect the current usage and capabilities of products (for example, clothes dryer use cycles per year, remaining moisture content (RMC) of clothes dryer loads, and load sizes), and to update test cloth preconditioning provisions, eliminate reference to an obsolete industry test standard, and clarify the required gas supply pressure for testing gas clothes dryers. *Id.* DOE sought and received written comments on the TP SNOPR and also held a public meeting on July 14, 2010 to receive oral comments.

On January 6, 2011, DOE published in the **Federal Register** a final rule for the test procedure rulemaking (76 FR 972) (TP Final Rule), in which it (1) adopted the provisions for the measurement of standby mode and off mode power use for both products proposed in the TP NOPR, as modified by the TP SNOPR, but required that products be installed and set up for standby and off mode testing in accordance with manufacturers' instructions (and if no instructions are given, then the appliance shall be tested at the factory or "default" settings); and (2) adopted several amendments to the clothes dryer and room air conditioner test procedures concerning the active mode for these products, as proposed in and informed by public comment on the TP SNOPR. 76 FR 972 (January 6, 2011). Specifically for room air conditioners, the amendments adopted in the TP Final Rule updated the references to industry test standards. Specifically for clothes dryers, DOE adopted the amendments to include provisions for the testing of ventless products proposed in the TP SNOPR, along with additional clarifications regarding the testing conditions for ventless clothes dryers. 76 FR 976–7. The amendments also include the following changes to reflect the current usage and capabilities of products: (1) Changing the annual clothes dryer use cycles from 416 to 283 cycle per year, (2) changing the initial RMC of clothes dryer loads from 70 percent ± 3.5 percent to 57.5 percent ±3.5 percent, and (3) changing the clothes dryer test load size from 7.00 pounds (lbs) ± .07 lbs to 8.45 ± .085 lbs for standard-size clothes dryers. 76 FR 977. The TP Final Rule also amends the DOE clothes dryer test procedure by updating test cloth preconditioning provisions; revising the water temperature for test load preparation from 100 degrees Fahrenheit (°F) ± 5 °F to 60 °F ± 5 °F; updating references to industry test standards; eliminating reference to an obsolete industry test standard; clarifying the required gas supply conditions for testing gas clothes dryers; clarifying the provisions for measuring the drum capacity; clarifying the definition of "automatic termination control" for clothes dryers; and adding the calculations of EF and CEF to 10 CFR part 430, subpart B, appendix D1. 76 FR 978.

DOE did not adopt the amendments to more accurately measure automatic cycle termination proposed in the TP SNOPR. As discussed in the TP Final Rule, DOE conducted testing of representative clothes dryers using the automatic cycle termination test procedure proposed in the TP SNOPR. The results showed that all of the clothes dryers tested significantly over-dried the DOE test load to near bone dry and, as a result, the measured EF values were significantly lower than EF values obtained using the existing DOE test procedure. The test data also indicated that dryers equipped with automatic termination controls were less efficient than timer dryers. 76 FR 977.

As noted in the TP Final Rule, DOE believes the test procedure amendments for automatic cycle termination proposed in the TP SNOPR do not adequately measure the energy consumption of clothes dryers equipped with such systems using the test load specified in the DOE test procedure. DOE believes that clothes dryers with automatic termination sensing control systems, which infer the RMC of the load from the properties of the exhaust air such as temperature and humidity, may be designed to stop the cycle when the consumer load has a higher RMC than the RMC obtained using the proposed automatic cycle termination test procedure in conjunction with the existing test load.[7] Manufacturers have indicated, however, that test load types and test cloth materials different than those specified in the DOE test procedure do not produce results as repeatable as those obtained using the test load as currenty specified. *Id.*

In addition, DOE presented data in the test procedure final rule published on May 19, 1981 from a field use survey conducted by AHAM as well as an analysis of field test data on automatic termination control dryers conducted by the National Bureau of Standards (now known as the National Institute of Standards and Technology (NIST)). Analysis of this data showed that clothes dryers equipped with an automatic cycle termination feature consume less energy than timer dryers by reducing over-drying. 46 FR 27324 (May 19, 1981).

For these reasons, DOE stated in the TP Final Rule that the test procedure amendments for automatic cycle termination proposed in the TP SNOPR do not adequately measure the energy consumption of clothes dryers equipped with such systems. As a result, DOE did not adopt the amendments for automatic cycle termination proposed in the TP SNOPR. 76 FR 972, 977 (January 6, 2011).

The following sections discuss the comments received in response to the preliminary analyses regarding the test procedures for clothes dryers and room air conditioners.

1. Clothes Dryer Test Procedure

ACEEE and Earthjustice (EJ) both commented that the DOE test procedure inadequately represents field energy use, seriously hindering efforts to develop effective regulations and sound public policy, and produces misleading information for consumers and other interested parties. (ACEEE, No. 24 at p. 2; EJ, No. 28 at p. 1)[8] ACEEE provided suggested test procedure changes, which are outlined in its comments and discussed in the sections below. ACEEE stated these suggested test procedure changes would improve the understanding of the overall contribution of clothes dryers to national energy consumption, the

[7] To investigate this, DOE conducted additional testing using a test load similar to that specified in AHAM Standard HLD–1–2009, which consists of cotton bed sheets, towels, and pillow cases. For tests using the same automatic cycle termination settings as were used in the testing described earlier (that is, normal cycle setting and highest temperature setting), the alternate test load was dried to 1.7 to 2.2 percent final RMC, with an average RMC of 2.0 percent. In comparison, the same clothes dryer under the same cycle settings dried the DOE test load to 0.3 to 1.2 percent RMC, with an average RMC of 0.7 percent. Thus, DOE concluded that the proposed automatic cycle termination control test procedures may not stop at an appropriate RMC when used with the current test load.

[8] A notation in the form "ACEEE, No. 24 at p. 2" identifies a written comment (1) made by the American Council for an Energy Efficient Economy (ACEEE), (2) recorded in document number 24 that is filed in the docket of this rulemaking, and (3) which appears on page 2 of document number 24.

relative performance of products currently on the market, and opportunities to improve clothes dryer energy performance (including the potential of the design options defined in DOE's analysis). ACEEE stated that its suggested test procedure changes would provide DOE better data for determining the appropriate level for standards that yield the maximum cost-effective energy savings for consumers. (ACEEE, No. 24 at p. 2) Earthjustice commented that DOE should correct errors in the existing test procedure that, according to Earthjustice, misstate the actual clothes dryer energy consumption, as identified in the report by ECOS Consulting (ECOS) (prepared for the NRDC),[9] and recalculate the estimates of clothes dryer energy use. (EJ, No. 28 at p. 1) As discussed above, DOE recently published the TP Final Rule amending its clothes dryer test procedure to address many of the test procedure issues identified by ACEEE and Earthjustice. DOE addresses each of these issues individually in the sections below.

a. Standby Mode and Off Mode

Referenced Standards

EPCA directs DOE to amend its test procedures to include measures of standby mode and off mode energy consumption. EPCA further directs DOE to amend the test procedures to integrate such energy consumption into a single energy descriptor for that product. If that is technically infeasible, DOE must prescribe a separate standby mode and off mode energy-use test procedure, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)) Any such amendment must consider the most current versions of the International Electrotechnical Commission (IEC) Standard 62301 ["Household electrical appliances—Measurement of standby power," First Edition 2005–06] and IEC Standard 62087 ["Methods of measurement for the power consumption of audio, video, and related equipment," Second Edition 2008–09].[10] *Id.*

AHAM supported DOE's evaluation of the most current draft version of IEC Standard 62301 Second Edition, which at the time of the preliminary analysis for the standards rulemaking was designated as the Committee Draft for Vote (IEC Standard 62301 CDV), for potential revisions to address standby mode and off mode power in DOE's clothes dryer test procedure. AHAM commented that DOE would thus harmonize with international standards, including those used in Canada and Europe. (AHAM, Public Meeting Transcript, No. 21.4 at p. 30).[11]

In the TP NOPR, DOE discussed that IEC Standard 62301 Second Edition was expected at that time to be published in July 2009. For this reason, DOE stated in the TP NOPR that IEC Standard 62301 First Edition would be the "current version" at the time of publication of the final rule, so consideration thereof would comply with EPCA. DOE incorporated sections from IEC Standard 62301 First Edition in the proposed amendments to the clothes dryer test procedure in the TP NOPR. 73 FR 74639, 74644 (Dec. 9, 2008). DOE did not receive any comments in response to the TP NOPR objecting to the proposed testing methods and procedures referenced in IEC Standard 62301 First Edition. Therefore, the TP SNOPR did not affect DOE's proposal in the TP NOPR to incorporate by reference clauses from IEC Standard 62301 First Edition. 75 FR 37594, 37602 (June 29, 2010). In the TP Final Rule, DOE noted that the most recent draft of IEC Standard 62301 Second Edition, designated as the Final Draft International Standard (IEC Standard 62301 FDIS) had yet to be made available on IEC's public Web site and that IEC Standard 62301 Second Edition is now projected to be issued in April 2011. For the reasons stated in the TP Final Rule, DOE amended its test procedures for clothes dryers in the final rule to incorporate by reference the clauses from IEC Standard 62301 First Edition proposed in the TP SNOPR. DOE also adopted the definitions of "active mode," "standby mode," and "off mode" based on the language presented in IEC Standard 62301 CDV. 76 FR 972, 976–977 (January 6, 2011). DOE may consider incorporating by reference clauses from IEC Standard 62301 Second Edition when that version has been published.

Testing Procedures

As discussed in the *Referenced Standards* section, EPCA directs DOE to amend the test procedures to integrate such energy consumption into a single energy descriptor for that product. If that is technically infeasible, DOE must prescribe a separate standby mode and off mode energy-use test procedure, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)) In the TP NOPR, DOE determined that it is technically feasible to incorporate measures of standby mode and off mode energy use into the overall energy use metric. 73 FR 74639, 74650 (Dec. 9, 2008). In the TP NOPR, DOE proposed to adopt the 140 hours associated with drying as the active mode hours and to associate the remaining 8,620 hours of the year with standby mode and off mode. 73 FR 74639, 74647 (Dec. 9, 2008). In the TP NOPR, DOE also proposed definitions and testing methods for multiple standby modes, including "inactive mode," "delay start mode," and "cycle finished mode."[12] 73 FR 74639, 74647–48 (Dec. 9, 2008). DOE proposed to calculate clothes dryer energy use per cycle associated with standby mode and off mode by (1) calculating the product of wattage and allocated hours for all possible standby modes and off modes; (2) summing the results; (3) dividing the sum by 1,000 to convert from watt-hours (Wh) to kWh; and (4) dividing by the number of cycles per year. 73 FR 74639, 74648 (Dec. 9, 2008). In the TP NOPR, DOE reported that the comparison of annual energy use of different clothes dryer modes showed that delay start and cycle finished modes represent a negligible percentage of total annual energy consumption. The comparison also showed that the power levels in these modes are similar to those for inactive mode and off mode. For these two reasons, DOE presented an alternate approach that would be limited to specifying the hours for only inactive mode and off mode when calculating energy use associated with standby mode and off mode. Under this alternate approach, all of the non-active mode hours (8,620) would be allocated to inactive mode and off mode. 73 FR 74639, 74648 (Dec. 9, 2008).

[9] NRDC, No. 30 at pp. 1–40.

[10] DOE considered IEC Standard 62087 and determined that this standard addresses the methods of measuring the power consumption of audio, video, and related equipment and is therefore inapplicable to the products covered in this rulemaking.

[11] A notation in the form "AHAM, Public Meeting Transcript, No. 21.4 at p. 30" identifies an oral comment that DOE received during the March 16, 2010 public meeting and which was recorded in the public meeting transcript in the docket for this rulemaking (Docket No. EE–2007–BT–STD–0010), maintained in the Resource Room of the Building Technologies Program. This particular notation refers to a comment (1) made by the Association of Home Appliance Manufacturers (AHAM) during the public meeting, (2) recorded in document number 21.4, which is the public meeting transcript that is filed in the docket of this rulemaking, and (3) which appears on page 30 of document number 21.4.

[12] "Inactive mode" is defined as "a standby mode other than delay start mode or cycle finished mode that facilitates the activation of active mode by remote switch (including remote control), internal sensor, or provides continuous status display." "Delay start mode" is defined as "a standby mode that facilitates the activation of active mode by timer." "Cycle finished mode" is defined as "a standby mode that provides continuous status display following operation in active mode."

In the TP NOPR, DOE proposed to establish the CEF[13] for clothes dryer to integrate energy use in the standby mode and off mode with the energy use of the main functions of the product. The CEF would be defined as 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 kWh. 73 FR 74639, 74650 (December 9, 2008).

As discussed in chapter 5 of the preliminary TSD, for the preliminary analyses, DOE analyzed the cost-efficiency relationship for CEF using the alternative approach for this metric in the TP NOPR. That approach allocates all of the non-active mode hours into inactive mode and off mode energy use, and then integrates inactive mode and off mode energy use with active mode energy use.

BSH commented that, in the formula to calculate the CEF in the clothes dryer test procedure, "8620" inactive/off mode hours should be replaced by (8720—per cycle duration (hours) × 416 clothes dryer annual cycles), where 8720 = 365 days × 24 hours per day. According to BSH, the standby mode is not valid during the active mode and, therefore, the duration of the active mode should be subtracted from the hours per year when calculating the standby energy consumption. (BSH, No. 23 at p. 5) DOE notes that the estimate for active mode hours presented in the TP NOPR was fixed based on the number of such hours specified in the existing test procedure (140 hours). 73 FR 74646–7 (Dec. 9, 2008). DOE acknowledges that its estimate of the number of cycles per year has decreased. As discussed in the TP Final Rule, DOE notes that changes to the initial RMC, test load size, and specified water temperature for test load preparation may also affect cycle time and the number of active mode hours per year. DOE is not aware, however, of any data indicating that the number of active mode hours has changed and, if so, what a more accurate number might be. Therefore, DOE did not adopt amendments to the number of active mode hours in the TP Final Rule. 76 FR 972, 988 (January 6, 2011). For these reasons, DOE believes that using the 140 annual active mode hours, as specified in the existing test procedure, to determine the number of annual inactive mode and off mode hour of 8,620, as adopted in the TP Final Rule (76 FR 990), provides a more representative estimate of consumer use than the method suggested by BSH.

[13] DOE proposed to use the term "Integrated Energy Factor" (IEF) in the TP NOPR. 73 FR 74639, 74650 (Dec. 9, 2008). However, in the TP SNOPR, DOE proposed to revise the name of the metric to "Combined Energy Factor" (CEF) to avoid confusion with an existing industry standard. 75 FR 37594, 37612 (June 29, 2010). DOE adopted CEF as the measure of clothes dryer energy efficiency in the TP Final Rule. 76 FR 972, 992 (January 6, 2011).

b. Automatic Cycle Termination

In the framework document, DOE stated the clothes dryer test procedure may not adequately measure the benefits of automatic cycle termination, in which a sensor monitors either the exhaust air temperature or moisture in the drum to determine the length of the drying cycle. Currently, the test procedure provides a single field use factor for the enhanced performance of clothes dryers equipped with automatic termination. This single field use factor does not distinguish between the type of sensing control system (for example, temperature-sensing or moisture-sensing controls) and the accuracy of the control system. In chapter 2 of the preliminary TSD, DOE stated that it agrees that the effects of automatic cycle termination should be more accurately measured in its clothes dryer test procedure, and that this effect should properly account for any over- or under-drying. Thus, DOE noted it was considering clothes dryer test procedure amendments to address automatic cycle termination in the active mode test procedure rulemaking. In response, interested parties commented on the following topics relating to automatic cycle termination.

Definition of Automatic Termination Control

The Joint Petitioners commented that DOE should revise section 1.11 of 10 CFR 430 subpart B, appendix D to more clearly account for electronic controls by specifying that a preferred automatic termination control setting can also be indicated by a visual indicator (in addition to the mark or detent). The clarification would read "* * * mark, visual indicator or detent which indicates a preferred * * *" (Joint Petitioners, No. 33 at p. 25) As discussed in the TP Final Rule, DOE agreed that a clarification should be added to the definition of "automatic termination control." The clarification would be that a mark, detent, or other visual indicator which indicates a preferred automatic termination control setting must be present if the dryer is to be classified as having an automatic termination control. DOE so revised the definition in the TP Final Rule. 76 FR 972, 978 (January 6, 2011).

Testing Procedures

AHAM commented in response to the preliminary analyses that it continues to support the use of the automatic termination field use factor as currently specified by the DOE clothes dryer test procedure. AHAM stated that clothes dryers utilize different algorithms to determine when the drying cycle should end, and any evaluation of a different approach will need to be thoroughly investigated and should not be based on DOE test results from four sample units. AHAM proposed that DOE conduct a study that evaluates: (1) The accuracy of the DOE field use factor for today's products; and (2) the repeatability and reproducibility of a procedure where cycle end is determined by a moisture or temperature sensor. (AHAM, No. 25 at p. 13)

Whirlpool commented that its testing showed significant improvement in the performance of sensors and automatic termination cycles when using systems that incorporate sensors that directly measure the moisture level of the clothes. Based on these test results, Whirlpool recommended that an additional automatic termination factor be included that would be equal to 1.01 to provide an appropriate field use factor for clothes dryers that utilize improved moisture sensor systems. (Whirlpool, No. 22 at p. 5)

After the publication of the preliminary analyses, the Joint Petitioners submitted the Joint Petition, in which they commented that DOE should modify the clothes dryer test procedure to address the effectiveness of automatic termination controls (for example, moisture sensor and temperature sensor controls). (Joint Petitioners, No. 33 at p. 25) Pacific Gas & Electric (PG&E), Southern California Gas Company (SCGC), San Diego Gas and Electric Company (SDGE), and Southern California Edison (SCE) jointly (hereafter the "California Utilities"). NRDC, and NEEP commented that the current DOE test procedure does not test the effectiveness of control sensors, which was found to vary significantly. (California Utilities, No. 31 at p. 3; NRDC, No. 26 at pp. 1, 2; NRDC, No. 30 at p. 29; NEEP, No. 27 at p. 3) NRDC, NEEP, and the California Utilities stated that the DOE test procedure is unrealistic and tests only the bulk-drying stage. In addition, by not testing the high-heat stage (which contributes very little to drying clothes) and instead applying a field use factor, the current test methods overestimate the efficiency of the clothes dryer. The current test methods also do not appropriately measure the energy use of clothes dryers that use more effective controls to limit the energy consumption of the high-heat stage. (NRDC, No. 26 at pp. 1, 2; NRDC, No. 30 at p. 29; NEEP, No. 27 at p. 3; California Utilities, No. 31 at p. 3) NRDC added that the ECOS report stated that there is not much variation in efficiency of the bulk drying stage among different clothes dryers. However, there are considerable differences in the energy consumption of the high-heat stage, which is not measured by the DOE test procedure. (NRDC, No. 30 at p. 23) The ECOS report found that the difference between a standard clothes dryer and one that is effective at turning itself off when clothes are actually dry is about 0.76 kWh per load (5,000 kWh over typical lifetime). (NRDC, No. 26 at pp. 1, 2) The California Utilities also added that according to the ECOS report, clothes dryers, even with the same sensors, can use very different control algorithms that result in substantial variations between clothes dryers in the length of, and the amount of energy consumed during, the high-heat stage. (California Utilities, No. 31 at p. 3)

NRDC commented that DOE should change its test procedure to measure at dryness levels less than 5-percent RMC with logging equipment that provides data enabling the lab to calculate when 5-percent RMC is reached and how long the clothes dryer continues to run thereafter. (NRDC, No. 26 at pp. 1, 2; NRDC, No. 30 at pp. 29–30) The California Utilities, ACEEE, and NPCC also commented that the test procedure should let the clothes dryer run until automatic shutoff, allowing the clothes dryer's sensors and termination controls to operate as intended, which would: (1) Be more representative of actual consumer behavior and give a better measure of expected energy use for consumers; (2) avoid the need for a field use factor to account for high-heat stage energy use and instead measure energy use directly; (3) appropriately measure the energy use of clothes dryers with better termination controls and encourage innovation in these controls; and (4) make the test procedure easier because the technician does not need to keep weighing the clothes. (California Utilities, No. 31 at pp. 3–4, 12; ACEEE, No. 24 at pp. 1–2; NPCC, No. 32 at pp. 1–2)

The California Utilities recommended the following amendments to section 3.3, "Test cycle" of the clothes dryer test procedure:

- Set the clothes dryer for its "Normal" or "Cotton" cycle. If this in turn sets a temperature or dryness control, leave those controls at the default setting. If a temperature control must also be set, set it for "High heat" or "Cotton." If a dryness control must also be set, set it for "Normal dry" or midway between "More dry" and "Less dry."
- Allow the clothes dryer to run until its cycle is complete. Promptly remove and weigh the test load. If it contains 5-percent or less RMC, the test cycle is complete.
- If the test load contains more than 5-percent RMC, return the load to the clothes dryer and reset the controls. In this case, the dryness control would then be set for "Maximum dry" and the cycle would be run to completion again and the test load weighed. Repeat if necessary until the RMC is 5 percent or less.
- Total the amount of electricity (and gas if applicable) used during the initial default cycle and any subsequent cycles. (California Utilities, No. 31 at p. 4)

The California Utilities also stated that section 4 of the DOE test procedure would be modified to remove all references to the field use factor. That factor is no longer needed because the test cycle now represents a typical consumer use cycle (including both the bulk-drying and high-heat stages), and would be omitted from all calculations. (California Utilities, No. 31 at p. 4) The California Utilities stated that the clothes dryers tested for the ECOS report using the default settings of the "Normal" or "Cotton" cycles all resulted in RMCs between 0 and 3 percent at the completion of the clothes dryer cycle. Therefore, it may be reasonable to assume that the additional cycles will rarely be used. The California Utilities stated that the additional cycles are included in their proposal to prevent a manufacturer from creating a default cycle that saves energy by not actually getting the clothes adequately dry. The California Utilities also stated that their proposed procedure represents the most likely consumer response to clothes that did not get dry the first time. (California Utilities, No. 31 at p. 4)

The California Utilities also commented that, under their recommended test procedure changes for automatic cycle termination, there is a noticeable difference in energy consumption between the best and worst clothes dryers. For clothes dryers that respond effectively when the clothes have reached 5-percent RMC by discontinuing the application of heat and allowing the residual heat in the clothes to evaporate the remaining moisture, the energy measured under the new test cycle will be very similar to the energy measured under the current DOE test procedure, as the shutoff point will occur near 5-percent RMC under either test. The California Utilities stated that its proposed test procedure would more accurately measure the real contribution of automatic termination controls and mimic consumer behavior. As a result there would be no need to use a field use factor for clothes dryers with automatic termination controls. (California Utilities, No. 31 at p. 4)

BSH commented that DOE should test clothes dryers using the automatically controlled programs including the cool-down phase. According to BSH, timer dryers waste energy because consumers will set a longer drying time than required to ensure the desired drying results, resulting in over-drying. BSH commented that a change in the test procedure to measure the real final moisture content for automatically controlled dryers will show the differences between competitive clothes dryers. BSH also commented that the cool-down phase is, in automatically controlled dryers, an essential part of the process to use the energy in the most efficient way, and that the heat accumulated in the appliance and the laundry may be used to finish drying the laundry and increase the efficiency of the clothes dryer. (BSH, No. 23 at pp. 4–5)

NRDC commented that the ECOS report states that newer clothes dryers are capable of moisture-sensing drying, but that feature can be (and likely routinely is being) overridden by consumers who continue to operate clothes dryers on a time basis as they always have. NRDC added that the ECOS report states that DOE should require manufacturers to incorporate moisture sensing into the timed cycle to ensure that the heating element shuts off and that airflow is greatly reduced once the clothes are dry. (NRDC, No. 30 at p. 29)

As discussed above in this section, DOE proposed amendments to its clothes dryer test procedure in the TP SNOPR to more accurately account for automatic cycle termination. However, as discussed in the TP Final Rule, DOE conducted testing on a sample of representative clothes dryers according to the amendments to the test procedure for automatic cycle termination proposed in the TP SNOPR. The tests consisted of running the clothes dryer on a "normal" automatic termination setting and stopping the clothes dryer when the heater switches off for the final time (immediately before the cool-down period begins). Three identical tests were conducted for each clothes dryer unit, and the results were averaged. DOE first noted that not all of the clothes dryers offered a "normal" cycle setting. For those clothes dryers, DOE chose the cycle that would most closely match a "normal" cycle. The results of this testing, presented below in Table III.1, showed that the tested clothes dryers had a measured EF of between 12.4 percent and 38.8 percent lower than the EF measured according to the current DOE clothes dryer test procedure. DOE also noted that all of tested units dried the test load to final RMCs well below the target RMC of 5 percent, ranging from 0.4 percent to 1.4 percent RMC, with an average of 0.8 percent. DOE also noted that even if the field use factor for a timer dryer is applied to the measured EF for a clothes dryer equipped with automatic cycle termination, using the current DOE clothes dryer test procedure (to add the fixed estimate of over-drying energy consumption associated with time termination control dryers), this EF would still be less than the EF measured under the automatic cycle termination test procedure amendments proposed in the TP SNOPR. 76 FR 972, 999 (January 6, 2011).

TABLE III.1—DOE CLOTHES DRYER AUTOMATIC CYCLE TERMINATION TESTS

Test unit	Current DOE test procedure EF *lb/kWh*	Current DOE test procedure w/modified field use factor * EF *lb/kWh*	Proposed automatic cycle termination test procedure		
			EF *lb/kWh*	% Change	Final RMC %
Vented Electric Standard:					
Unit 3	3.20	2.82	2.59	−19.1	1.0
Unit 4	3.28	2.89	2.59	−21.2	0.6
Vented Gas:					
Unit 8	2.83	2.50	2.42	−14.5	0.4
Unit 9	2.85	2.51	2.38	−16.3	0.9
Unit 11	2.98	2.63	2.40	−19.5	0.9
Vented Electric Compact 240V:					
Unit 12	3.19	2.81	2.64	−17.3	0.5
Unit 13	2.93	2.59	2.27	−22.7	1.4
Vented Electric Compact 120V:					
Unit 14	3.23	2.85	1.98	−38.8	0.7
Ventless Electric Compact 240V:					
Unit 15	2.37	2.09	2.07	−12.4	1.1

* Field use factor changed from 1.04 for clothes dryers with automatic termination to 1.18 for timer dryers.

In the TP Final Rule, DOE stated that these test results showed significantly higher measured energy use for clothes dryers tested under the DOE test procedure with the proposed automatic cycle termination amendments. DOE evaluated possible reasons for this difference. DOE concluded that given the test load specified in the test procedure,[14] the proposed automatic cycle termination control procedures may not adequately measure clothes dryer performance. As discussed in the previous paragraph, DOE believes that, although automatic termination control dryers may be measured as having a lower efficiency than a comparable dryer with only time termination control if tested according to the proposed test procedure, automatic termination control dryers may in fact be drying the clothing to approximately 5-percent RMC in real world use. DOE believes that automatic termination control dryers reduce energy consumption (by reducing over-drying) compared to timer dryers based on analysis of the AHAM field use survey and analysis of field test data conducted by NIST. 46 FR 27324 (May 19, 1981).

[14] The DOE clothes dryer test load is comprised of 22 in x 34 in pieces of 50/50 cotton/polyester-blend cloth.

For these reasons, DOE stated in the TP Final Rule that it believes that the test procedure amendments for automatic cycle termination proposed in the TP SNOPR do not adequately measure the energy consumption of clothes dryers equipped with such systems. As a result, DOE did not adopt the amendments for automatic cycle termination proposed in the TP SNOPR. 76 FR 972, 1000 (January 6, 2011). DOE noted that if data is made available to develop a test procedure that accurately measures the energy consumption of clothes dryers equipped with automatic termination controls, DOE may consider revised amendments in a future rulemaking.

With regard to NRDC's comment that DOE should require manufacturers to incorporate moisture sensing into the timed cycle, DOE notes that EPCA defines an energy conservation standard as either a performance standard or, for certain products including clothes dryers, a design requirement. (42 U.S.C. 6291(6)) EPCA also specifies that DOE may set more than one energy conservation standard for products that serve more than one major function by setting one energy conservation standard for each major function. (42 U.S.C. 6295(o)(5)) DOE notes the energy conservation standards for clothes dryers set forth in this final rule are based on drying performance and that an additional precriptive standard to require manufacturers to incorporate moisture sensing into the timed dry cycle would address the same major function of the drying performance. For these reasons, DOE is not adopting an additional prescriptive requirement for clothes dryers.

DOE believes that the alternate test procedure for automatic cycle termination recommended by the California Utilities is similar to the test cycle proposed by DOE in the TP SNOPR. DOE notes that the California Utilities' recommendations would clarify the settings to be used in cases where a "Normal" cycle or "High heat" temperature setting was not clearly specified. DOE does not believe that this added clarification would resolve the issues with the proposed automatic cycle termination test procedure identified in this section because the setting used during DOE testing would be the same under the California Utilities' recommendation. In addition, DOE notes that the California Utilties' recommendation to specify the "Normal dry" setting is generally the default setting under the "Normal" cycle. DOE also notes that the "Normal dry" setting was used during its testing, and as a result this clarification would not resolve the issues associated with the automatic cycle termination test procedure identified above. Finally, DOE notes the California Utilities' recommendation that if the test load contains more than 5-percent RMC, the test load would be placed back in the clothes dryer and the cycle would be run again using the "Maximum dry" setting is similar to the proposed amendments in the TP SNOPR. However, the proposed amendments in the TP SNOPR would require the test be re-run from the start using the specified initial RMC and the "Maximum dry" setting. The California Utilities' recommendations would require that the test load with the RMC at the end of the first test cycle be re-run on a cycle with the "Maximum dry" setting and the energy would then be accumulated. DOE believes that this recommendation would not resolve the issue of the significant over-drying observed during testing because it addresses cases only in which the test load under-dries. For these reasons, DOE is not adopting the alternate test procedure for automatic cycle termination recommended by the California Utilities. If DOE considers adopting test procedure amendments for automatic cycle termination in a future rulemaking, it may consider these recommendations.

Cycle Settings

NRDC commented that the testing described in the ECOS report showed that automatic termination cycles using lower heat settings or lower dryness level reduce energy consumption and increase efficiency because less energy is spent heating air, cloth, and metal. NRDC commented that the ECOS report summarized testing results for one clothes dryer that showed that the difference in energy consumption between the highest and lowest heat settings was 13 percent and that the drying time increased (from 35 to 49 minutes), but very similar final RMCs were achieved. (NRDC, No. 30 at p. 22) NRDC commented that the ECOS report found that a "normal dry" setting removed practically all of the water (producing a final RMC of less than 1 percent), making the "more dry" setting appear to be unnecessary. The ECOS report stated that the "normal dry" used about 12 percent less energy than the "more dry" setting, and the "less dry" setting saved another 18 percent, but did leave residual moisture in the clothes. NRDC commented that the ECOS report added that in all but the highest humidity climates, the "less dry" setting may be fully adequate and would give considerable energy savings. *Id.* NRDC commented that DOE should measure the efficiency of different clothes dryer settings, in particular the "more dry" setting, which the ECOS report stated may not be warranted because the "normal dry" settings remove effectively all of the moisture. (NRDC, No. 26 at pp. 1, 3)

As discussed in the previous section, DOE did not adopt amendments to more accurately account for automatic cycle termination in the TP Final Rule. Therefore DOE did not consider amendments to the clothes dryer test procedure to measure the efficiency of different clothes dryer automatic cycle termination temperature and dryness level settings.

Effect of Automatic Cycle Termination Test Procedure on Measured Energy Factor

The California Utilities stated that under their proposed test procedure, the 4 percent field use factor would not be necessary; therefore removing it would reduce apparent (reported) energy use by 4 percent. Instead of EFs from 3.01 to 3.4, these clothes dryers would be rated at EF from 3.13 to 3.54. According to the California Utilities, these higher ratings are appropriate because these clothes dryers stop quickly and save the consumer energy under real world operating conditions. (California Utilities, No. 31 at pp. 4–5) NRDC commented that the ECOS report summarized testing results that showed that some electronically controlled dryers could detect the clothes were already dry and shut down after 5 to 15 minutes, while electromechanically controlled dryers needed up to 50 minutes before shutting down. (NRDC, No. 30 at pp. 29–30) The California Utilities also noted that one clothes dryer tested in the ECOS report ran for an additional 30 minutes after reaching 5 percent RMC because of an inefficient control algorithm and would test with an EF of about 2.51 under their proposed test procedure. According to the California Utilities, this lower rating would be appropriate, because in real practice this dryer would significantly increase clothes dryer energy use. (California Utilities, No. 31 at p. 5) The California Utilities commented that a real savings opportunity exists simply through an improved test procedure (as they proposed), which will better characterize the real-world energy performance of dryers. The California Utilities added that dryers that meet the baseline EF under the current test procedure but have poor automatic termination controls will not meet the same EF under a revised test. Thus, those dryers will have to improve to meet the baseline EF of 3.01. The California Utilities added that, if tested using their proposed test procedure, the least efficient clothes dryers in the sample of clothes dryers in the ECOS report will need to increase their efficiency by 20 percent or more to meet the current energy conservation standard. (California Utilities, No. 31 at p. 5)

As discussed in the Test Procedures section, DOE did not adopt the amendments to the clothes dryer test procedure to better account for automatic cycle termination that were proposed in the TP SNOPR. As a result, DOE is not considering any revisions to the energy conservation standards based on the proposed amendments for automatic cycle termination in the TP SNOPR. If DOE considers potential amendments for automatic cycle termination in a future rulemaking, it would also consider any necessary revisions to the energy conservation standards. In addition, as discussed above, DOE noted that the alternate test procedure for automatic cycle termination recommended by the California Utilities is similar to the test cycle proposed by DOE in the TP SNOPR. As a result, DOE does not believe the measured EF would be different between the proposed amendments in the TP SNOPR and the California Utilities' recommendations except for cases in which the test load is not dried to below 5-percent RMC. In this case the California Utilities' recommendations would require that the measured energy consumption from any additional test cycles using the "Maximum dry" setting be added to the energy consumption from the first test cycle, whereas the measured efficiency under the proposed amendments in the TP SNOPR would be based on only the re-run test cycle using the "Maximum dry" setting. However, for the reasons discussed above, DOE believes that the California Utilities' recommendations would not resolve the issue of the significant over-drying observed during DOE testing. As a result, DOE is not adopting the alternate test procedure for automatic cycle termination recommended by the California Utilities and therefore is not considering any revisions to the energy conservation standards based on these recommendations.

c. Ventless Clothes Dryers

For the reasons discussed in section IV.A.3.a of this direct final rule, DOE defines two new product classes in this rulemaking for ventless clothes dryers. The clothes dryer test procedure at 10 CFR part 430, subpart B, appendix D is unable to test ventless clothes dryers, which include condensing clothes dryers as well as combination washer/dryers. Ventless clothes dryers do not vent exhaust air to the outside as a conventional, vented dryer does. Instead, they typically use ambient air in a heat exchanger to cool the hot, humid air inside the appliance, thereby condensing out the moisture. Alternatively, cold water can be used in the heat exchanger to condense the moisture from the air in the drum. In either case, the dry air exiting the drum is reheated and recirculated in a closed loop. Thus, rather than venting moisture-laden exhaust air outside, ventless clothes dryers produce a wastewater stream that can be either collected in an included water container or discharged down the household drain. The process of condensing out the moisture in the recirculated air results in higher energy consumption than a conventional dryer, and it can significantly increase the ambient room temperature.

To address the potential limitation of the clothes dryer test procedure for ventless dryers, DOE proposed an alternate test procedure for ventless dryers in the TP SNOPR and adopted this procedure in the TP Final Rule. [75 FR 37594, 37620 (June 29, 2010); 76 FR 972, 976–977 (January 6, 2011)] The alternate test procedure consists of adding separate definitions for a "conventional clothes dryer" (vented) and a "ventless clothes dryer." Further, the alternate test procedure qualifies the requirement for an exhaust simulator so that it would only apply to conventional clothes dryers. DOE also adopted provisions to clarify the testing procedures for ventless clothes dryers, including requirements for clothes dryers equipped with a condensation box, requirements for the condenser heat exchanger, and specifications for ventless clothes dryer preconditioning. DOE also adopted clarifications in the TP Final Rule to provide explicit instructions as to the procedure for re-running the test cycle when the condensation box is full. DOE also revised the requirement for ventless clothes dryer preconditioning to remove the maximum time limit for achieving a steady-state temperature. DOE also included additional editorial clarifications to the testing procedures for ventless clothes dryers. 76 FR 972, 976–977 (January 6, 2011).

In chapter 2 of the preliminary TSD, prior to adoption of the TP Final Rule, DOE stated that it was considering amendments to its clothes dryer test procedure to allow for the measurement of the energy efficiency of ventless clothes dryers in its active mode test procedure rulemaking.

The Joint Petitioners commented that DOE should create a ventless clothes dryer (including ventless combination washer/dryer) test procedure to inform a baseline energy consumption level for this new product category. (Joint Petitioners, No. 33 at p. 25)

AHAM suggested that DOE incorporate language from the alternate test procedure presented in the LG's Petition for Waiver and Denial of the Application for Interim Waiver (71 FR 49437, 49439 (Aug. 23, 2006)), with the additional changes that the term "condensing clothes dryer" be changed to "ventless clothes dryer" and "HLD–1" be changed to "AHAM HLD–1." AHAM stated that DOE should validate the proposed test procedure approach and the resultant energy consumption values through a viable statistical method. AHAM stated that it is not in a position to provide data on ventless products due to the small number of products in the proposed "compact ventless" product class. According to AHAM, ventless clothes dryers, when tested using the dryer-centric approach presented by DOE in the LG Petition for Waiver, will appear to have higher energy consumption (kWh per year) than conventional vented clothes dryers. (AHAM, No. 25 at p. 4)

Whirlpool commented that its proposal, which provides amendments to the DOE test procedure to include methods for testing of ventless clothes dryers, improves upon the DOE proposal for the ventless clothes dryer test procedure because it takes into account technical differences between vented and ventless clothes dryers.[15] (Whirlpool, No. 13 at pp. 1–22) Whirlpool indicated that their proposal was a draft only and they would be willing to work with DOE to make revisions or enhancements to this proposal. (Whirlpool, No. 22 at p. 1)

In the TP Final Rule, DOE adopted testing methods for the testing of ventless clothes dryers based on the alternate test procedure proposed in the TP SNOPR; the amendments suggested by Whirlpool; and additional language from the internationally accepted test standards Australia/New Zealand (AS/NZS) Standard 2442, "Performance of household electrical appliances—Rotary clothes dryers" and European Standard EN 61121, "Tumble dryers for household use—Methods for measuring the performance," Edition 3 2005 (EN Standard 61121). 76 FR 972, 976 (January 6, 2011). Also noted in the TP Final Rule, DOE used the term "ventless" instead of "condensing," as suggested by AHAM, to reflect the actual consumer utility (that is, no external vent required) because it is possible that vented dryers that also condense may become available on the market. *Id.* DOE also conducted testing for the TP Final Rule to evaluate the repeatability of the amended test procedure for ventless dryers. As detailed in the TP Final Rule, ventless electric compact 240V dryers and ventless electric combination washer/dryers showed less than 1 percent variation and less than 3.5 percent variation in EF from test to test, respectively. DOE stated in the TP Final Rule that it believes that the amendments for ventless clothes dryers produce repeatable measurements of EF. 76 FR 972, 1009 (January 6, 2011). DOE also notes that the measured EF values for ventless electric compact (240V) dryers and ventless electric combination washer/dryers tested according to the DOE test procedure at appendix D, using only the amendments for ventless clothes dryers (2.37 and 2.02, respectively), are in close agreement with the baseline values proposed in the preliminary analyses shown below in Table IV.15 and Table IV.16. Therefore, DOE did not revise the baseline EF levels for the ventless clothes dryer product classes.

In response to AHAM's comment that "HLD–1" should be changed to "AHAM HLD–1," DOE has adopted this editorial change in the TP Final Rule. 76 FR 972, 1032 (January 6, 2011).

BSH commented that DOE should consider the condensation rate for ventless clothes dryers. BSH added that the condensation rate efficiency is an important indicator to measure. (BSH, No. 23 at p. 4) DOE notes that EN Standard 61121 provides for a measurement of the condensation rate efficiency. However, this measurement is not used in the calculation of energy use, which considers only the energy required to dry the load to a specified final RMC. However, DOE also notes that the ability of a ventless clothes dryer to condense moisture directly affects the energy use per-cycle. For example, if a ventless clothes dryer has a lower condensation efficiency, the air recirculated into the drum would contain more moisture and thus would be able to remove less moisture from the test load. As a result, the energy use of such a ventless clothes dryer would be greater than a ventless clothes dryer with a higher condensation efficiency because it would need to run for a

[15] Whirlpool's proposed amendments for ventless clothes dryers included: (1) Definitions of "conventional" and "condensing" clothes dryers; (2) installation conditions; (3) requirements for clothes dryer preconditioning; (4) requirements for condensation boxes and condenser units; and (5) requirements for test cycle measurements.

longer time to condense the same amount of moisture from the test load. Therefore, DOE believes that the condensation efficiency of a ventless clothes dryer is sufficiently accounted for in the measurement of the per-cycle energy consumption. For these reasons, DOE is not providing for a measurement of condensation efficiency of a clothes dryer.

NRDC questioned whether ventless electric combination washer/dryers are going to be tested in drying mode only or as a unit with washing and drying capability. NRDC stated that, according to the ECOS report, there is a potential for energy savings if manufacturers are allowed to test units together that work together, because it is more efficient to manually remove the water than to dry it. NRDC supported the ECOS report suggestion that DOE consider a testing and labeling program based on the total energy use, cost, and CO_2 emissions for washing and drying a standard load of clothes. According to the ECOS report submitted by NRDC, highly efficient clothes washers greatly decrease the amount of work that a clothes dryer needs to do, but that a clothes dryer is less efficient when drying loads with lower initial RMCs. (NRDC, Public Meeting Transcript, No. 21.4 at p. 22; NRDC, No. 30 at pp. 31–32) Whirlpool commented that the development of a test procedure for ventless electric combination washer/dryers is not worth the time and resources necessary to develop it and suggested that DOE not proceed with such an effort. (Whirlpool, No. 22 at p. 1) DOE is not aware of repeatable and representative test methodologies to accurately measure the efficiency of a combined wash-dry cycle. DOE notes that the clothes washer test procedure requires the measurement of multiple load sizes (minimum, maximum, and average values) as well as multiple cycle settings and water temperatures, but the clothes dryer test procedure requires only a single test load size with a single timed dry cycle with the highest temperature setting. DOE is not aware of how the test load sizes and cycle settings would be aligned to produce accurate and representative test results. DOE also notes that the maximum load size for the washing portion of the cycle (sized according to the capacity of the drum), may be larger than the load size recommended by manufacturers for the drying portion of the cycle, and thus it is not clear what size test load should be specified for a combined cycle. For these reasons, DOE is not adopting a test procedure to measure a full combined wash-dry cycle. DOE also notes that the efficiency of the washer portion of a combination washer/dryer is covered under the minimum energy conservation standards for clothes washers, and that the TP Final Rule amended the clothes dryer test procedure to include methods for measuring the energy use of the drying portion of a combination washer/dryer.

d. Consumer Usage Habits

Annual Cycles

DOE published a final rule on August 27, 1997, amending the DOE clothes washer test procedure to lower the annual clothes washer use cycle value from 416 to 392 cycles per year, a value DOE determined to be more representative of current usage patterns. 62 FR 45484. Further, the revised DOE clothes washer test procedure assumes that 84 percent of all clothes washer loads are dried in clothes dryers. Thus, the annual usage pattern for clothes dryers would be 329 cycles per year. In addition, in the recently proposed amendments to the clothes washer test procedure, DOE proposed to amend the number of cycles per year to 295. 75 FR 57556, 57564 (Sept. 21, 2010). In contrast, the current DOE residential clothes dryer test procedure in appendix D assumes an average annual clothes dryer use of 416 cycles per year. (10 CFR 430.23(d)(1))

DOE stated in chapter 2 of the preliminary TSD that it was reviewing available data on the number of annual clothes dryer cycles, and would consider amendments to its test procedure to accurately reflect the number of annual clothes dryer cycles for the clothes dryer tests.

The Joint Petitioners and ACEEE commented that DOE should update the number of clothes dryer cycles per year based on the best available data (ideally based on a nationally representative sample). (Joint Petitioners, No. 33 at p. 25; ACEEE, No. 24 at p. 1) The California Utilities supported reducing the clothes dryer cycles per year from 416 to 329 to reflect new Energy Information Administration (EIA)'s "Residential Energy Consumption Survey" (RECS) survey data on household use. (California Utilities, No. 31 at pp. 2–3, 12) According to AHAM, a recent Proctor & Gamble (P&G) consumer survey showed that the average consumer dries 5.35 loads per week, or 278 load per year, which is essentially identical to the value estimated by RECS (279 cycles per year), providing good verification for the RECS approach. AHAM commented that DOE should ensure that any value used in the economic portion of the rulemaking analysis (that is, cycles per year) be used in the engineering analysis, and that the test procedure be modified to reflect this value. (AHAM, No. 25 at p. 9)

As discussed in the TP Final Rule, DOE amended its clothes dryer test procedure to change the number of clothes dryer cycles per year from 416 to 283 based on data from the 2005 RECS. 76 FR 972, 977 (January 6, 2011). DOE notes that this value is in close agreement with the estimates provided in the P&G data (278 cycles per year). DOE also noted in the TP SNOPR that data from the 2004 California Statewide Residential Appliance Saturation Study (RASS), which surveyed appliance product usage patterns, including clothes dryers, indicated an average of 4.69 loads per week, or approximately 244 loads per year, which is in agreement with the downward trend of the number of clothes dryer cycles per year. Because the 2004 California Statewide RASS provides only a limited dataset, however, DOE stated in the TP SNOPR that it did not intend to rely only on this data to determine an appropriate number of annual use cycles for the clothes dryer test procedure. 75 FR 37594, 37625 (June 29, 2010). DOE believes that these data sources provide sufficient justification for the revised value of 283 cycles per year using the RECS-based approach.

Cycle Time

Edison Electric Institute (EEI) commented that DOE's assumption of 8,620 standby hours leaves 140 active mode hours which would correspond to 20 minutes per drying cycle (if the assumption is that there are 416 dryer cycles per year). EEI questioned whether this was accurate and stated that DOE should review those numbers. (EEI, Public Meeting Transcript, No. 21.4, at p. 49) DOE notes that the TP Final Rule amends the DOE clothes dryer test procedure to lower the initial RMC of the clothes load from 70 percent to 57.5 percent which will result in a decreased cycle time. DOE also notes that the amendments in the TP Final Rule to increase the test load size for standard size dryers from 7 lb. to 8.45 lb. as well as changing the water temperature for test load preparation from 100 °F to 60 °F will result in an increased cycle time. 76 FR 972, 988 (January 6, 2011). The TP Final Rule also amended the clothes dryer test procedure to change the number of cycles per year from 416 to 283. 76 FR 977. Based on the amendment to the number of annual use cycles, DOE notes that the cycle length would be approximately 30 minutes (140 annual active mode hours/283 active mode cycles per year). DOE is unaware, however, of consumer usage data indicating that the number of active mode hours per year has changed. For these reasons, DOE did not change the number of clothes dryer active mode hours in the TP Final Rule.

Initial RMC

The DOE clothes dryer test procedure in appendix D specifies that the clothes load have an initial RMC of 70 ± 3.5 percent. DOE stated in the preliminary TSD that a review of residential clothes washer models in the California Energy Commission (CEC) product database suggests that the average RMC is less than the nominal 70 percent that is currently provided for in the DOE clothes dryer test procedure. Therefore, DOE stated it was considering amendments to the clothes dryer test procedure to address RMC.

The Joint Petitioners and ACEEE commented that DOE should update the initial RMC based on the best available data (ideally based on a nationally representative sample). (Joint Petitioners, No. 33 at p. 25; ACEEE, No. 24 at p. 1) NRDC commented that DOE's initial RMC assumptions do not reflect today's washing machines and should be revised to better reflect current washer technology. (NRDC, No. 26 at pp. 2, 4) NRDC commented that the ECOS report summarized test results for a single clothes washer which showed that the RMCs after the wash cycle is finished are 70-percent RMC for cotton bath towels and 40-percent RMC for the DOE 50/50 cotton/polyester test cloths. (NRDC, No. 30 at pp. 30–31) NRDC also stated that the energy consumption of a clothes dryer decreases when the initial RMC is lower, but not in direct proportion to the lowered water content because energy is still used to heat and move the air, cloth and metal. (NRDC, No. 26 at pp. 2, 4) The California Utilities and the NPCC both supported reducing the initial RMC from the current 70 percent to a value nearer to 56 percent, based on data submitted by AHAM, recognizing that today's washers have faster spin speeds and typically leave less water in the clothes. (California Utilities, No. 31 at pp. 2, 12; NPCC, No. 32 at p. 2) However, NPCC also commented that even an initial RMC of 56 percent may not reflect the RMC produced by higher efficiency clothes washers that may be required as a result of the current DOE rulemaking for those products. NPCC commented that the average RMC for clothes washers in the July 2008 CEC appliance product directory was only 46 percent (as presented by DOE), which is well below its proposed revised value. (NPCC, No. 32 at p. 2)

AHAM and Whirlpool supported using the industry shipment-weighted average residential clothes washer RMC of 47 percent derived from data provided by AHAM. They commented that DOE should use the 47-percent RMC in both the engineering and economic analyses; modify the test procedure by changing the RMC from 70 percent to 47 percent; and modify the baseline energy factor to reflect the change in the test procedure. Whirlpool added that failure to do so will result in overstating clothes dryer energy use, thus rendering all payback and LCC calculations erroneous. (AHAM, No. 25 at p. 10; Whirlpool, No. 22 at pp. 2–3) AHAM also stated that data collected by industry showed a 22-percent increase in EF when the initial RMC is changed to 56 percent. AHAM commented that they expect EF will increase further as RMC is reduced to 47 percent, but that the relationship is not expected to be linear. (AHAM No. 25 at p. 10)

BSH also commented that it supports reducing the initial RMC for testing purposes, and added that the DOE test procedure should be defined before any energy conservation standard levels are established. (BSH, No. 23 at p. 6) BSH also commented that it should be clarified which energy consumption results from each change in the test procedure before a suitable classification can be done and added that a round robin test may be helpful to estimate the energy levels. (BSH, No. 23 at p. 6)

In the TP SNOPR, DOE proposed to change the initial RMC from 70 percent to 47 percent based on shipment-weighted clothes washer RMC data provided by AHAM. 75 FR 37594, 37626–31 (June 29, 2010). As discussed in the TP Final Rule, DOE received comments in response to the TP SNOPR that the shipment-weighted average RMC value in the AHAM data was based on the clothes washer RMC, which uses an RMC correction factor to normalize testing results from different lots of test cloth, but the DOE clothes dryer test procedure should instead use the uncorrected RMC value. DOE determined that an initial clothes dryer RMC of 57.5 percent more accurately represents the moisture content of current laundry loads after a wash cycle for the purposes of clothes dryer testing, derived from the 47-percent shipment-weighted RMC for clothes washers (that was based on analysis of data provided by AHAM) without the application of the RMC correction factor specified in the DOE clothes washer test procedure, as discussed above in this paragraph. DOE validated this estimate using clothes washer uncorrected RMC data from testing of a limited sample of representative clothes washers for the DOE clothes washer energy conservation standards rulemaking. As a result, the TP Final Rule amended the DOE clothes dryer test procedure to adopt this value for the initial RMC. 76 FR 972, 977 (January 6, 2011). As discussed in section IV.C.2.a, DOE conducted testing for the TP Final Rule in order to analyze how the amendments to the test procedure, including the change to the initial RMC, would affect the measured efficiency of clothes dryers.

Load Size

Currently the DOE test procedure for clothes dryers requires a 7.00 lb. ± .07 lb. test load for standard-size dryers and a 3.00 lb. ± .03 lb. test load for compact-size dryers. (10 CFR part 430, subpart B, appendix D, section 2.7) DOE stated in chapter 2 of the preliminary TSD that it was reviewing available data to determine the current representative clothes dryer load size, and would consider amendments to its test procedure to accurately reflect the current clothes dryer test load size for the clothes dryer tests.

The Joint Petitioners and ACEEE commented that DOE should update the size of the clothes dryer test load based on the best available data (ideally based on a nationally representative sample). (Joint Petitioners, No. 33 at p. 25; ACEEE, No. 24 at p. 1) The California Utilities and NPCC both supported increasing the test load size from 7 lb. to 8.3 lb., or another appropriate value, commenting that 8.3 lb. is more typical of the size of loads in today's larger clothes dryers, as based on DOE's distribution of tub sizes from models in the CEC database. (California Utilities, No. 31 at p. 2; NPCC, No. 32 at p. 2) NRDC also commented that DOE should consider modifying the clothes dryer size criteria, stating that test load sizes for clothes dryers do not correlate to the test load sizes for washers and likely do not reflect real life load size. According to NRDC, current clothes dryer size classes are likely inaccurate given that today's clothes dryers can comfortably hold loads of 10 to 17 lb., with more 7 to 8 cubic foot (ft^3) models now on the market than models smaller than 7 ft^3. NRDC commented that DOE should reevaluate its clothes dryer size criteria and test load size to better reflect the clothes dryers available on the market today. (NRDC, No. 26 at pp. 2, 4; NRDC, No. 30 at p. 30)

AHAM commented that it prefers that DOE utilize industry values for data such as clothes dryer load size. AHAM stated that the shipment-weighted residential clothes washer drum volume for standard-size products in 2008 was 3.24 ft^3, which corresponds to an average clothes washer load size of 8.15 lb. AHAM also stated that for compact clothes washers, the shipment-weighted average drum volume was 1.5 ft^3, which corresponds to an average load size of 4.70 lb. AHAM added that because compact products are a separate product class, they should be treated as such in the analysis. AHAM commented that it supports the use of two separate load sizes (8.15 lb. for standard-size and 4.70 lb. for compact-size products), if the modified load size is used in both the engineering and economic analyses, and if the test procedure is modified to be consistent with this analysis and the baseline EF is modified to reflect the change in load size. (AHAM, No. 25 at pp. 10–11)

In the TP Final Rule, DOE amended the clothes dryer test procedure to change the load size from 7.00 lb ± .07 lb to 8.45 lb ± .085 lb based on the historical trends of the shipment-weighted average tub volume for residential clothes washers from 1981 to 2008 and the corresponding percentage increase in clothes washer load sizes (as specified in the load size table 5.1 in the DOE clothes washer test procedure at 10 CFR part 430, subpart B, appendix J1), which is assumed to proportionally impact clothes dryer load size. 76 FR 972, 977 (January 6, 2011). DOE believes that this estimate using the percentage increase in load size based on trends in clothes washer tub volumes would produce a more representative value than simply using the nominal load size value in the clothes washer test procedure, as suggested by AHAM. DOE does not have any consumer usage data indicating that consumers always machine dry the same size load from the wash cycle such that the average clothes washer load size can be directly applied to the clothes dryer test procedure, as suggested by AHAM. As discussed in section IV.C.2.a, DOE conducted testing for the TP Final Rule in order to analyze how the amendments to the test procedure, including the change to the load size, would affect the measured efficiency.

DOE stated in the TP Final Rule that it believes that most compact clothes dryers are used in conjunction with compact-size clothes washers, and DOE is not aware of data on the trends of compact clothes washer tub volumes that would suggest that the tub volume for such clothes washers has changed significantly. 76 FR 972, 1014 (January 6, 2011). DOE did not receive any such data in response to its requests in the TP SNOPR. In addition, as discussed above, DOE does not have any consumer usage data indicating that consumers always machine dry the same size load from the wash cycle such that the average clothes washer load size can be directly applied to the clothes dryer test procedure, as suggested by AHAM. For these reasons, DOE did not revise the test load size for compact clothes dryers in the TP Final Rule. *Id.*

NRDC also commented that the ECOS report states that if DOE were to test each model across a wide range of load sizes and report multiple values, it would help consumers choose the appropriate sized clothes dryer and to fill it with the recommended amount of clothing to dry as efficiently as possible. (NRDC, No. 30 at p. 30) DOE is not aware of any data indicating what load sizes typical consumers use or data on the percentage of clothes dryer cycles at different load sizes to determine how such results would be used to calculate an energy use or energy efficiency metric. DOE is also unaware of data showing how such a change would affect the measured EF compared to the existing test procedure, as required by EPCA. (42 U.S.C. 6293(e)(1)) DOE notes that requiring additional test cycles for different size loads would add significant testing burden on manufacturers. For these reasons, DOE did not amend the clothes dryer test procedure to require the testing of multiple test load sizes in the TP Final Rule.

BSH proposed that tumble clothes dryers be tested with a load size relative to the drum volume, and that this relationship be linear. BSH commented that the load size that the consumer uses generally matches the drum size of the clothes dryer (the larger the drum the higher the average load size dried). According to BSH, using only two load sizes for a wide range of drum volumes will cause unfairness in comparison of different clothes dryers. For example, a standard clothes dryer with a 125-liter drum volume but 60 centimeter (cm) housing (which is right above the limit to be "compact") has an unfair advantage when its energy efficiency is measured due to the fact that the load fills the drum much better than in a larger appliance. (BSH, No. 23 at p. 4) DOE is not aware of any consumer usage data indicating how load size varies with clothes dryer drum capacity. In addition, DOE is not aware of any data indicating how such a change would affect the measured efficiency. For these reasons, DOE did not amend the clothes dryer test procedure to require that the load size vary with drum capacity.

Water Temperature for Test Load Preparation

The current clothes dryer test procedure specifies a water temperature of 100 °F ± 5 °F for the test load preparation. (10 CFR part 430, subpart B, appendix D, section 2.7) The California Utilities, ACEEE, and NPCC stated that this initial clothes load temperature may have been common when most clothes washers used a hot water rinse. However, today almost all clothes washers now default to a cold water final rinse to save water heating energy. (California Utilities, No. 31 at pp. 3, 12; ACEEE, No. 24 at p. 2; NPCC, No. 32 at p. 2) According to ACEEE, today's clothes washers typically have a cold rinse default and consumers increasingly select cold water wash and rinse in response to public information campaigns and the introduction of special "cold water wash" detergents. (ACEEE, No. 24 at p. 2) The California Utilities, ACEEE, and NPCC recommended that DOE align the clothes dryer test method with the clothes washer test method by reducing the water temperature for clothes dryer test load preparation to 60 °F ± 5 °F. (ACEEE, No. 24 at p. 2)

As discussed in the TP Final Rule, DOE analyzed 2005 RECS data on the rinse water temperatures selected by consumers for clothes washer cycles, which indicates that for consumers that use a clothes washer in the home, approximately 80 percent of wash cycles per year use a cold rinse. 76 FR 972, 996 (January 6, 2011). In addition, DOE also noted that the clothes washer test procedure specifies a warm rinse temperature use factor of 27 percent, suggesting that for the majority of clothes washer cycles, consumers use the cold rinse. (10 CFR part 430, subpart B, appendix J1) DOE also sought comment on the warm rinse temperature use factor in the recent proposal to amend the test procedure for residential clothes washers because it received consumer usage survey data from a manufacturer indicating that, for one clothes washer model with no cold rinse option on the cycle recommended for cotton clothes and a default cold rinse on all other cycles, users participating in the survey reported using warm rinse for 1.6 percent of all cycles. 75 FR 57556, 57571 (Sept. 21, 2010) For these reasons, DOE amended the clothes dryer test procedure to change the water temperature for clothes dryer test load preparation from 100 °F ± 5 °F to 60 °F ± 5 °F to be more representative of the clothes load after a cold rinse cycle at the end of the wash cycle. 76 FR 972, 996 (January 6, 2011).

Test Cloth

The current clothes dryer test procedure specifies the use of energy test cloth consisting of a pure finished bleach cloth, made with a momie or granite weave, which is a blended fabric of 50-percent cotton and 50-percent polyester. Each energy test cloth measures 24 inches by 36 inches. Additional specifications are provided in the test procedure for the weight, thread count, and allowable shrinkage. (10 CFR part 430, subpart B, appendix D, section 2.7)

The ECOS report stated that DOE should test a mix of cotton and synthetics of various sizes, including large sheets, towels, and jeans, rather than only testing small, uniform synthetic-blend test cloths to more closely approximate real-world performance. The ECOS report also stated that this would deal more fairly with the real-world situation in which some fabrics have finished drying before others, causing the load to either finish before everything is dry or after some of the fabrics have been over-dried. NRDC also commented that the ECOS report presented test results using different mixes of test loads which showed that clothes dryers often stopped with the synthetic quite dry (less than 2-percent final RMC) but the cotton still damp (greater than 6-percent RMC). According to NRDC, if DOE were to test each model across a wide range of load types and report multiple values, it would help consumers choose an appropriately sized clothes dryer and to fill it with the recommended amount of clothing so that it would dry as efficiently as possible. (NRDC, No. 30 at pp. 22, 30) NRDC added that in this real-world scenario, clothes dryers may be less effective due to clothing balling up or the clothes dryer shutting off early due to a variety in cloth blends. NRDC added that certain techniques such as agitating the drum or reversing the cycle may help mitigate these problems and potentially increase efficiency in a real world scenario. NRDC also added that the standard DOE test cloths do not constitute a typical load and therefore do not accurately test clothes dryers' effectiveness at drying loads that have a variety of fabric types or are more likely to clump. NRDC suggested a mix of 100-percent cotton and 50:50 cotton/polyester as an alternative test load. (NRDC, No. 26 at pp. 1, 3; NRDC, Public Meeting Transcript, No. 21.4 at p. 43)

DOE is unaware of data to determine the composition of clothing types and materials that would be more representative of typical consumer clothing loads than the existing DOE test cloth and still produce accurate and repeatable results. Similarly, DOE is unaware of data showing the test-to-test repeatability of different test loads. Based on discussions with manufacturers, DOE understands the test material specified in the existing DOE clothes dryer test procedure produces the most repeatable results, and other tests loads are less repeatable. In addition, DOE also notes that requiring additional test cycles for loads with different clothes types and materials would add significant testing burden on manufacturers. For these reasons, DOE did not amend the clothes dryer test procedure in the TP Final Rule to change the DOE test load or to require the testing of multiple test loads composed of different clothes types and materials.

e. Drum Capacity Measurement

The Joint Petitioners commented that DOE should clarify section 3.1 of the clothes dryer test procedure regarding the measurement of drum capacity to specify that the clothes dryer's rear drum surface be supported on a platform scale to "prevent deflection of the drum surface * * *" instead of "prevent deflection of the dryer." (Joint Petitioners, No. 33 at p. 25) As discussed in the TP Final Rule, DOE agrees with the comments that the reference to deflection of the "dryer" is unclear and should be clarified to specify that the clothes dryer's rear drum surface should be supported on a platform scale to prevent deflection of the drum surface. For this reason, DOE amended the clothes dryer test procedure in TP Final Rule to reflect this change. 76 FR 972, 1019 (January 6, 2011).

f. HVAC Effects

According to EPCA, any prescribed or amended test procedures shall be reasonably designed to produce test results which measure energy efficiency, energy use, water use, or estimated annual operating cost of a covered product during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(3))

NRDC and NPCC commented that DOE should analyze the effects of clothes dryers on a home's heating and cooling energy use. (NRDC, No. 26 at pp. 1, 4; NPCC, No. 32 at p. 2) NRDC also commented that the current test procedure does not analyze the clothes dryer's effect on the heating and cooling of the surrounding room, in particular, whether the clothes dryer warms the room, cools it, or leaves it unchanged. NRDC stated that the test procedure does not distinguish between clothes dryers that vent their exhaust air outside (and require makeup air to be conditioned), and those that are unvented. (NRDC, No. 26 at pp. 1, 4; NRDC, No. 30 at p. 31) NPCC also commented that DOE's analysis of the economics of heat recovery clothes dryers should incorporate the reduced impact on space conditioning of this technology option. (NPCC, No. 32 at p. 2) The California Utilities recommended that the DOE clothes dryer test procedure be amended to measure the total airflow volume during the test cycle in order to gather data on heating, ventilation, and air conditioning (HVAC) loading. (California Utilities, No. 31 at pp. 9, 12)

As discussed above, EPCA requires that any prescribed or amended test procedures be reasonably designed to produce test results which measure energy efficiency, energy use, water use, or estimated annual operating cost of a covered product during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(3)) DOE believes that accounting for the effects of clothes dryers on HVAC energy use is inconsistent with the EPCA requirement that a test procedure measure the energy efficiency, energy use, or estimated annual operating cost of a covered product. As a result, DOE did not revise the clothes dryer test procedure to account for HVAC energy use in the TP Final Rule and does not account for HVAC energy use in these standards.

g. Efficiency Metric

The energy efficiency metric currently used for clothes dryer energy conservation standards, EF, is defined on the basis of a per-cycle measure of the lb. of clothes dried per kWh. (10 CFR 430.23)

BSH commented that DOE should calculate yearly energy consumption for clothes dryers by considering a defined amount of laundry dried within a year. BSH stated that the energy consumption for the yearly load dried in small clothes dryer should be correlated to the energy consumption when the same yearly load is dried in a larger clothes dryer. BSH added that if only the number of loads is used then for a larger clothes dryer, the energy labeled would refer to a much larger amount of clothing than for a smaller clothes dryer. According to BSH, the values would not be comparable and it would appear to the consumer that the larger clothes dryer uses more energy per cycle than the smaller. In reality, when using a compact size clothes dryer consumers would run more cycles per year to dry their yearly amount of laundry. (BSH, No. 23 at p. 5) DOE is not aware of consumer usage data showing the relationship between clothes dryer drum capacity and the amount of laundry dried by the consumer per year that would suggest that consumers typically dry the same amount of clothing per year, regardless of the drum capacity. For these reasons, DOE did not amend the clothes dryer test procedure in the TP Final Rule to specify a single value for the amount of laundry dried per year.

2. Room Air Conditioner Test Procedure

a. Standby Mode and Off Mode

Referenced Standards

As noted above, EPCA directs DOE to amend its test procedures to include measures of standby mode and off mode energy consumption, taking into consideration the most current versions of IEC Standard 62301 and IEC Standard 62087. (42 U.S.C. 6295(gg)(2)(A)) For the reasons discussed for the clothes dryer test procedure, DOE determined that only IEC Standard 62301 is relevant to the room air conditioner test procedure.

AHAM supported DOE's evaluation of IEC Standard 62301 CDV for potential revisions to address standby mode and off mode power in the room air conditioner test procedure. AHAM commented that DOE would thus harmonize with international standards, including those developed in Canada and Europe. (AHAM, Public Meeting Transcript, No. 21.4 at p. 30) As discussed for clothes dryers in section III.A.1.a, DOE considered the current version, IEC Standard 62301 First Edition, as required by EPCA. For the reasons stated in the TP Final Rule, DOE amended its test procedures for room air conditioners in the final rule to incorporate by reference the clauses from IEC Standard 62301 First Edition proposed in the TP SNOPR, as well as the provisions of IEC Standard 62301 CDV for the mode definitions. 76 FR 972, 975–6 (January 6, 2011). DOE may consider incorporating by reference clauses from IEC Standard 62301 Second Edition when that version has been published.

Testing Procedures

EEI commented that the total number of standby hours would be 8,010 if a product is plugged in all year (8,760 total hours in a year less the 750 cooling mode operating hours), and closer to 2,000 if unplugged. EEI requested clarification on the source of the 5,115 standby hours. (EEI, Public Meeting Transcript, No. 21.4 at p. 37) DOE notes that the estimate of 5,115 total standby and off mode hours, explained in greater detail in the TP SNOPR (75 FR 37594, 37610 (June 29, 2010), assumes (1) the cooling season length is 90 days or 2,160 hours; (2) half of the products in the field would be unplugged outside of the cooling season, while the others would be in standby and/or off mode; and (3) that the cooling season hours not associated with active mode cooling are evenly split between off-cycle mode and standby mode or off mode. Off-cycle mode involves operation of the fan but not the compressor. DOE noted in the TP NOPR that it is not aware of any reliable data for hours spent in different standby and off modes for room air conditioners. 73 FR 7439, 74648–49 (Dec. 9, 2008). In the absence of data suggesting a different allocation of annual hours, DOE adopted the estimate of 5,115 annual hours standby and off mode hours in the TP Final Rule. 76 FR 972, 991 (January 6, 2011).

b. Active Mode Referenced Standards

The current DOE room air conditioner test procedure incorporates by reference two industry test standards: (1) American National Standard (ANS) (since renamed American National Standards Institute (ANSI)) Z234.1–1972, "Room Air Conditioners;" [16] and (2) American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 16–69, "Method of Testing for Rating Room Air Conditioners." [17] (10 CFR part 430, subpart B, appendix F, section 1)

AHAM commented that its current room air conditioner standard is American National Standards Institute (ANSI)/AHAM RAC–1–2008. (AHAM, Public Meeting Transcript, No. 21.4 at p. 35; AHAM, No. 25 at p. 13) As discussed in the TP Final Rule, DOE adopted the amendments to reference the relevant sections of the current industry test standards for room air conditioners, which are designated as: (1) ANSI/AHAM RAC–1–R2008, "Room Air Conditioners;" and (2) ANSI/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 16–1983 (RA 2009), "Method of Testing for Rating Room Air Conditioners and Packaged Terminal Air Conditioners" (ANSI/ASHRAE Standard 16–1983 (RA 2009)). 76 FR 972, 978 (January 6, 2011)

c. Annual Active Mode Hours

The current DOE room air conditioner test procedure assumes that room air conditioners have an average annual use of 750 hours. (10 CFR part 430.23(f)) DOE noted in chapter 3 of the preliminary TSD that DOE's TSD from September 1997, issued in support of the 1997 room air conditioner rulemaking, provides estimates for average annual operating hours closer to 500.[18] DOE noted in the preliminary TSD developed in support of today's final rule, however, that a similar assessment of room air conditioner hours of operation developed in support of the June 2010 TP SNOPR suggests that the annual hours of operation have since increased and are now in fact close to 750. 75 FR 37594, 37633 (June 29, 2010).

EEI commented that the active mode hours for room air conditioners may be more than the 750 hours currently specified in the DOE room air conditioner test procedure and questioned whether the 750 hours reflect both residential and commercial applications. (EEI, Public Meeting Transcript, No. 21.4 at p. 36) As discussed in the TP Final Rule, DOE noted that estimates using data from the EIA's 2005 RECS [19] support maintaining the 750 annual operating hours specification. As a result, DOE did not amend the room air conditioner test procedure to change the number of annual operating hours. 76 FR 972, 978 (January 6, 2011).

d. Part-Load Operation

DOE noted in the preliminary TSD (chapter 5, "Engineering Analysis") that the DOE room air conditioner test procedure at appendix F measures full-load performance but is not able to assess energy savings associated with technologies which improve part-load performance.

DOE considered amendments to its room air conditioner test procedure to measure part-load performance, but did not propose such changes, as explained in the June 2010 TP SNOPR and the TP final rule. 75 FR 37594, 37634 (June 29, 2010); 76 FR 972, 1016 (January 6, 2011). DOE concluded that developing an additional test for part load, or switching to a seasonal metric to integrate part-load performance is not warranted. DOE noted that (1) sufficient information is not available at this time regarding use of room air conditioner

[16] ANSI standards are available at *http://www.ansi.org.*

[17] ASHRAE standards are available at *http://www.ashrae.org.*

[18] U.S. Department of Energy—Office of Energy Efficiency and Renewable Energy, Technical Support Document for Energy Conservation Standards for Room Air Conditioners. September 1997. Chapter 1, section 1.5. Washington, DC, available at *http://www.eere.energy.gov/buildings/appliance_standards/residential/room_ac.html*

[19] U.S. Department of Energy-Energy Information Administration. "Residential Energy Consumption Survey," 2005 Public Use Data Files, 2005. Washington, DC. Available online at: *http://www.eia.doe.gov/emeu/recs/.*

features that prevent over-cooling; (2) widespread use of part-load technology in room air conditioners is not likely to be stimulated by the development of a part-load or seasonal metric at this time, and therefore, the significant effort required to develop an accurate part-load metric is not likely to be justified by the expected minimal energy savings; and (3) key design changes that improve full-load efficiency also improve part-load efficiency, so the existing EER metric is already a strong indication of product efficiency over a wide range of conditions.

DOE stated in the preliminary TSD that it did not consider technologies such as variable speed compressors and thermostatic expansion valves as design options during the engineering analysis because these design options save energy only during part-load operation. DOE expects, based on available data and the considerations discussed in the test procedure SNOPR and reiterated above, that such technologies will not save enough energy to be cost effective.

DOE requested comments regarding additional design options that it should consider in the engineering analysis. (*See* the preliminary TSD Executive Summary, section ES.4).

NRDC commented that DOE should further analyze the efficiency of part-load operation. NRDC stated that DOE assumed that room air conditioners are generally undersized and run at full capacity and, therefore, did not take into consideration the potential to improve part-load efficiency. NRDC recommended that DOE further investigate the underlying assumption that room air conditioners are almost always run at full capacity and analyze the potential to improve part-load operation efficiency. (NRDC, No. 26 at p. 5) The comment does not provide any new information regarding room air conditioner operation that would allow development of an appropriate seasonal efficiency metric. As discussed in the TP Final Rule, development of such a metric that would take part load operation into account would require knowledge of the distribution of hours spent by room air conditioners at different load levels and at different outdoor and indoor temperature and humidity conditions. 76 FR 972, 1016 (January 6, 2011). Because such data is not available, DOE cannot establish an appropriate efficiency metric and cannot properly evaluate part-load technologies. DOE may amend the test procedure to account for part-load performance in a future rulemaking if sufficient information becomes available.

DOE also notes that the existing EER metric, which represents most of the CEER metric that is the basis of the energy standard prescribed in today's rule, is already a strong indicator of product efficiency over a wide range of conditions. Most of the design options that improve efficiency measured using EER would also improve efficiency measured using a part-load metric. For these reasons, DOE did not amend its room air conditioner test procedure to measure part-load performance. 76 FR 972, 1016 (January 6, 2011).

e. Distribution of Air

NRDC commented that DOE should consider how effectively room air conditioners distribute air throughout the room, adding that if all the cooling is provided by convection into the space, the effectiveness of delivering that cooling by the fan and integral diffuser may have a significant impact on energy use. NRDC stated that the DOE test procedure should take into account how far into the room the airflow travels and whether the unit allows for adjustments to the airflow pattern. NRDC also commented that many units will be placed at sill height, but buildings with wall sleeves will likely have units that are installed below the sill, which could pose different concerns with room air distribution to provide adequate mixing to avoid drafts. (NRDC, No. 26 at p. 6)

DOE notes that the DOE test procedure measures the cooling delivered by the room air conditioner regardless of the distribution of the cooling air within the test chamber. Thus, design options that optimize distribution of the cooling air would not improve the measurement.

DOE agrees with the comment's premise that the energy use of a room air conditioner used by a consumer may be affected by the air circulation patterns it establishes in a room. For example, a consumer located in a room far from the unit and not in line with the product's discharge air outlet may keep the unit operating longer to achieve comfortable local room conditions. This influence has as much to do with installation and use as it does with product characteristics. The relationship between room air circulation and room air conditioner energy use is not sufficiently well understood to allow any consideration of integration of such factors into the energy use metric. DOE is not aware of data evaluating the impact a product's air distribution patterns have on product energy use by consumers. As a result, this issue is not addressed by today's rule.

3. Effects of Test Procedure Revisions on the Measured Efficiency

In any rulemaking to amend a test procedure, DOE must determine to what extent, if any, the proposed test procedure would alter the measured energy efficiency of any covered product as determined under the existing test procedure. (42 U.S.C. 6293(e)(1)) If DOE determines that the amended test procedure would alter the measured efficiency of a covered product, DOE must amend the applicable energy conservation standard accordingly. In determining the amended energy conservation standard, the DOE must measure, pursuant to the amended test procedure, the energy efficiency, energy use, or water use of a representative sample of covered products that minimally comply with the existing standard. The average of such energy efficiency, energy use, or water use levels determined under the amended test procedure shall constitute the amended energy conservation standard for the applicable covered products. (42 U.S.C. 6293(e)(2)) EPCA also states that models of covered products in use before the date on which the amended energy conservation standard becomes effective (or revisions of such models that come into use after such date and have the same energy efficiency, energy use, or water use characteristics) that comply with the energy conservation standard applicable to such covered products on the day before such date shall be deemed to comply with the amended energy conservation standard. (42 U.S.C. 6293(e)(3))

EPCA also provides that amendments to the test procedures to include standby mode and off mode energy consumption will not determine compliance with previously established standards. (U.S.C. 6295(gg)(2)(C)) Because the amended test procedures for standby mode and off mode energy consumption would not alter existing measures of energy consumption or efficiency, these amendments would not affect a manufacturer's ability to demonstrate compliance with previously established standards.

For the TP Final Rule, DOE investigated how the amended test procedures would affect the measured efficiency as compared to the existing DOE test procedures. The following sections discuss these effects for each product.

a. Clothes Dryers

The Joint Petitioners proposed that the final rule amending the clothes dryer test procedure also amend the standards in the Joint Petition according to the procedures in section 323(e)(2) of EPCA, except that for the purposes of establishing a representative sample of products, DOE should choose a sample of minimally compliant dryers which automatically terminate the drying cycle at no less than 4-percent RMC. (Joint Petitioners, No. 33 at p. 17)

As discussed above, DOE did not adopt amendments to the clothes dryer test procedure to better account for automatic cycle termination. As a result, DOE did not consider any revisions to the energy conservation standards based on amendments for automatic cycle termination. However, DOE notes that EPCA does not include any exceptions that would allow for the measurement of only dryers that automatically terminate the drying cycle at no less than 4-percent RMC. (42 U.S.C. 6293(b)(1)–(3))

As part of the TP Final Rule, DOE conducted testing on a sample of 17 representative clothes dryers to evaluate the effects of the amendments to the clothes dryer test procedure on the measured EF. 76 FR 972, 1026–27 (January 6, 2011). DOE tested these units according to the amended clothes dryer test procedure in the TP Final Rule, conducting up to three tests for each test unit and averaging the results. The results from this testing are shown below in Table III.2. DOE noted in its testing that the amendments to the initial RMC, water temperature for test load preparation, and load size had an effect on the measured EF as compared to the existing test procedure. For vented electric-standard size clothes dryers tested using the amended test procedure, the measured EF increases by an average of about 20.1 percent. For vented gas clothes dryers, the measured EF increased by an average of about 19.8 percent. For vented electric compact 120V and 240V clothes dryers, the measured EF increased by an average of about 15.6 and 12.8 percent, respectively. For ventless electric compact 240V clothes dryers and ventless electric combination washer/dryers, the measured EF increased by an average of about 13.6 and 11.4 percent, respectively, as compared to the measured EF using the existing test procedure with only the amendments for ventless clothes dryers. (That is, without the changes to the initial RMC, water temperature for test load preparation, or other changes) DOE noted that the increase in measured EF is greater for the standard-size products (that is, vented electric standard and vented gas clothes dryers) than for compact-size products due to the additional amendments to increase the test load size for standard-size products. 76 FR 972, 1027 (January 6, 2011). As discussed in section IV.C.2.a, DOE applied these percentage increases in the measured EF based on the test procedure amendments for each product class to the efficiency levels proposed in the preliminary analysis.

TABLE III.2—DOE TEST RESULTS TO EVALUATE THE EFFECTS OF THE CLOTHES DRYER TEST PROCEDURE AMENDMENTS ON MEASURED EF

Test unit	Average EF *lb/kWh*		Change (percent)
	Current test procedure	Amended test procedure	
Vented Electric Standard:			
Unit 1	3.07	3.69	20.4
Unit 2	3.14	3.77	19.5
Unit 3	3.20	3.83	19.6
Unit 4	3.28	3.92	19.4
Unit 5	3.24	3.96	22.5
Unit 6	3.12	3.72	19.1
Vented Gas:			
Unit 7	2.78	3.36	20.6
Unit 8	2.83	3.40	19.9
Unit 9	2.85	3.42	20.2
Unit 10	2.80	3.37	20.5
Unit 11	2.98	3.50	17.6
Vented Electric Compact (240V):			
Unit 12	3.19	3.56	11.4
Unit 13	2.93	3.35	14.2
Vented Electric Compact (120V):			
Unit 14	3.23	3.74	15.6
Ventless Electric Compact (240V):			
Unit 15	2.37	2.69	13.6
Ventless Electric Combo Washer/Dryer:			
Unit 16	2.01	2.27	12.5
Unit 17	2.50	2.76	10.3

Table III.3 shows how the current energy conservation standards are affected by the amendments to the DOE clothes dryer test procedure.

TABLE III.3—ENERGY FACTOR OF A MINIMALLY COMPLIANT CLOTHES DRYER WITH THE CURRENT AND AMENDED TEST PROCEDURE

Product class	EF *lb/kWh*	
	Existing test procedure	Amended test procedure
1. Electric, Standard (4.4 ft^3 or greater capacity)	3.01	3.62

TABLE III.3—ENERGY FACTOR OF A MINIMALLY COMPLIANT CLOTHES DRYER WITH THE CURRENT AND AMENDED TEST PROCEDURE—Continued

Product class	EF *lb/kWh*	
	Existing test procedure	Amended test procedure
2. Electric, Compact (120 v) (less than 4.4 ft³ capacity)	3.13	3.62
3. Electric, Compact (240 v) (less than 4.4 ft³ capacity)	2.90	3.27
4. Gas	2.67	3.20

b. Room Air Conditioners

The Joint Petitioners proposed that the final rule amending the room air conditioner test procedure amend the standards in the consensus agreement according to the procedures in section 323(e)(2) of EPCA. (Joint Petitioners, No. 33 at p. 18) These are the provisions that require DOE to adjust the efficiency standard if DOE determines that changes in the energy test procedure alter the measured energy use of covered products. While the measured efficiency of room air conditioners is altered by the incorporation of standby and off mode energy use in the new efficiency metric. However, DOE determined in the TP Final Rule that the amendments to the room air conditioner test procedure do not impact the measurement of EER while providing more accurate and repeatable measurements of capacity and greater flexibility to manufacturers in selecting equipment and facilities. 76 FR 972, 1028 (January 6, 2011). For this reason, DOE believes that revisions to the energy conservation standards for room air conditioners because of the amendments to the test procedure would not be warranted.

B. Technological Feasibility

1. General

In each standards rulemaking, DOE conducts a screening analysis based on information it has gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the rulemaking. As the first step in such analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. DOE then determines which of these means for improving efficiency are technologically feasible. DOE considers a technology option to be technologically feasible if it is incorporated into commercially available products or working prototypes. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i).

Once DOE has determined that particular technology options are technologically feasible, it further evaluates each of these technology options in light of the following additional screening criteria: (1) Practicability to manufacture, install, or service; (2) adverse impacts on product utility or availability; and (3) adverse impacts on health or safety. Section IV.B of this notice discusses the results of the screening analysis for clothes dryers and room air conditioners, particularly the designs DOE considered, those it screened out, and those that are the basis for the trial standard levels (TSLs) in this rulemaking. For further details on the screening analysis for this rulemaking, see chapter 4 of the technical support document accompanying today's direct final rule (direct final rule TSD).

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an amended standard for a type or class of covered product, it must "determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible" for such product. (42 U.S.C. 6295(p)(1)) Accordingly, DOE determined the maximum technologically feasible ("max-tech") improvements in energy efficiency for clothes dryers and room air conditioners in the engineering analysis, using the design options used in the most efficient products available on the market or in working prototypes. (*See* chapter 5 of the direct final rule TSD.) Table III.4 lists the max-tech levels that DOE determined for this rulemaking.

TABLE III.4—MAXIMUM TECHNOLOGICALLY FEASIBLE EFFICIENCY LEVELS FOR RESIDENTIAL CLOTHES DRYERS AND ROOM AIR CONDITIONERS

Residential clothes dryers	
Product class	Max-tech CEF *lb/kWh*
1. Vented Electric, Standard (4.4 ft³ or greater capacity)	5.42
2. Vented Electric, Compact (120 V) (less than 4.4 ft3 capacity)	5.41
3. Vented Electric, Compact (240 V) (less than 4.4 ft³ capacity)	4.89
4. Vented Gas	3.61
5. Ventless Electric, Compact (240 V) (less than 4.4 ft³ capacity)	4.03
6. Ventless Electric Combination Washer/Dryer	3.69
Room air conditioners	
Product class	Max-tech CEER *Btu/Wh*
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	11.67
2. Without reverse cycle, with louvered sides, and 6,000 to 7,999 Btu/h	11.96
3. Without reverse cycle, with louvered sides, and 8,000 to 13,999 Btu/h	11.96

Room air conditioners

Product class	Max-tech CEER *Btu/Wh*
4. Without reverse cycle, with louvered sides, and 14,000 to 19,999 Btu/h	11.96
5A. Without reverse cycle, with louvered sides, and 20,000 to 27,999 Btu/h	10.15
5B. Without reverse cycle, with louvered sides, and 28,000 Btu/h or more	9.80
6. Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	10.35
7. Without reverse cycle, without louvered sides, and 6,000 to 7,999 Btu/h	10.35
8A. Without reverse cycle, without louvered sides, and 8,000 to 10,999 Btu/h	10.35
8B. Without reverse cycle, without louvered sides, and 11,000 to 13,999 Btu/h	10.02
9. Without reverse cycle, without louvered sides, and 14,000 to 19,999 Btu/h	10.02
10. Without reverse cycle, without louvered sides, and 20,000 Btu/h or more	9.80
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	11.96
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	10.15
13. With reverse cycle, with louvered sides, and 20,000 Btu/h or more	10.35
14. With reverse cycle, without louvered sides, and 14,000 Btu/h or more	10.02
15. Casement-Only	10.35
16. Casement-Slider	10.35

a. Clothes Dryers

For electric vented and vent-less clothes dryers, the max-tech level corresponds to the efficiency improvement associated with incorporating heat pump technology, according to information from manufacturer interviews and available research on heat pump dryers. For vented gas clothes dryers, the max-tech level is the value proposed in the framework document was based on data contained in the CEC product database. AHAM submitted aggregated incremental manufacturing cost data in support of this max-tech efficiency level for vented gas clothes dryers. As discussed in chapter 5 of the preliminary TSD, multiple manufacturers stated during interviews that the current maximum efficiency listed for vented gas clothes dryers in a more recent version of the CEC product database is not achievable. Also, as discussed in chapter 5 of the preliminary TSD, DOE testing of the "maximum-available" vented gas clothes dryer in this more recent version of the CEC product database determined that this unit did not achieve the rated efficiency. For these reasons, DOE considered the vented gas clothes dryer max-tech value for which AHAM submitted aggregated incremental manufacturing costs. This max-tech level was supported by multiple manufacturers during interviews.

b. Room Air Conditioners

As described in the direct final rule TSD (chapter 5, "Engineering Analysis"), DOE conducted a full engineering analysis for seven room air conditioner product classes, which comprise a large percentage of identified products on the market. DOE's approach for extending the analysis of the proposed standard levels to the non-analyzed product classes is described in chapter 5, "Engineering Analysis", of the direct final rule TSD. This section of this notice reports specifically on the max-tech efficiency levels for the product classes directly analyzed in the engineering analysis.

DOE used the full set of design options considered applicable to these product classes to determine the max-tech efficiency levels. (*See* chapter 5 of the direct final rule TSD.) Table III.5, below, lists the max-tech levels that DOE determined for this rulemaking—the table shows the levels for the directly analyzed product classes (*see* section IV.C regarding discussion of the product classes that were directly analyzed). The max-tech levels that DOE determined for this rulemaking are based on design options that are used in commercially-available products.

TABLE III.5—MAX-TECH EERS FOR THE ROOM AIR CONDITIONER PRODUCTS RULEMAKING

Analyzed product class	Description	Combined energy efficiency ratio (EER) level
		DOE final rule max-tech
1	Less than 6,000 Btu/h, without reverse cycle and with louvered sides	11.7
2	6,000 to 7,999 Btu/h, without reverse cycle and with louvered sides	*N/A
3	8,000 to 13,999 Btu/h, without reverse cycle and with louvered sides	12.0
4	14,000 to 19,999 Btu/h, without reverse cycle and with louvered sides	*N/A
5A	20,000 Btu/h to 27,999 Btu/h, without reverse cycle and with louvered sides	10.2
5B	28,000 Btu/h or more, without reverse cycle and with louvered sides	9.8
8A	8,000 to 10,999 Btu/h, without reverse cycle and without louvered sides	10.4
8B	11,000 to 13,999 Btu/h, without reverse cycle and without louvered sides	10.0

The DOE max-tech levels differ from those presented in the preliminary TSD. They are higher for three of the analyzed product classes, and lower for three (one product class was not analyzed during the preliminary analysis). The engineering analysis revisions are discussed in section IV.C.2.b below.

DOE determined that max-tech levels for most room air conditioner product classes higher than the commercially available max-tech were technologically feasible. Although the commercially available products generally do not use all the energy efficient design options considered in the DOE max-tech analyses, the design options are all used in commercially available products, some of which combine nearly all of the design options used in the DOE max-tech configurations.

DOE determined the max-tech levels of each analyzed product class as part of its engineering analysis. The max-tech levels represent the most efficient design option combinations applicable for the analyzed products. Details of this analysis are described in the direct final rule TSD in chapter 5. DOE used different design option groups for each analyzed product class's max-tech design, as indicated in Table III.6.

Table III.6. Options Considered for Room Air Conditioner Max-Tech Levels

Product Class	Design Option						
	BLDC* Fan Motors	High Efficiency PSC Motors	Heat Exchanger Improvement	Subcoolers	10 EER Cmpressor	10.3 EER Cmpressor	Chassis Growths
1	✓	✓	✓	✓	✓		✓
3	✓	✓	✓	✓	✓		✓
5A	✓	✓	✓	✓		✓	✓
5B	✓	✓	✓	✓		✓	✓
8A	✓	✓	✓	✓	✓		
8B	✓	✓	✓	✓	✓		

Stakeholder comments and questions regarding the preliminary analysis max-tech levels primarily addressed the max-tech levels that DOE selected for the analyses. Some stakeholders argued that max available products exist at higher levels, while others argued that the conversion to R–410A refrigerant requires a re-examination of max-tech levels.

c. Available Max-Tech Products With Higher EER Ratings

Numerous stakeholders commented that DOE should update its analysis to include all current ENERGY STAR® and max-tech units on the market. The California Utilities suggested that DOE consider the current best R–410A products on the ENERGY STAR list (California Utilities, No. 31 at pp. 16–17). The California Utilities also pointed out that the ENERGY STAR Database listed products with a 13.5 EER, and that the CEC Database listed four products with a 13.8 EER (California Utilities, No. 31 at p. 13). The Northwest Power and Conservation Council (NPCC) and ACEEE also commented that there were higher efficiency products available than had been assumed by DOE (NPCC, No. 32 at p. 4; ACEEE, No. 24 at p. 4).

DOE is aware that the ENERGY–STAR and CEC databases list products that exceed the max-tech EER of 12.0 that DOE identified in the preliminary analysis. Table III.7 lists products listed at 12.0 EER or higher in one or both of these databases.

TABLE III.7—ROOM AIR CONDITIONER MODELS OF INTEREST FOR MAX-TECH ANALYSIS, AS LISTED IN THE ENERGY STAR AND CEC DATABASES

Brand	Model	Listed EER	Source	
			CEC	ENERGY STAR
Climette	CH1826A	13.8	✔	
Comfort-Aire	REC–183	13.8	✔	
Fedders	AED18E7DG	13.8	✔	
Maytag	MED18E7A	13.8	✔	
Fedders	A7Q06F2A	13.4	✔	
Turbo Air	TAS–09EH	13.5		✔
Turbo Air	TAS–12EH	13.0		✔
Turbo Air	TAS–18EH	13.0		✔
Friedrich	SS10M10	12.0	✔	✔
Friedrich	YS09L10	12.0	✔	✔
Friedrich	SS10L10	12.0	✔	✔
Friedrich	XQ06M10	12.0	✔	✔
Friedrich	SS12M10	12.0	✔	
Haier	ESAD4066	12.0		✔

DOE searched product databases and manufacturer Web sites to gather information about these products and to determine whether these products represented valid room air conditioner ratings. DOE's investigation indicates that none of the products listed with EER higher than 12.0 represent valid room air conditioner ratings, and that some of the products rated at an EER of 12.0 are also invalid representations. The first five products in the table are listed with much lower EER ratings in Natural Resources Canada (NRCan) database.[20] The three Turbo-Air products are ductless mini-split products (as identified by the manufacturer's Web site [21]), not room air conditioners. The Friedrich SS12M10 has been re-rated at lower than 12.0 EER [22], and the validity of the 12.0 rating of the Haier ESAD4066 is likely also incorrect, as discussed in greater detail below. Consequently, DOE concludes that its identification of a max-tech available level no higher than 12.0 EER is valid.

The California Utilities stated that the analysis for room air conditioners was quite favorable in terms of cost-effectiveness, and that many of the analyzed efficiency levels had LCC savings relative to the baseline levels. They indicated that, if DOE's selected efficiency levels are as cost-effective as the analysis suggests, that there may be additional design options or higher efficiency levels that also merit DOE's analysis. (California Utilities, No. 31 at p. 13) PG&E asked whether DOE would consider higher max-tech levels that might result in more stringent standards (Public Meeting Transcript, No. 21.4 at p. 130).

DOE is required to establish energy conservation standards that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)). DOE developed max-tech levels in the preliminary analysis and made adjustments in the engineering analysis based on new information, as mentioned above, particularly regarding compressors designed for R–410A refrigerant. The engineering analysis adjustments are discussed in more detail in section IV.C.2.b below. DOE determined that the products cited by the commenters that appeared to have higher efficiencies than the max-tech levels either were not room air conditioners or did not have valid ratings. The max-tech levels incorporate all applicable design options for each of the product classes, and based on DOE's research and engineering analysis, DOE does not believe that products with higher efficiency than DOE's max-tech are technologically feasible.

d. Consideration of Conversion to R–410A Refrigerant in Max-Tech Selections

As detailed in the direct final rule TSD (chapter 5), the use of HCFC–22 refrigerant in room air conditioners was phased out starting January 1, 2010. The industry has switched to R–410A refrigerant, which has required significant design modification. Although DOE based its preliminary analyses on use of R–410A refrigerant because HCFC–22 can no longer be used, few R–410A products were available for reverse engineering when DOE conducted the preliminary analyses. Also, there was limited information regarding compressors designed for the new refrigerant, or regarding manufacturers' experiences developing product designs for the new refrigerant.

GE Consumer & Industrial (GE) asked during the March 2010 public meeting whether any of the models considered for the engineering analysis (specifically the max-tech levels) were R–410A products (GE, Public Meeting Transcript, No. 21.4 at pp. 72–73). DOE responded that it based the max-tech analysis of product class 1 on a 12 EER R–410A product that was available at the time of the analysis. GE commented that Consumer Reports published an article in October 2008 [23] in which it reported on test results indicating that this product's efficiency was not 12 EER (Public Meeting Transcript, No. 21.4 at 72–73). GE indicated that DOE should not consider this model to be representative of the technologies or costs required to achieve 12 EER. GE recommended that DOE instead use an alternative model to represent this efficiency level: the Friedrich model XQ06M10,[24] which has a 6,000 Btu/h capacity and 12.0 EER, with a retail price of over $600 and a weight of 72 lbs.

The California Utilities requested clarification on DOE's decision to not pursue a full teardown of the single R–410A unit identified in the preliminary analysis (California Utilities, No. 31 at p. 17). In response, DOE notes that it had obtained sufficient information about this unit to allow development of both an energy model and manufacturing cost model through close examination of heat exchanger details, identification of the compressor and fan motor model number, and measurement of fan power input.

DOE considered the Consumer Reports article regarding the product identified in the preliminary analysis, which was initially considered to represent 12.0 EER using R–410A. Matching this performance level with the energy model required making some input assumptions that DOE considers unlikely, particularly for the condenser air flow rate. Given the information available, DOE agrees with GE's suggestion to instead use the Friedrich 12.0 EER product as a representation of this performance level. The revised analysis for product class 1 is based on calibration of the energy model to match the performance of the Friedrich product. DOE conducted a teardown of this product to verify its design details.

The analysis shows that the product class 1 max-tech level is 11.8, slightly lower than 12. This reflects (1) reduction of the capacity from the 6,000 Btu/h of the Friedrich unit to the 5,000 Btu/h considered representative for the product class, and (2) adopting a 50 lb. product weight limit, as suggested by AHAM (AHAM, No. 25 at p. 6) AHAM commented that OSHA recommends that articles heavier than 50 lbs. should be lifted by two rather than one person. *Id.* DOE considers this limit to be an appropriate demarcation for product class 1, since most of these products currently weigh less than 50 lb. Increase in weight beyond 50 lbs., requiring additional personnel for installation, represents a distinct reduction in consumer utility (specifically, the ability to remove the unit from the window during the off-season, relocate it to other windows without calling an installer, or both). Size limits for room air conditioners are discussed in greater detail in section IV.C.2.b, below.

During the final rule analysis, DOE also considered new products of other product classes that use R–410A refrigerant and adjusted its analysis accordingly based on new information regarding designs and efficiency levels

[20] (1) Natural Resources Canada, Office of Energy Efficiency. *EnerGuide for Equipment—EnerGuide Room Air Conditioner Directory 2002.* 2002; (2) Room Air Conditioner Model Listing. "EnerGuide Room Air Conditioner Directory 2004" *http://oee.nrcan.gc.ca/.*

[21] Product Specifications and Descriptions for Turbo Air Products TAS–09EH, TAS–12EH, TAS–18EH. *http://www.turboairinc.net/productspecs/productspecs.html.*

[22] Friedrich product specifications. Specifications for SS12M10. *http://kuhl.friedrich.com/model-specifications/.*

[23] "Energy Star has lost some luster." Consumer Reports. October 2008. Pg. 24 Vol. 73 No. 10. Copyright 2008 Consumers Union of U.S., Inc.

[24] The GE comment identified Friedrich model AQ06M10, but the listing on the Friedrich Web site is XQ06M10 for a product matching the GE description (same capacity, EER, weight, and other relevant attributes).

of these products. Adjustments DOE made to the engineering analysis during the final rule phase are detailed in section IV.C.2.b below, and in chapter 5 of the TSD.

C. Energy Savings

1. Determination of Savings

DOE used its NIA spreadsheet model to estimate energy savings from amended standards for the products that are the subject of this rulemaking.[25] For each TSL, DOE forecasted energy savings beginning in 2014, the year that manufacturers would be required to comply with amended standards, and ending in 2043. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between the standards case and the base case. The base case represents the forecast of energy consumption in the absence of amended mandatory efficiency standards, and considers market demand for more-efficient products.

The NIA spreadsheet model calculates the electricity savings in "site energy" expressed in kWh. Site energy is the energy directly consumed by appliances at the locations where they are used. DOE reports national energy savings on an annual basis in terms of the aggregated source (primary) energy savings, the savings in the energy used to generate and transmit the site energy. (See direct final rule TSD chapter 10.) To convert site energy to source energy, DOE derived annual conversion factors from the model used to prepare the EIA *Annual Energy Outlook 2010 (AEO2010).*

2. Significance of Savings

As noted above, DOE cannot adopt a standard for a covered product if such standard would not result in "significant" energy savings. 42 U.S.C. 6295(o)(3)(B) While the term "significant" is not defined in the Act, the U.S. Court of Appeals, in *Natural Resources Defense Council* v. *Herrington,* 768 F.2d 1355, 1373 (DC Cir. 1985), indicated that Congress intended "significant" energy savings in this context to be savings that were not "genuinely trivial." The energy savings for all of the TSLs considered in this rulemaking are nontrivial, and, therefore, DOE considers them "significant" within the meaning of 42 U.S.C. 6295(o)(3)(B).

[25] The NIA spreadsheet model is described in section IV.G of this notice.

D. Economic Justification

1. Specific Criteria

As noted in section II.B, EPCA provides seven factors to be evaluated in determining whether a potential energy conservation standard is economically justified. (42 U.S.C. 6295(o)(2)(B)(i)) The following sections discuss how DOE has addressed each of those seven factors in this rulemaking.

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of an amended standard on manufacturers, DOE first determines the quantitative impacts using an annual cash-flow approach. This step includes both a short-term assessment—based on the cost and capital requirements during the period between the issuance of a regulation and when entities must comply with the regulation—and a long-term assessment over a 30-year analysis period. The industry-wide impacts analyzed include INPV (which values the industry on the basis of expected future cash flows), cash flows by year, changes in revenue and income, and other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on different types of manufacturers, including analysis of impacts on small manufacturers. Third, DOE considers the impact of standards on domestic manufacturer employment and manufacturing capacity, as well as the potential for standards to result in plant closures and loss of capital investment. Finally, DOE takes into account cumulative impacts of different DOE regulations and other regulatory requirements on manufacturers.

For individual consumers, measures of economic impact include the changes in LCC and the PBP associated with new or amended standards. The LCC, specified separately in EPCA as one of the seven factors to be considered in determining the economic justification for a new or amended standard, 42 U.S.C. 6295(o)(2)(B)(i)(II), is discussed in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the economic impacts on consumers over the forecast period used in a particular rulemaking.

b. Life-Cycle Costs

The LCC is the sum of the purchase price of a product (including its installation) and the operating expense (including energy and maintenance and repair expenditures) discounted over the lifetime of the product. The LCC savings for the considered efficiency levels are calculated relative to a base case that reflects likely trends in the absence of amended standards. The LCC analysis requires a variety of inputs, such as product prices, product energy consumption, energy prices, maintenance and repair costs, product lifetime, and consumer discount rates. DOE assumed in its analysis that consumers will purchase the considered products in 2014.

To account for uncertainty and variability in specific inputs, such as product lifetime and discount rate, DOE uses a distribution of values with probabilities attached to each value. A distinct advantage of this approach is that DOE can identify the percentage of consumers estimated to receive LCC savings or experience an LCC increase, in addition to the average LCC savings associated with a particular standard level. In addition to identifying ranges of impacts, DOE evaluates the LCC impacts of potential standards on identifiable subgroups of consumers that may be disproportionately affected by a national standard.

c. Energy Savings

While significant conservation of energy is a separate statutory requirement for imposing an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings expected to result directly from the standard. (42 U.S.C. 6295(o)(2)(B)(i)(III)) DOE uses the NIA spreadsheet results in its consideration of total projected energy savings.

d. Lessening of Utility or Performance of Products

In establishing classes of products, and in evaluating design options and the impact of potential standard levels, DOE sought to develop standards for clothes dryers and room air conditioners that would not lessen the utility or performance of these products. (42 U.S.C. 6295(o)(2)(B)(i)(IV)) None of the TSLs considered in this notice would reduce the utility or performance of the clothes dryers under consideration in this rulemaking. DOE considered the possibility that room air conditioners size increases (and related weight increases) may reduce utility. DOE requested comments from stakeholders during the preliminary analysis phase addressing this issue. In response, DOE received comments from AHAM recommending limits to product weights and from NRDC recommending limits to product dimensions. These comments and DOE's response to them are discussed in section IV.C.2.b. DOE adjusted its analysis so that analyzed

TSLs are within the weigh and dimension limits suggested by stakeholders. These adjustments included: (1) Use of a 50 lbs. limit for the product class 1 analysis, and (2) use of maximum height and width dimensions (for all product classes with louvered sides) consistent with max-tech available products. DOE made these adjustments to its analysis specifically to avoid the possible reduction in consumer utility that could result from increases in size and weight. Further discussion of this analysis can be found in the direct final rule TSD in chapter 5. Furthermore, the energy conservation standards are performance standards rather than design standards, so they do not specify the design options that manufacturers must use to achieve the required efficiency levels. Manufacturers may use design options other than those selected by DOE in its analyses to achieve the required levels. Consequently, DOE believes that the TSLs considered and the TSLs adopted for the energy conservation standard do not represent any such consumer utility reductions, notwithstanding increases in size and weight that DOE considered in the analyses for some of the product classes.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider any lessening of competition that is likely to result from standards. It also directs the Attorney General of the United States (Attorney General) to determine the impact, if any, of any lessening of competition likely to result from a proposed standard and to transmit such determination to the Secretary within 60 days of the publication of a proposed rule, together with an analysis of the nature and extent of the impact. (42 U.S.C. 6295(o)(2)(B)(i)(V) and (B)(ii)) DOE published a NOPR containing energy conservation standards identical to those set forth in today's direct final rule and transmitted a copy of today's direct final rule and the accompanying TSD to the Attorney General, requesting that the Department of Justice (DOJ) provide its determination on this issue. DOE will consider DOJ's comments on the rule in determining whether to proceed with the direct final rule. DOE will also publish and respond to DOJ's comments in the **Federal Register** in a separate notice.

f. Need for National Energy Conservation

The energy savings from new or amended standards are likely to improve the security and reliability of the nation's energy system. Reduced demand for electricity may also result in reduced costs for maintaining the reliability of the nation's electricity system. DOE conducts a utility impact analysis to estimate how standards may affect the nation's needed power generation capacity.

Energy savings from the proposed standards are also likely to result in environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with energy production. DOE reports the environmental effects from the proposed standards, and from each TSL it considered, in the environmental assessment contained in chapter 15 in the direct final rule TSD. DOE also reports estimates of the economic value of emissions reductions resulting from the considered TSLs.

g. Other Factors

EPCA allows the Secretary of Energy, in determining whether a standard is economically justified, to consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VII)) In developing the direct final rule, DOE has also considered the submission of the Joint Petition, which DOE believes sets forth a statement by interested persons that are fairly representative of relevant points of view (including representatives of manufacturers of covered products, States, and efficiency advocates) and contains recommendations with respect to an energy conservation standard that are in accordance with 42 U.S.C. 6295(o). DOE has encouraged the submission of consensus agreements as a way to bring diverse stakeholders together, to develop an independent and probative analysis useful in DOE standard setting, and to expedite the rulemaking process. DOE also believes that standard levels recommended in the consensus agreement may increase the likelihood for regulatory compliance, while decreasing the risk of litigation.

2. Rebuttable Presumption

As set forth in 42 U.S.C. 6295(o)(2)(B)(iii), EPCA creates a rebuttable presumption that an energy conservation standard is economically justified if the additional cost to the consumer of a product that meets the standard is less than three times the value of the first-year of energy savings resulting from the standard, as calculated under the applicable DOE test procedure. DOE's LCC and PBP analyses generate values used to calculate the payback period for consumers of potential amended energy conservation standards. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable presumption test. DOE routinely conducts, however, an economic analysis that considers the full range of impacts to the consumer, manufacturer, nation, and environment, as required under 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification). The rebuttable presumption payback calculation is discussed in section IV.F.12 of this direct final rule and chapter 8 of the direct final rule TSD.

IV. Methodology and Discussion

DOE used two spreadsheet tools to estimate the impact of today's proposed standards. The first spreadsheet calculates LCCs and payback periods of potential new energy conservation standards. The second provides shipments forecasts and then calculates national energy savings and net present value impacts of potential energy conservation standards. The two spreadsheets are available online at *http://www1.eere.energy.gov/buildings/appliance_standards/.*

The Department also assessed manufacturer impacts, largely through use of the Government Regulatory Impact Model (GRIM).

Additionally, DOE estimated the impacts on utilities and the environment of energy efficiency standards for clothes dryers and room air conditioners. DOE used a version of EIA's National Energy Modeling System (NEMS) for the utility and environmental analyses. The NEMS model simulates the energy sector of the U.S. economy. EIA uses NEMS to prepare its *Annual Energy Outlook* (*AEO*), a widely known baseline energy forecast for the United States. For more information on NEMS, refer to "The National Energy Modeling System: An Overview," DOE/EIA–0581 (98) (Feb. 1998), available at: *http://tonto.eia.doe.gov/FTPROOT/forecasting/058198.pdf.*

The version of NEMS used for appliance standards analysis is called NEMS–BT, and is based on the *AEO* version with minor modifications.[26]

[26] EIA approves the use of the name "NEMS" to describe only an *AEO* version of the model without any modification to code or data. Because the present analysis entails some minor code modifications and runs the model under various policy scenarios that deviate from AEO

Continued

NEMS–BT offers a sophisticated picture of the effect of standards, because it accounts for the interactions between the various energy supply and demand sectors and the economy as a whole.

A. Market and Technology Assessment

1. General

When beginning an energy conservation standards rulemaking, DOE develops information that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, and market characteristics.

This activity includes both quantitative and qualitative assessments based on publicly available information. The subjects addressed in the market and technology assessment for this rulemaking include quantities and types of products sold and offered for sale; retail market trends; products covered by the rulemaking; product classes and manufacturers; regulatory and non-regulatory programs; and technology options that could improve the energy efficiency of the product(s) under examination. See chapter 3 of the direct final rule TSD for further discussion of the market and technology assessment.

2. Products Included in This Rulemaking

This subsection addresses the scope of coverage for today's direct final rule, discussing whether certain products are subject to the amended standards and whether certain technologies provide a viable means of improving energy efficiency. In the sections that follow, DOE discusses the comments received on the scope of coverage set forth in the preliminary analysis.

a. Clothes Dryers

Hydromatic Technologies Corporation (HTC) suggested that DOE consider "solar" clothes dryers in this rulemaking. (HTC, No. FDMS DRAFT 0068 at p. 3) Under EPCA, any standard for clothes dryers must establish either a maximum amount of energy use or a minimum level of efficiency based on energy use. (42 U.S.C. 6291(5)–(6)) EPCA defines "energy use," in part, as "the quantity of energy" that the product consumes. (42 U.S.C. 6291(4)) EPCA defines "energy" as meaning "electricity, or fossil fuels," or other fuels that DOE adds to the definition, by rule, upon determining "that such inclusion is necessary or appropriate to carry out the purposes" of EPCA. (42 U.S.C. 6291(3)) DOE has not added solar energy (or any other type of fuel) to EPCA's definition of "energy." Thus, DOE currently lacks authority to prescribe standards for clothes dryers when they use the sun's energy instead of fossil fuels or electricity. DOE also notes that it is unaware of any existing clothes dryers that are solar-powered.

DOE has also considered in this rulemaking standards based on microwave or heat pump technology. EPCA does not define "clothes dryer," but DOE's regulations under EPCA provide separate definitions for electric and gas products. Because the types of clothes dryers just mentioned are or would be electric products, DOE's definition of "electric clothes dryer" is relevant in considering them. DOE defines electric clothes dryer as 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). 10 CFR 430.2.

As to microwave technology, in this rulemaking DOE has considered whether microwave drying would be a viable option for improving clothes dryer efficiency. DOE determined, however, that this technology did not merit further consideration for reasons discussed in section IV.B.1. In addition, DOE is unaware of any microwave dryers that are currently commercially available for sale in the United States or elsewhere. Therefore, in this rulemaking DOE did not consider clothes dryer standards based on microwave technology.

DOE also identified heat pump technology as a possible option for improving the energy efficiency of electric clothes dryers. Unlike microwave technology, DOE did not screen out this technology from further consideration in this rulemaking. Furthermore, DOE determined that heat pump clothes dryers are commercially available in Europe and Japan. Accordingly, DOE has fully evaluated in this rulemaking whether standards based on heat pump technology are warranted for clothes dryers.

DOE also considered non-tumbling (that is, cabinet) clothes dryers. DOE notes that, because they do not use a tumbling-type drum, they are not currently within DOE's definition of "electric clothes dryer." 10 CFR 430.2. In analyzing non-tumbling dryers, DOE determined that although these clothes dryers are currently on the market in the United States, DOE understands that they have a very limited market share. Based on a survey of cabinet clothes dryer models available on the U.S. market, DOE is aware of only three cabinet clothes dryer models from two clothes dryer manufacturers that have very low market share (*i.e.,* less than 1 percent) in the conventional tumbling-type clothes dryer market. For these reasons, DOE is not considering standards for these clothes dryers in this rulemaking.

DOE also considered centrifugal spinners. DOE notes that, although centrifugal spinners remove a certain quantity of moisture from a clothes load, they are not within DOE's definition of "electric clothes dryer" as a product designed to dry fabrics in a tumble-type drum with forced air circulation, where the heat source is electricity and the drum and blower(s) are driven by an electric motor(s). 10 CFR 430.2. Such products extract moisture from a clothes load by means of centrifugal force at high spin speeds, without the application of additional heat. The ECOS report submitted to DOE by NRDC states that centrifugal spinners remove 5–14 lbs. of water per kWh of electricity, depending on the size and type of load, making them at least two to seven times as efficient as a typical electric dryer. The ECOS report further cites multiple sources suggesting that mechanical extraction of water is 19–70 times more efficient than evaporating it in a typical drying process. According to the ECOS report, a centrifugal spinner can reduce initial RMC in a clothes load to be dried in a conventional clothes dryer from 60–70 percent down to 45 percent. Sources cited in the ECOS report variously ascribe to this decrease in initial RMC a 25-percent reduction in clothes dryer electricity use, or 209 kWh annual energy savings for a typical clothes dryer. (NRDC, No. 30 at pp. 10–11) Although such centrifugal spinners are currently on the market in the United States, DOE understands that they have a very limited market share. DOE also notes that it is not aware of any centrifugal spinners that can remove moisture from the test load down to 2.5–5 percent RMC, as required by the DOE clothes dryer test procedure. In addition, DOE is not aware of any clothes dryers currently available on the market or prototype designs that incorporate centrifugal spinning and are capable of drying the test load to 2.5–5 percent RMC. For these reasons, DOE is not considering standards for these clothes dryers in this rulemaking

b. Room Air Conditioners

DOE defines "room air conditioner" under EPCA, in part, as a "consumer product * * * which is an encased assembly designed as a unit for mounting in a window or through the wall for the purpose of providing

assumptions, the name "NEMS–BT" refers to the model as used here. (BT stands for DOE's Building Technologies Program.)

delivery of conditioned air to an enclosed space. It includes a prime source of refrigeration and may include a means for ventilating and heating." 10 CFR 430.2. A product known as a "portable air conditioner" has most of these characteristics. However, it rests on the floor, often on wheels, with a short ducted connection to a window or other access to the outside to vent warm condenser air and, for some of these products, to provide condenser cooling air from the outside. DOE notes that portable air conditioners are not within the current DOE definition of "room air conditioner" because they are not designed "for mounting in a window or through the wall." 10 CFR 430.2

DOE notes that EPCA authorizes the prescription of standards for room air conditioners (42 U.S.C. 6292(2)), and that portable air conditioners do not fall within DOE's regulatory definition of room air conditioner at 10 CFR 430.2, as stated above, or the definitions found in the current industry standards ANSI/AHAM RAC–1–2008 and ANSI/ASHRAE Standard 16–1983 (RA 2009).[27] DOE also notes that portable air conditioners cannot be tested in the window configuration used in the referenced standard ANSI/ASHRAE Standard 16–1983 (RA 2009), in the amended test procedure. 76 FR 972, 978 (January 6, 2011). DOE believes that a separate test procedure analysis would need to be considered for these products; as an example, DOE notes that the ANSI/ASHRAE test procedure standard for portable air conditioners (ANSI/ASHRAE Standard 128–2001, "Method of Rating Unitary Spot Air Conditioners") references the ANSI/ASHRAE Standard 37–2005 "Methods of Testing for Rating Unitary Air-Conditioning and Heat Pump Equipment" for testing, and excludes equipment covered by ANSI/AHAM RAC–1 2008. Thus, DOE is not considering standards for portable air conditioners in this rulemaking. DOE may, however, consider standard for portable air conditioners in a future rulemaking.

3. Product Classes

In evaluating and establishing energy conservation standards, DOE divides covered products into classes by the type of energy used, or by capacity or other performance-related feature that justifies a different standard for products having such feature. (See 42 U.S.C. 6295(q)) In determining whether a feature justifies a different standard, DOE must consider factors such as the utility of the feature to users. *Id.* DOE is required to establish different energy conservation standards for different product classes based on these criteria.

a. Clothes Dryers

In the preliminary analysis, DOE proposed to analyze six product classes for residential clothes dryers (for details on these product classes, see chapter 3 of the preliminary TSD). In particular, DOE considered four product classes for vented clothes dryers and two product classes for ventless clothes dryers, ventless electric compact (240 V) and combination washer/dryers, recognizing the unique utility that ventless clothes dryers offer to consumers.[28]

AHAM, BSH, and Whirlpool suggested that DOE consider an additional product class for electric standard-size ventless clothes dryers, even though such products are not currently on the market in the United States, to prepare for likely market entry. AHAM stated that a standard-size ventless product class would decrease the request for waivers that DOE may receive in the near future. AHAM further commented that the analysis for a standard-size ventless product class could be extrapolated from the analysis for compact-size ventless clothes dryers. (AHAM, Public Meeting Transcript, No. 21.4 at pp. 19–20; AHAM, No. 25 at pp. 4–5; BSH, No. 23 at p. 3; Whirlpool, No. 22 at p. 1)

Because DOE is unaware of any standard-size ventless clothes dryers currently on the market, as discussed in section IV.A.2.a, and because DOE does not have information on the performance of standard-size ventless clothes dryers that would warrant the definition of a separate product class, DOE is not establishing a product class for standard-size ventless clothes dryers in today's direct final rule.

According to BSH, clothes dryers should be classified as vented, ventless, and gas product classes, without differentiation by drum size. (BSH, No. 23 at p. 4) EPCA requires DOE to specify a level of energy use or efficiency different from that which applies to the type of covered product for any group of such products that have a capacity or other performance-related feature that justifies a different standard. DOE has previously determined, and has verified in recent testing, that compact-size clothes dryers have inherently different energy consumption than standard-size clothes dryers. DOE also notes that compact-size clothes dryers provide utility to consumers by allowing for installation in space-constrained environments. Therefore, DOE has determined that the capacity and utility of compact clothes dryers justifies a different standard and establishes separate product classes for compact clothes washers under EPCA. (42 U.S.C. 6295(q))

b. Room Air Conditioners

The 1997 final rule for room air conditioners established standards for 16 product classes based on the following characteristics: Capacity, presence or absence of louvered-sides (louvered-side products are intended for installation in windows, while products without louvered sides are for through-the-wall installation), type of cabinet (casement-only, casement-slider, and other), and presence or absence of heat pump mode for heating. 72 FR 50122 (Sept. 24, 1997).

In its preliminary analysis, DOE proposed no changes to the existing product class structure. DOE received two comments addressing product classes, as discussed below.

AHAM recommended that DOE consider splitting the following two product classes: Product class 5 (room air conditioners without reverse cycle, with louvered sides, and capacity 20,000 Btu/h or more) and product class 8 (room air conditioners without reverse cycle, without louvered sides, and capacity 8,000 to 13,999 Btu/h) (AHAM, No. 25 at p. 6). AHAM recommended that product class 5 be split into two product classes, (1) from 20,000 Btu/h to 24,999 Btu/h, and (2) greater than 25,000 Btu/h. AHAM also recommended that product class 8 be split into two product classes, (1) 8,000 Btu/h to 10,999 Btu/h, and (2) 11,000 Btu/h to 13,999 Btu/h. AHAM stated that manufacturers are reaching the limit of achievable efficiency levels for higher-capacity room air conditioners. *Id.*

The Joint Comment also proposed splitting both product classes 5 and 8, but recommended a different capacity at which to split product class 5. The Joint Comment proposed that the new product classes derived from the current product class 5 be (1) from 20,000 Btu/h to 27,999 Btu/h, and (2) 28,000 Btu/h and greater. The Joint Comment proposed the same two separated product classes for product class 8 that AHAM proposed. (Joint Comment, No. 31 at pp. 7–8)

DOE agrees with the recommendations of AHAM and the

[27] EPCA also authorizes the classification of additional consumer products as covered products pursuant to 42 U.S.C. 6292(b) provided that certain criteria are met.

[28] Previously, DOE has described ventless dryers as condensing dryers. The new designation reflects the actual consumer utility (that is, no external vent required) and the market availability of vented dryers that also condense.

Joint Comment that the new product classes are needed to ensure establishment of meaningful efficiency levels over the full range of capacities. This is discussed in detail in the following sections which separately address each of the product class splits.

Splitting of Product Class 5

DOE splits current product class 5 (room air conditioners without reverse cycle, with louvered sides, and capacity 20,000 Btu/h or more) into two new product classes: 5A (room air conditioners without reverse cycle, with louvered sides, and capacity from 20,000 Btu/h to 27,999 Btu/h) and 5B (room air conditioners without reverse cycle, with louvered sides, and capacity 28,000 Btu/h or more). This step is consistent with the recommendations of AHAM and the Joint Comment recommendations to split the product class, but uses the split recommended by the Joint Comment.

DOE made this decision based on the following input:

- Discussions with individual manufacturers of the efficiency options available to large room air conditioners.
- Research on available product sizes and available product efficiencies.
- Reverse engineering of two product class 5 units, including a 28,500 Btu/h unit.
- Engineering analysis of R–410A product class 5 baseline products at two capacity levels (24,000 Btu/h and 28,000 Btu/h).

Max-tech available EER for product classes 1 through 5 (room air conditioners without reverse cycle, with louvered sides, covering the full capacity range of available products) for products using R–410A refrigerant are shown in Table IV.1 below. The max-tech EER drops gradually as capacity increases above 6,000 Btu/h, but drops significantly above 28,000 Btu/h.

TABLE IV.1—MAX-TECH LOUVERED R–410A ROOM AIR CONDITIONERS

Room air conditioner R–410A louvered products (market max available levels)		
Product class	Capacity	Max available EER
1	5,200	11.0
1	5,500	11.2
2	6,000	12.0
2	7,900	11.7
3	11,700	11.4
4	18,000	10.7
5	20,800	10.0
5	27,800	9.7
5	36,000	8.5

DOE produced cost-efficiency curves for product class 5 products at both 24,000 Btu/h and 28,000 Btu/h capacity levels. Table IV.2 shows the results of these analyses, which clearly show (1) much steeper increase in cost as the CEER increases and (2) significantly lower max-tech for the larger capacity products. This analysis demonstrates the much greater potential for efficiency improvement for the lower-capacity products.

TABLE IV.2—COMPARISON OF 24,000 Btu/h AND 28,000 Btu/h ROOM AIR CONDITIONER INCREMENTAL COSTS

Efficiency level	PC5A—24,000 Btu/h		PC5B—28,000 Btu/h	
	CEER	Incremental cost	CEER	Incremental cost
1	8.47	$0.00	8.48	$0.00
2	9.0	8.85	9.0	23.52
3	9.4	19.04	9.4	50.27
4	9.8	50.66	9.8	229.01
5	10.15	204.62		

The cost-efficiency analysis and the market analysis demonstrate that limitations in the max-tech levels for product class 5 units occur at the 28,000 Btu/h capacity, rather than the 24,000 Btu/h capacity. DOE used these analyses to determine that the 28,000 Btu/h capacity split was more appropriate than the 24,000 Btu/h split.

DOE's decision to establish the new product classes 5A and 5B that take the place of the current product class 5, and split the product class at the 28,000 Btu/h capacity level, is based on the stakeholder comments and DOE's analysis. Additional details of the analysis can be found in chapter 3 of the direct final rule TSD.

Splitting of Product Class 8

DOE splits product class 8 (room air conditioners without reverse cycle, without louvered sides, and capacity 8,000 to 13,999 Btu/h) to establish two new product classes: 8A (room air conditioners without reverse cycle, without louvered sides, and capacity 8,000 to 10,999 Btu/h) and 8B (room air conditioners without reverse cycle, without louvered sides, and capacity 11,000 to 13,999 Btu/h).

DOE based this split on information similar to that of the decision to split product class 5, as discussed above. DOE focused its reverse engineering and engineering for these product classes on capacities of 8,000 Btu/h and 12,000 Btu/h.

The max-tech EERs of available room air conditioners without louvered sides using R–410A refrigerant are dependent on capacity range. These products are designed to fit in sleeves installed in the building wall. Due to the dependence of this market on replacement sales, as reported by manufacturers during interviews for the final rule analysis, there is little opportunity to adjust the physical size of the product. (This is in contrast to products with louvered sides, designed to fit in windows, which allows more flexibility for size increase to improve efficiency.) Non-louvered products with capacity greater than 12,600 Btu/h are unable to meet the current ENERGY STAR EER level. DOE further notes that non-louvered ENERGY STAR products in the capacity range 11,500 to 12,800 Btu/h require oversized sleeves. At a slightly higher capacity level, these products cannot be designed to meet the DOE energy standard—the available data show that there are currently no available non-louvered products having greater than 13,999 Btu/h capacity.

DOE produced cost-efficiency curves for non-louvered R–410A room air conditioners at 8,000 Btu/h and 12,000 Btu/h capacities, shown in Table IV.3 below. As for the product class 5 analyses, the results show the significantly steeper increase in cost as efficiency level is raised above the baseline and the reduced max-tech level for the higher-capacity product.

TABLE IV.3—COMPARISON OF 8,000 Btu/h AND 12,000 Btu/h ROOM AIR CONDITIONER INCREMENTAL COSTS

Efficiency level	PC8A—8,000 Btu/h		PC8B—12,000 Btu/h	
	CEER	Incremental cost	CEER	Incremental cost
1	8.41	$0.00	8.44	$0.00
2	9.3	4.61	9.3	11.72
3	9.6	6.68	9.5	15.39
4	10.0	16.63	9.8	26.06
5	10.4	88.45	10.0	93.36

DOE's decision to establish the new product classes 8A and 8B that take the place of the current product class 8 is based on the stakeholder comments and DOE's analysis. DOE has decided to split the product class at the 11,000 Btu/h capacity level recommended by both AHAM and the Joint Comment. Additional details of the analysis can be found in chapter 3 of the direct final rule TSD.

Product Class Summary

Table IV.4 below presents the product classes established in this rulemaking, including both current and classes established in this rulemaking.

TABLE IV.4—PROPOSED ROOM AIR CONDITIONER PRODUCT CLASSES

Number	Product class
Classes Listed in the CFR	
1	Without reverse cycle, with louvered sides, and less than 6,000 Btu/h.
2	Without reverse cycle, with louvered sides, and 6,000 to 7,999 Btu/h.
3	Without reverse cycle, with louvered sides, and 8,000 to 13,999 Btu/h.
4	Without reverse cycle, with louvered sides, and 14,000 to 19,999 Btu/h.
6	Without reverse cycle, without louvered sides, and less than 6,000 Btu/h.
7	Without reverse cycle, without louvered sides, and 6,000 to 7,999 Btu/h.
9	Without reverse cycle, without louvered sides, and 14,000 to 19,999 Btu/h.
10	Without reverse cycle, without louvered sides, and 20,000 Btu/h or more.
11	With reverse cycle, with louvered sides, and less than 20,000 Btu/h.
12	With reverse cycle, without louvered sides, and less than 14,000 Btu/h.
13	With reverse cycle, with louvered sides, and 20,000 Btu/h or more.
14	With reverse cycle, without louvered sides, and 14,000 Btu/h or more.
15	Casement-Only.
16	Casement-Slider.
Product Classes Established in This Rulemaking	
5A	Without reverse cycle, with louvered sides, and 20,000 Btu/h to 27,999 Btu/h.
5B	Without reverse cycle, with louvered sides, and 28,000 Btu/h or more.
8A	Without reverse cycle, without louvered sides, and 8,000 to 10,999 Btu/h.
8B	Without reverse cycle, without louvered sides, and 11,000 to 13,999 Btu/h.

EPCA requires that the establishment of separate product classes be based on either (A) consumption of a different kind of energy from that consumed by other covered products within such type (or class); or (B) a capacity or other performance-related feature which other products within such type (or class) do not have, where such feature justifies a higher or lower standard from that which applies to other products within such type (or class). (42 U.S.C. 6295(q)). The second of these criteria is applicable to the new product classes proposed in this rulemaking, because the new product classes are based on product capacity. The justification of different standards for the new product classes of different capacities is discussed above in this section.

4. Non-Regulatory Programs

DOE's market assessment provides a profile of the residential clothes dryer and room air conditioner industries in the United States. As part of the market and technology assessment, DOE reviews non-regulatory programs promoting energy-efficient residential appliances in the United States. Non-regulatory programs that DOE considers in its market and technology assessment include ENERGY STAR, a voluntary labeling program jointly administered by the U.S. Environmental Protection Agency (EPA) and DOE. ENERGY STAR identifies energy efficient products through a qualification process.[29] To qualify, a product must exceed Federal minimum standards by a specified amount, or if no Federal standard exists, exhibit select energy-saving features. ENERGY STAR specifications currently exist for room air conditioners, but not for residential clothes dryers.

BSH commented that it would support ENERGY STAR qualification for clothes dryers, as well as an energy label system that would help consumers purchase the most efficient models on the market. According to BSH, the European labeling system for clothes dryers has resulted in benefits to

[29] For more information, please visit *http://www.energystar.gov.*

consumers, manufacturers, and the environment. (BSH, No. 23 at pp. 2, 6) The California Utilities commented that a revised test procedure could better differentiate clothes dryer models in terms of energy performance, facilitating an ENERGY STAR program. According to the California Utilities, there is currently no ENERGY STAR program because clothes dryers do not differ in apparent energy use as measured by the existing clothes dryer test procedure. (California Utilities, No. 31 at p. 6).

DOE notes that, according to the joint program between the EPA and DOE, the EPA determines whether to add qualification specifications for newly covered products within ENERGY STAR. DOE encourages the implementation of ENERGY STAR specifications and labeling as a means to achieve national energy savings, and would assist the EPA in applying the DOE clothes dryer test procedure to evaluate qualifying products in any future ENERGY STAR ratings for clothes dryers.

Energy labeling for clothes dryers under the EnergyGuide program is regulated by the FTC. (10 CFR 305) Although DOE does not have the authority under EPCA to revise the regulations for energy labeling to include clothes dryers, DOE would provide technical information to the FTC to support any new EnergyGuide labeling requirement for these products.

5. Technology Options

As part of the market and technology assessment, DOE develops a list of technologies for consideration for improving the efficiency of clothes dryers and room air conditioners. Initially, these technologies encompass all those DOE believes are technologically feasible (the first of the four criteria in the screening analysis). Chapter 3 of the preliminary TSD includes the detailed list of all technology options identified for clothes dryers and room air conditioners. DOE received several comments in response to the technologies proposed in the preliminary analysis to be analyzed for clothes dryers and room air conditioners.

a. Clothes Dryers

Heat Pump Clothes Dryers

DOE notes that heat pump clothes dryers function by recirculating the exhaust air back to the dryer while moisture is removed by a refrigeration-dehumidification system. The warm and damp exhaust air of the dryer enters the evaporation coil of the dehumidifier where it cools down below the dew point, and sensible and latent heat are extracted. The heat is transferred to the condenser coil by the refrigerant and reabsorbed by the air, which is moving in a closed air cycle. DOE notes that there are no heat pump dryers currently available on the U.S. market, but that heat pump clothes dryers are available on the market in Europe.

BSH commented that it foresees the heat pump clothes dryer as an innovative technology breakthrough for improved efficiency in the next few years in North America. BSH noted that in Europe in the last 2 years the market share for heat pump clothes dryers has increased from 3 to 11 percent, and that this success is based on four key factors: (1) European energy consumption values are comparable for all sizes of clothes dryers because they are independent of drum size; (2) the percent range between energy classes in Europe (A = best, B, C * * *) [30] remains constant, so one energy classification is not proportionally larger than another; (3) realistic load quantities are used for testing; and (4) automatic termination control dryers are standard and are given preferential treatment over timer dryers (which tend to over dry and use more energy). (BSH, No. 23 at p. 2)

In the context of the energy conservation standards rulemaking, DOE conducts its analysis to determine an economically justified minimum efficiency standard. DOE notes that the efficiency levels proposed in the preliminary analyses are not used for product marketing classification as they are in the European energy label system. As a result, DOE does not intend to create an energy class system as part of the energy conservation standard rulemaking. As discussed in section III.A.1.d, DOE also notes that its clothes dryer test procedure specifies a single test load size for standard-size clothes dryers and a single test load size for compact-size clothes dryers. In response to BSH's comments regarding realistic load quantities, DOE also notes that it amended the clothes dryer test procedure to revise the test load size for standard-size clothes dryers to be more representative of current consumer usage habits, as discussed in the TP Final Rule. 76 FR 972, 977 (January 6, 2011). Also, as discussed above in section III.A.1.b, DOE did not amend the test procedure in the TP Final Rule to better account for automatic cycle termination. DOE notes that the clothes dryer test procedure provides a field use factor for automatic termination control dryers and a different field use factor for timer dryers. As discussed above, DOE notes that heat pump clothes dryers are available on the market in Europe. DOE also notes that multiple clothes dryer manufacturers that manufacture heat pump clothes dryers for the international markets also manufacture clothes dryers for the United States. For these reasons, DOE believes that heat pump technology is technologically feasible and therefore considered heat pump clothes dryers for the engineering analysis.

Heat Recovery

For this technology option, a heat exchanger is used to recover exhaust heat energy and to preheat inlet air. Based on research of this technology and discussions with manufacturers, this system is feasible for both gas and electric dryers because none of the exhaust air re-enters the dryer. Energy savings are achieved either by using the additional recovered heat to increase the temperature of the air entering the drum and thus reduce the drying time or by using the additional recovered heat to reduce the required heater input power, depending on how the system is implemented. As reported in chapter 3 of the preliminary TSD, estimated energy savings from several researchers range from 2 to 6 percent in non-condensing mode.

The California Utilities and NRDC commented that the energy savings associated with heat recovery would be significantly higher. According to the California Utilities, 80-percent efficient counter-flow heat exchangers are widely available, while 90-percent efficient heat exchangers are technically feasible. The California Utilities estimate energy savings for heat recovery to be about 30 percent for electric clothes dryers and 20 percent for gas clothes dryers. The California Utilities noted that ventless dryers are available in the United States and are common in Europe, suggesting that heat recovery is both technically feasible and practical to manufacture (California Utilities, No. 31 at pp. 6–7, 12, 21) The California Utilities stated that the technologies behind heat recovery and ventless clothes dryers differ only in where the air from the heat exchanger is routed. In ventless clothes dryers, cooled exhaust air is channeled to the heater to be reused and the warmed room air is vented back to the room. For heat recovery, these are reversed, such that cooled exhaust air is vented (usually outside) and the warmed room air is channeled into the heater. (California Utilities, No. 31 at p. 6) The California Utilities provided a

[30] The European energy label system uses a letter scale from "A" to "G" to rate the efficiency and performance of certain appliance products. A rating of "A" denotes the highest efficiency unit, whereas a rating of "G" denotes the lowest efficiency unit.

specific example of a dryer with an EF of 3.10, or 2.26 kWh per cycle, which is stopped at the end of the bulk drying stage. The clothes dryer in this example is assumed to have an average exhaust temperature of 110 °F, or 40 °F above ambient temperature. According to the California Utilities, a 90-percent efficient counter-flow heat exchanger would preheat the incoming air by 36 °F, which would result in 0.684 kWh directly replacing heat that would otherwise be supplied by the electric resistance heater. The replaced heat would correspond to 1.58 kWh per cycle to dry the 7-lb. test load and an EF of 4.43. This would result in a 30-percent energy savings due to heat recovery. *Id.* According to NRDC, as stated in the ECOS report, 40-percent energy savings (1.348 kWh of heater energy savings per cycle) can be achieved for a load of cotton towels with a 90-percent efficient air-to-air cross-flow heat exchanger between the exhaust and intake of the clothes dryer. (NRDC, No. 30 at p. 27)

DOE is not aware of any data indicating that a cross-flow heat exchanger may be used in a clothes dryer application and achieve 80-percent or 90-percent efficiency. DOE notes that an air-to-air heat exchanger used in a clothes dryer must have sufficient fin spacing to prevent lint fouling of the heat exchanger. DOE also notes that the ECOS report does not provide details of how the potential energy savings associated with heat recovery were calculated (that is, data for airflow, temperature, specific heat, and similar items). DOE notes that the California Utilities comment stated that, for an exhaust temperature of 110 °F and a 90-percent efficient cross-flow heat exchanger, the energy savings would be approximately 0.684 kWh per cycle. However, the ECOS report estimated that the energy savings would be 1.348 kWh for what appear to be the same conditions. Because the details of how these estimates were calculated were not provided, DOE is unable to verify the energy savings suggested by the commenters would occur.

DOE also notes that it is unclear whether the estimates provided by the California Utilities and the ECOS report for heat recovery considered condensation in the exhaust air stream. Manufacturers indicated that such heat recovery systems must be designed to prevent condensation in the exhaust ducting, and as a result, there is a limit to the amount of heat that can be recovered.

DOE notes that it has revised the cost-efficiency analysis from the preliminary analyses based on its analysis and discussions with manufacturers. As discussed in section IV.C.2, inlet air preheating (that is, heat recovery) is considered applicable to the maximum-available efficiency levels for vented clothes dryer product classes, and DOE estimates this technology option would provide roughly a 6–7 percent improvement in efficiency. Manufacturers confirmed during interviews with DOE that this efficiency improvement accurately estimates the energy savings potential associated with inlet-air preheating in real-world applications, considering such factors as condensation in the exhaust airstream and lint accumulation in the heat exchanger.

Hydronic Heating

HTC requested that DOE consider its "hydronically heated" clothes dryer, which uses a self-contained hydronic heating system, as a technology option. According to HTC, this technology currently exists, but products incorporating such a design are not yet being sold pending HTC's resolution of licensing and private labeling considerations. (HTC, No. FDMS DRAFT 0068 at p. 3) DOE is also aware of HTC's stand-alone hydronic heater that could be implemented as a clothes dryer heat source, utilizing water or other heat transfer fluids and an immersion element similar to a water heater. The heated fluid would then pass through a heat exchanger, where the heat would be transferred to the air entering the drum and then pumped back to the hydronic heater. Because DOE has not been able to identify any clothes dryers with such hydronic heating systems currently on the market, however, DOE is unable to evaluate the energy consumption associated with a clothes dryer equipped with a stand-alone hydronic heating device and thus has not included it as a design option in today's direct final rule.

Improved Cycle Termination

According to NRDC, the test results in the ECOS report show that a clothes dryer equipped with improved automatic cycle termination saves 0.76 kWh per load compared to a clothes dryer with electromechanical controls. (NRDC, Public Meeting Transcript, No. 21.4 at p. 42) The California Utilities noted that "high performance" automatic cycle termination controls are already available in dryers on the market that produce energy savings on the order of 10-percent or more above current energy use, although DOE's clothes dryer test procedure must be amended to measure this improvement. The California Utilities strongly urged DOE to analyze this technology option.

For the reasons described in section III.A.1.b, DOE did not adopt in the TP Final Rule the amendments for measuring automatic cycle termination proposed in the TP SNOPR. Therefore, DOE did not analyze this technology option further.

Modulating Heat

The NRDC/ECOS report stated that if a conventional gas clothes dryer is improved with modulating burner technology, the performance of the clothes dryer would be roughly equivalent to or superior to many heat pump clothes dryers in terms of CO_2 emissions, source energy use, and energy cost. This performance would be achieved while also offering faster drying times and lower initial purchase price. (NRDC, No. 30 at pp. 37–38) DOE notes that heat pump technology is applicable only to electric clothes dryers, for which DOE maintains a product class distinction from gas clothes dryers. DOE analyzed technologies currently available on the market and concluded that two-stage gas burner modulation is necessary to achieve max-tech performance. Because DOE is not aware of any gas clothes dryers with fully modulating burner systems currently on the market, DOE did not consider this technology further in developing the standards set forth in today's direct final rule. DOE does include this technology as a longer-term means to achieve energy efficiency improvements in a sensitivity analysis described in chapter 16 of the direct final rule TSD.

Outdoor Intake Air

The California Utilities and NRDC suggested that DOE consider as a technology option those technologies that draw intake air for the clothes dryer from outside the residence, thereby reducing space conditioning loads in the home. (California Utilities, No. 31 at p. 8; NRDC, Public Meeting Transcript, No. 21.4 at p. 44) The California Utilities further suggest that such a technology option may be necessitated by the trend in residential new construction towards tighter building envelopes. Tighter envelopes result in reduced exhaust airflow from the clothes dryer and greater depressurization impacts, which can potentially result in indoor air quality problems. According to the California Utilities, the HVAC load is proportional to the amount of air vented from the clothes dryer, but this load can be reduced or eliminated by reducing the total air drawn through the dryer or by having a separate outside air intake and vent. The California Utilities estimate energy savings due to reductions in HVAC load on the order of 10 percent or more. (California Utilities, No. 31 at pp. 2, 8–9) The NRDC/ECOS report states that outdoor intake air could save about 1 kWh per load, but that without heat recovery this technology option would only be advantageous in the summer. The NRDC/ECOS report adds that with heat recovery outdoor intake air is advantageous year-round. (NRDC, No. 30 at pp. 27–28).

As discussed in section III.A.1.f, EPCA requires that any test procedures prescribed or amended under this section shall be reasonably designed to produce test results which measure energy efficiency, energy use, water use, or estimated annual operating cost of a covered product during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(3)) DOE believes that accounting for the effects of clothes dryers on HVAC energy use is inconsistent with this requirement. Therefore, DOE did not revise the clothes dryer test procedure to account for HVAC energy use in the TP Final Rule, and does not consider outdoor intake air as an additional technology option.

Reverse Tumble

NRDC commented that the use of synthetic mixed fabric in the DOE clothes dryer test procedure may be underestimating the efficiency improvement associated with reverse tumble. NRDC stated that cotton and other natural fabrics tend to ball up when rotated continuously in one direction, and therefore the test procedure is underestimating the potential benefit of reverse tumble. (NRDC, Public Meeting Transcript, No. 21.4 at pp. 42–43) As discussed in section III.A.1.d, DOE is unaware of data to determine the composition of clothing types and materials that would produce results as repeatable as those resulting from use of the current test cloth. Therefore, DOE did not amend the clothes dryer test procedure in the TP Final Rule to change the test load composition. In the absence of comments providing information on the efficacy of reverse tumble for the existing DOE test cloth, DOE continues to believe that no measurable energy savings are associated with this technology option.

Switch Mode Power Supply

ACEEE stated that the technology to reduce standby power consumption to less than 1 W, via switch mode power supply controllers, is widely available at low cost. (ACEEE, No. 24 at p. 2) NRDC stated that the ECOS report found standby power levels in the range of 0.03 to 0.05 W with switch mode power supply controllers, corresponding to energy consumption of 4–6 kWh over the lifetime of the clothes dryer. (NRDC, No. 26 at p. 3; NRDC, No. 30 at p. 5) DOE has observed that switching power supplies offer the highest conversion efficiencies (up to 75 percent) and lowest no-load standby losses (0.2 W or less), though at a higher cost, higher part count, and greater complexity than conventional linear power supplies. DOE noted, however, that switch mode power supplies are incorporated in many clothes dryers currently on the market, and thus has included switch mode power supplies in its analysis for today's direct final rule.

Vent Selector Switch

The NRDC/ECOS report suggested as an additional technology option the incorporation of a "summer/winter" selector so that the waste heat would be delivered to the building during the winter instead of being vented outside. According to the ECOS report, 60 percent of the energy used by the clothes dryer evaporates water from the clothes load and the other 40 percent is available as waste heat to the room. (NRDC, No. 30 at p. 28) For the reasons discussed in section III.A.1.f, DOE did not consider the energy impacts on the space conditioning requirements in amending its clothes dryer test procedure, and thus did not evaluate this technology further.

b. Room Air Conditioners

DOE received comments from several interested parties recommending that DOE also consider the following technologies: Alternative refrigerants, suction line heat exchangers (SLHX), flooded evaporator coils, and automatic timers.

AHAM commented that it had no additional design option suggestions for room air conditioners, and that many of the design options proposed and initially evaluated by DOE are already employed by a number of manufacturers to increase the efficiency of today's products (AHAM, No. 25 at p. 4).

Alternative Refrigerants

DOE notes that HCFC–22 was traditionally the refrigerant used in room air conditioners. On December 15, 2009, the EPA issued a final rule banning the sale and distribution of air-conditioning and refrigeration appliances containing HCFC–22, applying to appliances and components manufactured on or after January 1, 2010. 74 FR 66412, 66418.

During individual manufacturer interviews conducted for the preliminary analysis, manufacturers revealed that the room air conditioning industry was transitioning to using R–410A refrigerant. DOE also discussed the transition with compressor manufacturers, who were developing and manufacturing R–410A rotary compressors for use in room air conditioners.

Because of the phaseout of HCFC–22 and the transition to R–410A, DOE conducted the analysis for today's direct final rule based on use of R–410A refrigerant. DOE's analysis of R–410A room air conditioners is presented in chapter 5 of the direct final rule TSD.

A number of commenters urged DOE to consider alternative refrigerants as a technology option in the screening process. Both ACEEE and the California Utilities suggested that DOE consider hydrocarbon refrigerants possible alternatives to R–410A. (ACEEE, No. 24 at p. 4; California Utilities, No. 31 at p. 16) The California Utilities also suggested that DOE consider R–407C. (California Utilities, No. 31 at p. 16) NPCC supported consideration of alternative refrigerants as well. (NPCC, No. 32 at p. 4)

DOE notes that no hydrocarbon refrigerants are currently included as acceptable for use in air-conditioning applications by the EPA Significant New Alternatives Policy (SNAP) Program list. This program was established to identify acceptable alternatives to ozone-depleting substances used in a variety of applications.[31] The list identifies allowed applications for use of the alternative substances. Since there have been no hydrocarbons included on the SNAP list as acceptable for use in air conditioning appliances, DOE did not consider these alternative refrigerants in its analysis.

R–407C, on the other hand, is approved as an acceptable substitute for use in air-conditioning equipment, which includes room air conditioners. DOE analyzed R–407C to determine whether it offers efficiency improvement over R–410A, using the energy model developed and used throughout the engineering analysis. The results indicate that the efficiency of R–407C is less than that of R–410A for room air conditioners operating at rating conditions. As a result, DOE determined that use of R–407C refrigerant is not a viable design option. Additional details of this analysis are

[31] *See* the SNAP program Web site at *http://www.epa.gov/ozone/snap/.*

presented in chapter 3 of the direct final rule TSD.

DOE also performed research to identify other potential alternative refrigerants during the preliminary analysis, but was unable to identify viable alternative refrigerants to R–410A. The research included a review of air-conditioning products, academic articles, industry publications, and interviews with component vendors. DOE sought to include refrigerants that were approved by the EPA for use in room air conditioners. For more detail, see chapter 3 of the direct final rule TSD.

Suction Line Heat Exchangers

An SLHX transfers heat between the high-temperature liquid refrigerant leaving the condenser and the low-temperature vaporized refrigerant leaving the evaporator. The heat exchanger lowers the outgoing temperature of the liquid refrigerant and raises the temperature of the outgoing vapor refrigerant. This heat transfer allows for the liquid refrigerant to be subcooled before entering the expansion device and offers the potential to increase the vapor-compression cycle's cooling capacity.

The California Utilities and NPCC argued that DOE should consider SLHXs based on possible performance improvements (California Utilities, No. 31 at pp. 14–15; NPCC, No. 32 at p. 4). The California Utilities comment cited the 1997 room air conditioner rulemaking, which cited a study by Allied-Signal demonstrating a 4 percent increase in system performance with the addition of a SLHX in a 2.5 ton split system AC application, and simulations by NIST for split-system air conditioning applications showing EER improvement of 3.5 percent [32] for R–410A systems using SLHX. (California Utilities, No. 31 at pp. 14–15).

DOE reviewed the room air conditioner rulemaking cited by the California Utilities and noted that the improvement was based on a comparison to a non-optimized system. DOE also considered the NIST simulation study referenced by the California Utilities.[33] In this study, the EER improvement of 3.5 percent occurred for an outdoor temperature of 131 °F. The paper includes performance data for an outdoor temperature condition of 95 °F (which is used in the DOE Test Procedure), for which the EER improvement was 1.0 percent [34] using a SLHX. These results were simulated for systems using reciprocating-type compressors, and the analyzed systems were not optimized to maximize performance of individual fluids. There is no indication in the paper that the simulations address room air conditioners because it does not mention outdoor air moisture content, which would be an important parameter affecting performance of room air conditioners. While the simulations show a potential for slight performance improvement, it is not clear that the simulations are applicable for room air conditioners, and the results were not validated experimentally. DOE therefore concludes that the cited studies do not support the conclusion that SLHXs will significantly improve room air conditioner efficiency.

During interviews conducted during the preliminary and final rule analysis, manufacturers did not indicate that SLHX could be used to improve system performance. Furthermore, use of SLHX's may be inconsistent with the operating temperature limits for compressors. The technology significantly raises the temperature of the suction gas entering the compressor. Because hermetic compressors are cooled by the suction gas, the compressor will overheat if the suction gas temperature exceeds limits specified by the compressor manufacturer. DOE notes that 65 °F is typically the highest allowable suction temperature for R–410A rotary compressors. DOE noted that a SLHX operating at close to 50% effectiveness (as analyzed in the NIST study) would raise suction temperature roughly 20 °F, thus significantly exceeding the specified limit. For additional details of this analysis, see chapter 3 of the TSD. Use of this technology would adversely affect the reliability of the compressor, and consequently, DOE cannot consider SLHX as a design option.

Flooded Evaporator Coils

Flooded evaporator coils are evaporators for which refrigerant flow is higher than the amount that can be evaporated. As a result, a portion of the refrigerant leaves such an evaporator unevaporated (that is, still in the liquid phase). Such a design assures that liquid is available for boiling heat transfer throughout the evaporator. Because boiling heat transfer is much more effective than vapor phase heat transfer, the evaporator's heat transfer characteristics can be improved. However, the liquid refrigerant leaving the evaporator cannot be routed to the compressor, because (1) compressors cannot tolerate significant amounts of liquid without damage; and (2) this would represent lost cooling and lost efficiency. The liquid refrigerant returns to a reservoir from which it can be redirected to the evaporator. The reservoir inventory is controlled to allow low pressure vapor to exit to the compressor, while "fresh" refrigerant from the condenser enters through an expansion valve that may vary flow based on the reservoir liquid level.

The California Utilities stated that DOE should consider flooded evaporator coils as a design option, as this technology is used in some refrigerant systems (California Utilities, No. 31 at p. 14). Oak Ridge National Laboratories (ORNL) tests on window air conditioners found that a flooded evaporator coil setup using R–22 increased cooling capacity by 8 percent.[35]

DOE considered the ORNL study referenced by the California Utilities. The article describes work in which a room air conditioner was tested, modified to have a flooded evaporator, and then retested. Data provided in the article shows that the evaporator of the unmodified unit was very poorly controlled. A plot graph of heat exchanger tube temperature versus evaporator length shows the tube temperature rising after the refrigerant liquid had traveled 60 percent of the heat exchanger tube length, indicating that the refrigerant liquid has evaporated. Air conditioner designs that incorporate flooded evaporator coils are not optimized, and the performance of such designs could have improved significantly with much less costly changes than converting to a flooded evaporator. As a result, DOE does not believe that the cited ORNL study supports analyzing flooded evaporator coils as a technology option in the room air conditioner engineering analysis.

Automatic Timers

The California Utilities stated that DOE should consider automatic timers as a design option in its analysis,

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[32] This efficiency increase was described in the source as reduction of an EER loss of 6.5 percent (when comparing R–410A performance to HCFC–22, at 131 °F outdoor temperature) to 3.2 percent.

[33] National Institute of Standards and Technology. *Performance of R–22 and its Alternatives Working at High Outdoor Temperatures.* In Eighth International Refrigeration Conference at Purdue University, 2000. West Lafayette, IN—July 25–28, 2000, pp. 47–54.

[34] Again, expressed as reduction of an EER loss of 2.5 percent (when comparing R–410A performance to HCFC–22, at a 95 °F outdoor temperature) to 1.5 percent.

[35] V.C. Mei and F.C. Chen, *et al. Experimental Analysis of a Window Air Conditioner with R–22 and Zeotropic Mixture of R–32/125/134a.* Energy Renewable and Research Section, Energy Division, Oak Ridge National Laboratory: Oak Ridge, TN. August 1995.

arguing that many room air conditioner models currently feature an automatic timer that shuts off operation after a pre-determined amount of time, thus avoiding unnecessary cooling (California Utilities, No. 31 at p. 14). The California Utilities argued that this is a simple and inexpensive option that can be implemented to improve consumer utility and provide potential energy savings.

DOE notes that automatic timers may save energy by preventing cooling of the space when occupants have left. However, the benefits of automatic timers would not be measured by the current or amended test procedures, unless the test procedure allocation of hours to full-load and standby or off mode were adjusted based on presence of the automatic timer. Information to allow proper allocation of the hours in this fashion is not available, thus the test procedure rulemaking did not establish adjustment of hours to address this technology. DOE acknowledges the importance of conducting appropriate test programs to provide a basis for crediting technologies such as automatic timers. DOE will consider supporting such work to assist in a future test procedure rulemaking. At this time, however, DOE cannot consider automatic timers in the engineering analysis.

B. Screening Analysis

DOE uses the following four screening criteria to determine which technology options are suitable for further consideration in a standards rulemaking:

1. *Technological feasibility.* DOE will consider technologies incorporated in commercial products or in working prototypes to be technologically feasible. (The technological feasibility of options was discussed in the preceding section as part of the market and technology assessment.)

2. *Practicability to manufacture, install, and service.* If mass production and reliable installation and servicing of a technology in commercial products could be achieved on the scale necessary to serve the relevant market at the time the standard comes into effect, then DOE will consider that technology practicable to manufacture, install, and service.

3. *Adverse impacts on product utility or product availability.* If DOE determines a technology would have significant adverse impact on the utility of the product to significant subgroups of consumers, or would result in the unavailability of any covered product type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as products generally available in the United States at the time, it will not consider this technology further.

4. *Adverse impacts on health or safety.* If DOE determines that a technology will have significant adverse impacts on health or safety, it will not consider this technology further.

10 CFR part 430, subpart C, appendix A, (4)(a)(4) and (5)(b).

Technologies that pass through the screening analysis are referred to as "design options" in the engineering analysis. Details of the screening analysis are in chapter 4 of the direct final rule TSD.

1. Clothes Dryers

In the preliminary analysis, DOE identified the following technology options that could improve the efficiency of clothes dryers, as shown in Table IV.5.

TABLE IV.5—TECHNOLOGY OPTIONS FOR RESIDENTIAL CLOTHES DRYERS

Dryer Control or Drum Upgrades:
Improved termination.
Increased insulation.
Modified operating conditions.
Improved air circulation.
Reverse tumble.
Improved drum design.
Methods of Exhaust Heat Recovery (vented models only):
Recycle exhaust heat.
Inlet air preheat.
Inlet air preheat, condensing mode.
Heat Generation Options:
Heat pump, electric only.
Microwave, electric only.
Modulating, gas only.
Water-cooling, ventless electric only.
Indirect heating.
Component Improvements:
Improved motor efficiency.
Improved fan efficiency.
Standby Power Improvements:
Switching power supply.
Transformerless power supply with auto-powerdown.

For the preliminary analysis, DOE considered eliminating the following clothes dryer technology options from consideration:

Microwave, Electric Only

DOE's research suggested that significant technical and safety issues would be introduced with microwave drying by the potential arcing from metallic objects in the fabric load, including zippers, buttons, or "stray" items such as coins. While DOE noted that efforts have been made to mitigate the conditions that are favorable to arcing, or to detect incipient arcing and terminate the cycle, the possibility of fabric damage could not be completely eliminated. Thus, for these reasons of consumer utility and adverse impacts on safety, microwave drying was not considered further for analysis.

Water-Cooling, Ventless Electric Only

DOE noted that water-cooling for ventless electric clothes dryers, which uses water as a cooling fluid to condense the moisture in the air exiting the drum, would require significant plumbing to circulate water through a heat exchanger in the dryer and add to the complexity of maintenance. Such home renovations would require installing a water hook-up and drain in the laundry area, which is not typically done for clothes dryers. Therefore, DOE determined in the preliminary analysis that the water-cooling for ventless electric dryers technology option does not meet the criterion of practicability to install and service on a scale necessary to serve the relevant market at the time of the compliance date of a new standard and proposed screening it out of the analysis. DOE did not receive any comments objecting to this determination. For these reasons, DOE is continuing to screen out water-cooling for ventless electric clothes dryers in today's final rule.

Indirect Heating

DOE tentatively concluded in the preliminary analysis that indirect heating would be viable only in residences which use a hydronic heating system. An energy conservation standard that required indirect heating would require homes without a hydronic heating system to have such a system installed. DOE also notes that there would be added maintenance requirements because the home's hydronic heating system because it would be used more frequently (that is, year-round). Also, to derive dryer heat energy from the home's heating system, significant plumbing work would be required to circulate heated water through a heat exchanger in the dryer. Therefore, DOE determined that this technology option does not meet the criterion of practicability to install on a scale necessary to serve the relevant market at the time of the compliance date of a new standard and did not consider it further in the preliminary analysis.

In response, ACEEE commented that DOE should reconsider its decision to leave water-cooled clothes dryers unregulated because these products are very water-intensive. ACEEE stated that, although water-cooled clothes dryers are currently of very limited use in the

United States, this technology is used overseas and could find a larger market niche in the United States if left unregulated. (ACEEE, No. 24 at pp. 2–3) DOE believes that the current unavailability of such products in the Unites States, along with the reasons noted above, confirms its initial conclusion regarding the failure of this technology to meet the screening criteria of practicability to install and service on the scale necessary to serve the relevant market at the time of the effective date of a new standard. In addition, EPCA does not authorize DOE to set water-efficiency standards for clothes dryers. (42 U.S.C. 6291(6), 6295(g)) Therefore, DOE continues to screen out this technology option.

No other comments were received objecting to the technology options which were screened out in the preliminary analysis, or to the initial determination that the remaining design options met all of the screening criteria listed above. Therefore, DOE considered the same design options in the final rule as those evaluated in the preliminary analysis (see Table IV.6).

TABLE IV.6—RETAINED DESIGN OPTIONS FOR RESIDENTIAL CLOTHES DRYERS

Dryer Control or Drum Upgrades:
- Improved termination.
- Increased insulation.
- Modified operating conditions.
- Improved air circulation.
- Reverse tumble.
- Improved drum design.

Methods of Exhaust Heat Recovery (vented models only):
- Recycle exhaust heat.
- Inlet air preheat.
- Inlet air preheat, condensing mode.

Heat Generation Options:
- Heat pump, electric only.
- Modulating, gas only.

Component Improvements:
- Improved motor efficiency.
- Improved fan efficiency.

Standby Power Improvements:
- Switching power supply.
- Transformerless power supply with auto-powerdown.

2. Room Air Conditioners

In the preliminary analysis, DOE identified the following technology options that could improve the efficiency of room air conditioners, as shown in Table IV.7.

TABLE IV.7—TECHNOLOGY OPTIONS FOR ROOM AIR CONDITIONERS

Increased Heat Transfer Surface Area:
- Increased frontal coil area.
- Increased depth of coil (add tube rows).
- Increased fin density.
- Add subcooler to condenser coil.

Increased Heat Transfer Coefficients:
- Improved fin design.
- Improved tube design.
- Hydrophilic film coating on fins.
- Spray condensate onto condenser coil.
- Microchannel heat exchangers.

Component Improvements:
- Improved indoor blower and outdoor fan efficiency.
- Improved blower/fan motor efficiency.
- Improved compressor efficiency.

Part-Load Technology Improvements:
- Two-speed, variable-speed, or modulating-capacity compressors.
- Thermostatic or electronic expansion valves.
- Thermostatic cyclic controls.

Standby Power Improvements:
- Switching power supply.

For the preliminary analysis, DOE tentatively concluded that all room air conditioner technology options met the screening criteria listed above and did not propose to eliminate any of these technology options from consideration. DOE did not receive any comments objecting to this list of technology options and, therefore, retained all of the technologies in Table IV.7 as room air conditioner design options. As described and explained below in section IV.C.1.b below, however, some of the technologies were not considered in the engineering analysis.

C. Engineering Analysis

The engineering analysis develops cost-efficiency relationships to show the manufacturing costs of achieving increased efficiency. DOE has identified the following three methodologies to generate the manufacturing costs needed for the engineering analysis: (1) The design-option approach, which provides the incremental costs of adding to a baseline model design options that will improve its efficiency; (2) the efficiency-level approach, which provides the relative costs of achieving increases in energy efficiency levels, without regard to the particular design options used to achieve such increases; and (3) the cost-assessment (or reverse engineering) approach, which provides "bottom-up" manufacturing cost assessments for achieving various levels of increased efficiency, based on detailed data as to costs for parts and material, labor, shipping/packaging, and investment for models that operate at particular efficiency levels.

DOE conducted the engineering analyses for this rulemaking using the efficiency-level approach for clothes dryers and room air conditioners. For this analysis, DOE relied upon efficiency data published in multiple databases, including those published by CEC, the Consortium for Energy Efficiency (CEE), and ENERGY STAR, which were supplemented with laboratory testing, data gained through engineering analysis, and primary and secondary research. Details of the engineering analysis are in chapter 5 of the direct final rule TSD.

1. Technologies Not Analyzed

In performing the engineering analysis, DOE did not consider for analysis certain technologies that were not evaluated for one or more of the following reasons: (1) Data are not available to evaluate the energy efficiency characteristics of the technology; (2) available data suggest that the efficiency benefits of the technology are negligible; and (3) for the reasons stated in the TP Final Rule, DOE did not amend the test procedure to measure the energy impact of these technologies.

In the preliminary analysis, DOE did not include the following design options:

a. Clothes Dryers

Reverse Tumble

As discussed in section IV.A.5.a, NRDC commented that the DOE clothes dryer test procedure may be underestimating the efficiency improvement associated with reverse tumble due to the composition of the test cloth. (NRDC, Public Meeting Transcript, No. 21.4 at pp. 42–43) Because DOE did not amend the specifications for the test cloth composition in the TP Final Rule (as discussed in section III.A.1.d), and in the absence of comments providing information on the efficacy of reverse tumble for the existing DOE test cloth, DOE continues to conclude that no measurable energy savings are associated with this design option. Thus, this design option was not considered further in the analysis for today's final rule.

Improved Termination

For the reasons noted in section III.A.1.b, DOE did not adopt amendments to its clothes dryer test procedure to better account for automatic cycle termination. Therefore, energy savings due to improved termination technologies cannot be measured according to the test procedure, and this design option was not considered further in the analysis for today's direct final rule.

b. Room Air Conditioners

DOE eliminated the following technologies from further consideration due to the three criteria mentioned above.

1. Improved fin design
2. Improved tube design
3. Hydrophilic-film coating on fins
4. Spray condenser onto condenser coil
5. Improved indoor blower and outdoor fan efficiency
6. Variable speed compressors
7. Thermostatic or electronic expansion valves
8. Thermostatic cyclic controls

Of these technologies, numbers 1 through 4 are used in baseline products. Information indicating efficiency improvement potential is not available for number 5. Any potential energy savings of technologies 6 through 8 cannot be measured with the established energy use metric because those technologies are associated with part-load performance. As discussed in Section III.A.2.d above, DOE did not amend the test procedure to measure part-load performance of room air conditioners. Chapter 5 of the direct final rule TSD discusses these reasons in greater detail.

2. Efficiency Levels and Cost-Efficiency Results

a. Clothes Dryers

In the preliminary analysis, DOE analyzed active mode and standby mode separately to develop integrated cost-efficiency results. For vented clothes dryer product classes, DOE proposed the active mode efficiency levels shown in Table IV.8, which were based on EF values measured using the previous clothes dryer test procedure. For ventless clothes dryer product classes, DOE proposed the active mode efficiency levels shown in Table IV.9, which were based on EF values measured using the previous clothes dryer test procedure without the requirement to install an exhaust simulator. DOE proposed the standby power levels shown in Table IV.10 for all clothes dryer product classes.

TABLE IV.8—CLOTHES DRYER ACTIVE MODE EFFICIENCY LEVELS (EF)—VENTED PRODUCT CLASSES

Level	Efficiency level description	Efficiency level (EF) *lb/kWh*			
		Electric standard	Electric compact (120V)	Electric compact (240V)	Gas
Baseline	DOE Standard	3.01	3.13	2.90	2.67
1	Gap Fill	3.10	3.22	2.98	2.75
2	Gap Fill	3.16	3.29	3.09	2.85
3	Gap Fill/Maximum Available	3.4	3.54	3.2	3.02
4	Max-Tech	4.51	4.70	4.35	....

TABLE IV.9—CLOTHES DRYER ACTIVE MODE EFFICIENCY LEVELS (EF)—VENTLESS PRODUCT CLASSES

Level	Efficiency level description	Efficiency level (EF) *lb/kWh*	
		Electric compact (240V)	Electric combination washer/dryer
Baseline	DOE Test Data	2.37	1.95
1	Gap Fill	2.39	2.21
2	Gap Fill	2.59	2.42
3	Max-Tech	3.55	3.32

TABLE IV.10—CLOTHES DRYER STANDBY POWER LEVELS

Level	Standby power source	Power Input *W*
Baseline	DOE Test Data and Analysis	2.0
1	DOE Test Data	1.5
2	DOE Test Data (Max-Tech)	0.08

In the preliminary analyses, DOE developed integrated efficiency levels based on the integrated EF (IEF) metric proposed as an alternative option in the TP NOPR. The IEF is calculated as the clothes dryer test load weight in lb divided by the sum of active mode per-cycle energy use and standby/off mode per-cycle energy use in kWh. Table IV.11 through Table IV.13 show the integrated efficiency levels proposed in the preliminary analyses.

TABLE IV.11—CLOTHES DRYER INTEGRATED EFFICIENCY LEVELS (IEF)—VENTED PRODUCT CLASSES

Level	Efficiency level description	Integrated efficiency level (IEF) *lb/kWh*			
		Electric standard	Electric compact (120V)	Electric compact (240V)	Gas
Baseline	DOE Standard + 2.0 W Standby	2.96	3.00	2.79	2.63
1	Gap Fill + 2.0 W Standby	3.04	3.08	2.86	2.71
2	Gap Fill + 2.0 W Standby	3.10	3.15	2.96	2.80
3	Gap Fill/Maximum Available + 2.0 W Standby	3.33	3.37	3.06	2.97
4	Maximum Available + 1.5 W Standby	3.35	3.41	3.10	2.98
5	Maximum Available + 0.08 W Standby	3.40	3.53	3.19	3.02
6	Heat Pump (Max-Tech) + 0.08 W Standby	4.52	4.69	4.34	

TABLE IV.12—CLOTHES DRYER INTEGRATED EFFICIENCY LEVELS (IEF)—VENTLESS ELECTRIC COMPACT (240V)

Level	Efficiency level description	Integrated efficiency level (IEF) *lb/kWh*
		Electric compact (240 V)
Baseline	Baseline + 2.0 W Standby	2.29
1	Baseline + 1.5 W Standby	2.31
2	Baseline + 0.08 W Standby	2.37
3	Gap Fill + 0.08 W Standby	2.39
4	Gap Fill + 0.08 W Standby	2.59
5	Heat Pump (Max-Tech) + 0.08 W Standby	3.54

TABLE IV.13—CLOTHES DRYER INTEGRATED EFFICIENCY LEVELS (IEF)—VENTLESS ELECTRIC COMBINATION WASHER/DRYERS

Level	Efficiency level description	Integrated efficiency level (IEF) *lb/kWh*
		Electric combination washer/dryer
Baseline	Baseline + 2.0 W Standby	1.90
1	Gap Fill + 2.0 W Standby	2.15
2	Gap Fill + 2.0 W Standby	2.34
3	Gap Fill + 1.5 W Standby	2.36
4	Gap Fill + 0.08 W Standby	2.42
5	Heat Pump (Max-Tech) + 0.08 W Standby	3.31

DOE also noted that it was considering revisions to the clothes dryer test procedure for active mode, standby mode, and off mode, and that those potential amendments would affect the calculated IEF. (IEF has since been renamed CEF for this direct final rule to avoid confusion with an existing industry standard.) AHAM commented that, to ensure a rigorous analysis and to mitigate confusion, DOE should modify the baseline efficiency level to account for a revised initial RMC in the clothes dryer test procedure. (AHAM, No. 25 at p. 10) The TP Final Rule was published on January 6, 2011, and DOE has adjusted the efficiency levels, including the baseline level, as discussed later in this section to account for the impacts of all test procedure revisions, including those pertaining to initial RMC.

Integrated Efficiency Metric

DOE received comments from interested parties on the adequacy of IEF as the energy efficiency metric for clothes dryer energy conservation standards. AHAM supported the incorporation of standby mode and off mode power into the total energy use of clothes dryers, and commented that the integrated metric is appropriate. (AHAM, No. 25 at p. 2)

Whirlpool commented that standby power technologies should not be considered as separate design options associated with specific TSLs, and that doing so would avoid the requirement that standby power be incorporated into the total energy use of the clothes dryer. Whirlpool also stated that standby levels should not vary by TSL. (Whirlpool, No. 22 at p. 5) DOE notes that the CEF metric at each TSL incorporates a measure of standby power as a contributor to energy use along with energy use in active mode, as required by EPCA. Because CEF does not preferentially weigh the energy use contributions attributable to either active or standby mode, improvements in CEF due to standby power reductions are considered equally to those due to active mode design options. For these reasons, DOE believes that technologies associated with standby power reductions should be considered in the definition of efficiency levels and thus TSLs. In today's direct final rule, DOE analyzes some TSLs that would require standby power reductions only, and some that would require reductions to both standby power and active mode power, as shown later in this section.

The NRDC/ECOS report stated that the fact that natural gas clothes dryers tend to have lower average energy factors than electric clothes dryers could lead consumers to believe that electric dryers are generally more efficient. NRDC/ECOS report stated that conventional gas clothes dryers that have been available for 30 years have significantly less source energy use and environmental impact than today's efficient electric clothes dryers. The NRDC/ECOS report added that heat pump clothes dryers that may reach the U.S. market in the future have only slightly lower impacts than conventional gas clothes dryers. (NRDC, No. 30 at pp. 17–18) The NRDC/ECOS report further stated that the current EF metric is not intuitive and fails to capture meaningful differences between electric and natural gas models. According to the NRDC/ECOS report, converting natural gas consumption into equivalent electrical consumption on a site basis ignores all of the losses that occur in the electrical generation and transmission process. The NRDC/ECOS report stated that this draws attention from the substantial advantage of most gas clothes dryers—that they convert their fuel directly into heat at the site where it is needed, avoiding upstream losses. According to the NRDC/ECOS report, there are three ways to compare gas and electric clothes dryers more fairly: (1) Source Btu basis, (2) total CO_2 emissions basis, and (3) energy cost basis. The NRDC/ECOS report presented test results which showed that the standard natural gas clothes dryer uses less source energy, costs less, and emits less CO_2 per lb of water removed than any other option except (in some cases) a heat pump clothes dryer. (NRDC, No. 30 at pp. 32–33) NRDC commented that DOE should consider reporting actual kWh and Btu consumption rather than converting to site equivalent kWh. NRDC stated that it would be more useful to consumers to have information on actual kWh of electricity and Btu of gas consumed. According to NRDC, organizations such as EnergyGuide, ENERGY STAR, and Top Ten could use this information to more accurately inform prospective buyers on CO_2 emitted or operating costs of a given clothes dryer. (NRDC, No. 26 at pp. 1, 3)

In response, DOE notes that EPCA defines "energy conservation standard" in relevant part as either: (1) A performance standard which prescribes a minimum level of energy efficiency or a maximum quantity of energy use; or (2) for certain products, including clothes dryers but not including room air conditioners, a design requirement; the term also includes any other requirements that DOE may prescribe under 42 U.S.C. 6295(r). (42 U.S.C. 6291(6)) EPCA also provides definitions for the terms "energy use" and "energy efficiency". Specifically, "energy use" refers to the quantity of energy directly consumed by a consumer product at the point of use, and "energy efficiency" means the ratio of the useful output of services from a consumer product to the energy use of such product. (42 U.S.C. 6291(4)–(5)) Therefore, an energy conservation standard metric based on source energy use, emissions, or annual energy cost would be inconsistent with the definitions set forth in EPCA. In addition, DOE promulgates test procedures for all product classes of clothes dryers that calculate energy use or energy efficiency on a consistent basis, regardless of the type of energy used. The energy content of either the electricity or fossil fuels used at the site of the clothes dryer may be equally and interchangeably expressed in any unit of energy measurement, including kWh and Btu. DOE notes that, for other covered products which may consume gas as well as electricity, such as cooking products, DOE defines an energy efficiency metric (EF) in which any contributory site gas energy use is expressed in equivalent kWh. DOE continues to believe that the measure of CEF in terms of lb of clothes load per kWh is meaningful and representative of the performance for both electric and gas clothes dryers, and thus is not adopting alternative measures of energy use or energy efficiency.

NRDC and the California Utilities recommended that the metric be based on the water removed in the clothes load per kWh. The NRDC/ECOS report stated that the efficiency using this approach would be measured by converting the lbs. of water removed into kWh with a conversion factor of 0.308 (the kWh necessary to evaporate a 1 lb. of water,) then dividing by the measured energy consumption. According to the NRDC/ECOS report, this metric would be more meaningful because it would measure the work actually being performed by the clothes dryer. The NRDC/ECOS report provided as an example the case in which a clothes dryer removed 3 lbs. of water from either a heavily saturated small load of absorbent fabrics such as cotton or a lightly saturated larger load of synthetics. According to the NRDC/ECOS report, testing and reporting the results for both situations would help consumers choose the most efficient clothes dryers. The California Utilities stated that the metric should be based on lbs. of water removed per kWh, and that this metric would correct for small variations in actual test load or moisture content. The California Utilities also stated that this approach would eliminate the need for the 0.66 correction factor (in sections 4.1–4.3 of the current clothes dryer test procedure), which corrects for the RMC change during the test. (California Utilities, No. 31 at pp. 11–12; NRDC, Public Meeting Transcript, No. 21.4 at pp. 49–50; NRDC, No. 26 at pp. 1–3; NRDC, No. 30 at pp. 8, 32)

As noted above, DOE did not amend the clothes dryer test procedure to allow for testing materials other than the current 50–50 cotton-polyester test cloth. In addition, test conditions that would allow the test load size or initial RMC to vary would only be allowable if the resulting measured energy efficiency metric was independent of such variations, implying that the metric would need to be a linear function of these test conditions. DOE testing indicates that the efficacy of moisture removal becomes significantly non-linear as the RMC in the clothes load approaches low values, particularly near the 5-percent maximum allowable RMC for the conclusion of the test cycle according to the clothes dryer test procedure. Therefore, test loads with different initial RMC that are allowed to dry to a range of final RMCs, or differences in test load size, would not produce repeatable and consistent measures of energy efficiency performance due to this non-linearity of efficiency through the drying process. In order for testing results to be comparable, the test procedure would need to be amended to specific an exact starting and ending RMC, which would likely represent a significant testing burden. In addition, DOE does not believe that a metric based on lbs. of water removed per kWh, as commented by NRDC/ECOS, would be more meaningful to consumers, who may not be aware of how much water is contained in their test load. For these reasons, and because DOE has insufficient data to suggest that a metric based on lbs. of water removed per kWh instead of lb of test cloth per kWh is a more accurate or representative measure of clothes dryer energy use, DOE is not amending the clothes dryer energy conservation standards as suggested by NRDC and the California Utilities.

The California Utilities recommended that DOE consider a prescriptive design requirement that all vented clothes dryers have a standard 4-inch round port for air intake, which would be the same diameter as the exhaust duct. According to the California Utilities, there would be negligible cost associated with this design, and would allow consumers the option to install outdoor intake air in the future. (California Utilities, No. 31 at pp. 8, 12) As noted in section IV.A.5.a, DOE concluded that consideration of HVAC energy use associated with outdoor intake air was inconsistent with EPCA's requirement that a test procedure measure the energy use or energy efficiency of a covered product. As a result, DOE did not consider this technology in its analysis and is not adopting a prescriptive design standard addressing the potential implementation of outdoor intake air.

PG&E inquired whether DOE would consider a performance metric that would include the non-energy benefit of clothing life if such data were available. (PG&E, Public Meeting Transcript, No. 21.4 at p. 129) DOE is not aware of such data and notes that EPCA provides that any test procedures prescribed or amended under this section shall be reasonably designed to produce test results which measure energy efficiency, energy use, water use, or estimated annual operating cost of a covered product during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(3)) DOE believes that a clothes dryer metric incorporating the non-energy benefit of clothing life would be inconsistent with this requirement. Therefore, DOE did not consider such a metric in the TP Final Rule. DOE is required, however, to consider any lessening of utility or performance in establishing energy conservation standards. 42 U.S.C. 6295(o)(2)(B)(i)(IV).

The NRDC/ECOS report stated that, due to the complexity of the current DOE clothes washer test procedure and energy use calculations, it might be simpler for manufacturers to report total energy used to wash and dry one load. (NRDC, No. 30 at p. 32) EPCA provides separate standards for clothes dryers and clothes washers, and directs DOE to consider amended energy conservation standards for each product separately. (42 U.S.C. 6295(g)) Therefore, DOE is unable to adopt a single standard based on overall energy use of the wash and dry cycles in total.

Comments on Preliminary Analysis Integrated Efficiency Levels

DOE also received comments from interested parties on the efficiency levels proposed in the preliminary analysis. The California Utilities stated that, with the low or negative incremental costs of the standby power design options, such design options should be implemented at lower efficiency levels. According to the California Utilities, this implementation would not affect clothes dryers with electromechanical controls, which have zero standby and are thus receiving a "free" benefit of 2.0 W. (California Utilities, No. 31 at pp. 11–12) DOE agrees that the low cost of the standby power design options should result in these technologies being included in the initial efficiency levels above the baseline. Thus, the clothes dryer efficiency levels analyzed in this direct final rule implement the standby power design options at the efficiency levels where they are most cost-effective. As noted by the California Utilities, these changes would impact only those clothes dryers that consume standby power, that is, those products with electronic controls.

Earthjustice commented that EPCA contains an "anti-backsliding provision" that constrains DOE's authority in revising energy efficiency standards. According to Earthjustice, some of the clothes dryer efficiency levels that DOE is considering would violate the anti-backsliding requirement. Earthjustice commented that adding standby power consumption factors into the existing metrics reduces the stringency of each metric. Earthjustice provided an example for vented electric compact (120 V) clothes dryers in which the addition of the 2 W of standby power lowers the EF rating of the baseline efficiency level from 3.13 to 3.00. If DOE adopts efficiency level 1, with an IEF of 3.08, such a standard would violate EPCA's anti-backsliding provision. NRDC commented that if an existing vented electric compact (120V) clothes dryer model with electromechanical controls (which DOE has shown to consume no power in standby mode) has an EF of 3.10, it would be barred from the U.S. market by the existing standard. However, it would meet an IEF standard set at 3.08 (which DOE proposed as efficiency level 1 in the preliminary TSD). Earthjustice commented that implementing an IEF standard set at 3.08 would have the effect of decreasing the minimum required energy efficiency as is prohibited by the anti-backsliding provisions. (EJ, No. 28 at pp. 1–2; EJ, Public Meeting Transcript, No. 21.4 at p. 58) Earthjustice also commented that DOE's proposed approach to the integration of standby and off mode energy consumption into the performance standards for clothes dryers would require DOE to adopt standards that increase EF sufficiently to avoid violating EPCA's anti-backsliding provision. (EJ, No. 28 at p. 1)

EPCA contains what is commonly known as an "anti-backsliding" provision. This provision prohibits DOE from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product or equipment. (42 U.S.C. 6295(o)(1)) Congress also directed DOE to incorporate standby and off mode energy use in a single amended or new standard, or to prescribe a separate standard if such incorporation is not feasible, pursuant to 42 U.S.C. 6295(o). (42 U.S.C. 6295(gg)(3)) Today's final rule incorporates additional measures of energy consumption in the energy conservation standards for clothes dryers (that is, standby and off mode energy use). DOE notes that clothes dryers and room air conditioners that consume energy in standby and off modes have always used energy in these modes, and that today's final rule now accounts for that energy as directed by 42 U.S.C. 6295(gg). Given the Congressional directive to account for standby and off mode energy use, DOE does not believe that accounting for energy use in these modes could result in backsliding under 42 U.S.C. 6295(o)(1). In addition, DOE evaluated the clothes dryer TSLs to ensure that no product currently on the market could be determined compliant with the new energy conservation standards while consuming more energy in active mode than was allowable under the previous standards.

NPCC commented that the clothes dryer test procedure does not measure the efficiency improvement associated with improved automatic termination controls such as moisture sensing. NPCC stated that because moisture sensing would require switching from electromechanical controls to electronic controls, part of the incremental manufacturing cost associated with electronic controls would be accounted for in the improved automatic cycle termination design option. However, NPCC also stated that all clothes dryers have some form of automatic cycle termination for which the current test procedure uses a fixed field use factor. NPCC commented that because moisture sensing requires electronic controls and thus consumes standby power, the cost of the implementing electronic controls is inappropriately accounted for only in the standby power design options because the test procedure does not measure the efficiency improvement associated with moisture sensing. NPCC stated that part of the costs for implementing electronic controls should be accounted for in the costs associated with improved automatic cycle termination with moisture sensing. (NPCC, Public Meeting Transcript, No. 21.4 at pp. 58–60, 61–62) NPCC commented that if a product is receiving the 1.04 field use factor for automatic cycle termination, then the cost of that type of device (that is, the cost of electronic controls) needs to be in the baseline cost analysis. (NPCC, Public Meeting Transcript, No. 21.4 at p. 60)

DOE first notes that electronic controls are not required to implement automatic cycle termination. Clothes dryers are currently available on the market that use inputs from exhaust air temperature sensors to control or modify the length of the drying cycle without the use of electronic controls. For this reason, DOE did not include the cost of electronic controls in the baseline cost, unless the baseline product already incorporated electronic controls (such as, ventless electronic compact (240V) and ventless electric combination washer/dryers). As discussed below, DOE noted that baseline efficiency clothes dryers implement both electromechanical controls and electronic controls. As a result, DOE analyzed baseline efficiency products available on the market, and weighted the contribution of the 2 W baseline standby power as well as the efficiency improvement and incremental manufacturing cost for standby power design changes based on the percentage of baseline efficiency products that used electronic controls.

BSH commented that DOE should analyze and implement evenly distributed efficiency levels to help consumers make purchasing decisions. BSH also commented that the implementation of the proposed efficiency levels in the preliminary analyses would cause confusion to consumers. According to BSH, with a relatively small improvement in efficiency in the lower efficiency levels, a better rating can be achieved, and at the high end of the efficiency levels, much more effort must be taken to improve the rating. In addition, according to BSH, consumers will not support the higher efficiency level because they cannot see the advantage of paying a significantly higher price for a small change in product efficiency. (BSH, No. 23 at pp. 3–4) BSH also commented that DOE should use the same efficiency scale to analyze ventless and vented clothes dryers. According to BSH, ventless clothes dryers, especially those with heat pump technology, will be penalized by keeping a lower number of efficiency levels. (BSH, No. 23 at p. 4)

DOE notes that the efficiency levels analyzed for the preliminary analyses were derived from the distribution of efficiencies for products available on the market from data provided in the CEC and NRCan product databases. DOE also notes that the efficiency levels for the ventless clothes dryer product classes were based on product testing as well as scaling of the efficiency improvements associated with vented clothes dryer product classes. The efficiency levels analyzed are not being established for a product marketing classification system for consumers to make purchasing decisions (as is done in the European energy class system). As a result, DOE does not intend to create an energy class system for product marketing based on evenly distributed efficiency levels.

BSH commented that a separate classification of heat pump clothes dryers will not be possible because the European market shows large variation within this class of clothes dryers. According to BSH, heat pump clothes dryers in Europe differ by up to 40 percent in energy efficiency. (BSH, No. 23 at pp. 3–4) DOE notes that the efficiency levels established by DOE for the max-tech heat pump design are based on research and discussions with manufacturers. In addition, DOE does not intend to create a marketing classification system that would create a "heat pump" label from which consumers may perceive that all heat pump clothes dryers have the same efficiency. For these reasons, DOE continued to analyze the efficiency levels associated with heat pump clothes dryers presented in the preliminary analyses for today's direct final rule.

BSH commented that the gap between conventional and heat pump dryers is not filled with intermediate levels to show consumers the large improvement in efficiency they would be paying for when making purchasing decisions. (BSH, No. 23 at p. 6) DOE is not aware of products available on the market at efficiency levels between the maximum-available (on the U.S. market) efficiency levels and the max-tech heat pump efficiency level. In addition, DOE does not have any information indicating that design options are available that may be implemented to achieve efficiencies between the maximum-available and max-tech heat pump efficiency levels. As discussed above, DOE is not creating a marketing classification system for consumers to make purchasing decisions. As a result, DOE did not analyze additional intermediate efficiency levels between those associated with conventional and heat pump dryers.

Integrated Efficiency Levels—Final Rule

As discussed in section III.A, DOE recently published the TP Final Rule amending the clothes dryer test procedure. DOE conducted testing on a sample of representative clothes dryers to evaluate the effects of the amendments to the clothes dryer test procedure on the measured EF. As discussed in section III.A.3.a, DOE test results showed that the measured EF according to the amended test procedure resulted in an average increase of about 20.1 percent for vented electric standard clothes dryers. For vented gas clothes dryers, the measured EF increased by an average of about 19.8 percent. For vented electric compact-size 120V and 240V clothes dryers, the measured EF increased by an average of about 15.6 and 12.8 percent, respectively. For the ventless clothes dryer product classes, the preliminary analyses were based on the DOE test procedure with only the proposed amendments to for ventless clothes dryers. DOE also conducted testing according to the final amended test procedure (that is, including changes to the initial RMC, water temperature for test load preparation, etc.). Test results showed that for ventless electric compact 240V clothes dryers and ventless electric combination washer/dryers, the measured EF increased by an average of about 13.6 and 11.4 percent, respectively. DOE applied these results for each product class to adjust the active mode efficiency levels to account for the amendments to the DOE clothes dryer test procedure in the TP Final Rule. In addition, DOE revised the active mode efficiency level 1 for vented electric standard clothes dryers and vented gas clothes dryers from 3.10 EF to 3.11 EF and from 2.75 to 2.76 EF, respectively. The revisions were based on discussions with manufacturers and the efficiency improvement associated with the design options modeled by DOE. See chapter 5 of the direct final rule TSD for more details. DOE subsequently integrated the standby power efficiency levels to convert these EF values to CEF. For the preliminary analyses, DOE only incorporated incremental standby power levels into IEF efficiency levels above which electronic controls would be required as part of the active mode design option changes. At that point, DOE incorporated the incremental standby power levels where it determined them to be most cost effective. Chapter 5 of the direct final rule TSD provides details of the active mode and standby mode efficiency levels for each product class. The revised CEF efficiency levels for each product class are shown below in Table IV.14 through Table IV.16.

TABLE IV.14—CLOTHES DRYER INTEGRATED EFFICIENCY LEVELS (CEF)—VENTED PRODUCT CLASSES

Level	Efficiency level description	Integrated efficiency level (CEF) *lb/kWh*			
		Electric standard	Electric compact (120V)	Electric compact (240V)	Gas
Baseline	DOE Standard + 2.0 W Standby	3.55	3.43	3.12	3.14
1	DOE Standard + 1.5 W Standby	3.56	3.48	3.16	3.16
2	DOE Standard + 0.08 W Standby	3.61	3.61	3.27	3.20
3	Gap Fill + 0.08 W Standby	3.73	3.72	3.36	3.30
4	Gap Fill + 0.08 W Standby	3.81	3.80	3.48	3.42
5	Gap Fill/Maximum Available + 0.08 W Standby	4.08	4.08	3.60	3.61
6	Heat Pump (Max-Tech) + 0.08 W Standby	5.42	5.41	4.89	

TABLE IV.15—CLOTHES DRYER INTEGRATED EFFICIENCY LEVELS (CEF)—VENTLESS ELECTRIC COMPACT (240V)

Level	Efficiency level description	Integrated efficiency level (CEF) *lb/kWh*
		Electric compact (240 V)
Baseline	Baseline + 2.0 W Standby	2.55
1	Baseline + 1.5 W Standby	2.59
2	Baseline + 0.08 W Standby	2.69
3	Gap Fill + 0.08 W Standby	2.71
4	Gap Fill + 0.08 W Standby	2.80
5	Heat Pump (Max-Tech) + 0.08 W Standby	4.03

TABLE IV.16—CLOTHES DRYER INTEGRATED EFFICIENCY LEVELS (CEF)—VENTLESS ELECTRIC COMBINATION WASHER/DRYERS

Level	Efficiency level description	Integrated efficiency level (CEF) *lb/kWh*
		Electric combination washer/dryer
Baseline	Baseline + 2.0 W Standby	2.08
1	Gap Fill + 2.0 W Standby	2.35
2	Gap Fill + 1.5 W Standby	2.38
3	Gap Fill + 0.08 W Standby	2.46
4	Gap Fill + 0.08 W Standby	2.56
5	Heat Pump (Max-Tech) + 0.08 W Standby	3.69

Cost-Efficiency Results—Preliminary Analysis

For the preliminary analysis, DOE first analyzed design options separately for active mode and standby mode and developed the cost-efficiency relationships based on product teardowns and cost modeling. Details of the active mode and standby mode cost-efficiency relationships for each product class are presented in chapter 5 of the preliminary TSD. DOE then developed overall cost-efficiency relationships for the IEF efficiency levels presented in the preliminary analyses. Table IV.17 through Table IV.22 shows DOE's estimates of incremental manufacturing cost for improvement of clothes dryer IEF above the baseline. Also shown below are the technologies DOE analyzed for each efficiency level to develop incremental manufacturing costs. Detailed descriptions of the design options associated with each efficiency level are also presented in chapter 5 of the preliminary TSD. DOE used an efficiency level approach, noting that different manufacturers may implement different design changes to achieve certain efficiency levels.

TABLE IV.17—PRELIMINARY ANALYSIS: COST-EFFICIENCY RELATIONSHIP FOR VENTED ELECTRIC STANDARD CLOTHES DRYERS

Integrated efficiency level (IEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (2.96)	DOE Standard + 2.0 W Standby	$0
1 (3.04)	DOE Standard + Change in Airflow Patterns, Dedicated Heater Duct, Open-Cylinder Drum.	11.89
2 (3.10)	IEL 2 + Inlet Air Pre-Heating	63.56
3 (3.33)	IEL 2 + Modulating Heat	97.48
4 (3.35)	IEL 3 + 1.5 W Standby	98.78
5 (3.40)	IEL 3 + 0.08 W Standby	98.14
6 (4.52)	Heat Pump + 0.08 W Standby	259.13

TABLE IV.18—PRELIMINARY ANALYSIS: COST-EFFICIENCY RELATIONSHIP FOR VENTED ELECTRIC COMPACT (120V) CLOTHES DRYERS

Integrated efficiency level (IEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (3.00)	DOE Standard + 2.0 W Standby	$0
1 (3.08)	DOE Standard + Change in Airflow Patterns, Dedicated Heater Duct, Open-Cylinder Drum.	10.95
2 (3.15)	IEL 2 + Inlet Air Pre-Heating	63.37
3 (3.37)	IEL 2 + Modulating Heat	96.45
4 (3.41)	IEL 3 + 1.5 W Standby	97.75
5 (3.53)	IEL 3 + 0.08 W Standby	97.11
6 (4.69)	Heat Pump + 0.08 W Standby	246.35

TABLE IV.19—PRELIMINARY ANALYSIS: COST-EFFICIENCY RELATIONSHIP FOR VENTED ELECTRIC COMPACT (240V) CLOTHES DRYERS

Integrated efficiency level (IEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (2.79)	DOE Standard + 2.0 W Standby	$0
1 (2.86)	DOE Standard + Change in Airflow Patterns, Dedicated Heater Duct, Open-Cylinder Drum.	10.95
2 (2.96)	IEL 2 + Inlet Air Pre-Heating	63.37
3 (3.06)	IEL 2 + Modulating Heat	96.45
4 (3.10)	IEL 3 + 1.5 W Standby	97.75
5 (3.19)	IEL 3 + 0.08 W Standby	97.11
6 (4.34)	Heat Pump + 0.08 W Standby	246.35

TABLE IV.20—PRELIMINARY ANALYSIS: COST-EFFICIENCY RELATIONSHIP FOR VENTED GAS CLOTHES DRYERS

Integrated efficiency level (IEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (2.63)	DOE Standard + 2.0 W Standby	$0
1 (2.71)	DOE Standard + Change in Airflow Patterns, Dedicated Heater Duct, Open-Cylinder Drum.	14.79
2 (2.80)	IEL 2 + Inlet Air Pre-Heating	65.36
3 (2.97)	IEL 2 + Modulating Heat	156.01
4 (2.98)	IEL 3 + 1.5 W Standby	157.31
5 (3.02)	IEL 3 + 0.08 W Standby	156.67

TABLE IV.21—PRELIMINARY ANALYSIS: COST-EFFICIENCY RELATIONSHIP FOR VENTLESS ELECTRIC COMPACT (240V) CLOTHES DRYERS

Integrated efficiency level (IEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (2.29)	Baseline + 2.0 W Standby	$0
1 (2.31)	Baseline + 1.5 W Standby	1.30
2 (2.37)	Baseline + 0.08 W Standby	0.66

TABLE IV.21—PRELIMINARY ANALYSIS: COST-EFFICIENCY RELATIONSHIP FOR VENTLESS ELECTRIC COMPACT (240V) CLOTHES DRYERS—Continued

Integrated efficiency level (IEF), *lb/kWh*	Technology	Incremental manufacturing cost
3 (2.39)	IEL 2 + Change in Airflow Patterns, Open-Cylinder Drum	13.01
4 (2.59)	IEL 3 + Modulating Heat	69.02
5 (3.54)	Heat Pump + 0.08 W Standby	216.37

TABLE IV.22—PRELIMINARY ANALYSIS: COST-EFFICIENCY RELATIONSHIP FOR VENTLESS ELECTRIC COMBINATION WASHER/DRYERS

Integrated efficiency level (IEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (1.90)	Baseline + 2.0 W Standby	$0
1 (2.15)	Baseline + 2.0 W Standby + Baseline Automatic Termination	0.81
2 (2.34)	IEL 1 + Modulating Heat	54.04
3 (2.36)	IEL 2 + 1.5 W Standby	55.34
4 (2.42)	IEL 2 + 0.08 W Standby	54.70
5 (3.31)	Heat Pump + 0.08 W Standby	230.83

DOE received comments from interested parties on the whether the baseline clothes dryer manufacturing costs should be adjusted to reflect the cost of complying with the Underwriters Laboratory (UL) Standard 2158 "Electric Clothes Dryers" (UL 2158) fire containment requirements. AHAM commented that it would need to look into and understand how the fire containment regulation in UL 2158 would affect the cost similar to the refrigerant change from R–22 to R–410a for room air conditioners. (AHAM, Public Meeting Transcript, No. 21.4 at p. 153) AHAM commented that when manufacturers submitted incremental clothes dyer manufacturing cost estimates to DOE in late 2008, costs to comply with UL 2158 were not included. According to AHAM, while the new UL requirements may not directly impact energy efficiency, the requirements place significant cumulative regulatory burden on clothes dryer manufacturers. AHAM commented that DOE should evaluate an additional step for clothes dryers, where the costs to implement the UL fire containment requirements are incorporated into the baseline analysis, similar to the approach used to evaluate the phase-out of R–22 to R–410A for room air conditioners. AHAM commented that DOE should evaluate these costs through manufacturer interviews and determine how this cost affects the incremental costs to reach higher efficiency. (AHAM, No. 25 at p. 5) DOE notes that it attempted to obtain data on the incremental manufacturing cost associated with complying with the fire containment requirements in UL 2158 during manufacturing interviews. While manufacturers noted that different manufacturers will be required to make different changes to their product design to meet the fire containment requirements, DOE did not receive sufficient data to determine the incremental manufacturing costs to baseline clothes dryers to comply with the fire containment requirements of UL 2158. In addition, DOE did not receive sufficient information to indicate that the cost associated with complying with UL 2158 would vary at efficiency levels above the baseline. As a result, DOE did not include additional cost to comply with UL 2158 in the baseline manufacturing production cost. As discussed below in section IV.I.3.b, DOE has investigated the costs of complying with the fire containment requirements in UL 2158 in the cumulative regulatory burden for the MIA.

Cost-Efficiency Results—Final Rule

For today's final rule, DOE updated the cost-efficiency analysis from the preliminary analyses by updating the costs of raw materials and purchased components, as well as updating costs for manufacturing equipment, labor, and depreciation.

In addition, based on discussions with clothes dryer manufacturers, DOE revised the design options analyzed for each integrated efficiency level in the preliminary analyses. Based on these discussions, DOE believes that manufacturers would apply a two-stage modulating heater design (which would also require moisture sensing and multi-speed airflow) to achieve integrated efficiency level 4 for all clothes dryer product classes. In addition, based on discussions with manufacturers, DOE believes that inlet-air preheating (which would require better airflow control and more advanced control systems), along with the design options for the lower efficiency levels (that is, changes in airflow patterns, open cylinder drum, dedicated heater duct, two-stage modulating heat, and standby power changes), would be applied to achieve integrated efficiency level 5 (maximum-available) for vented clothes dryer product classes. As a result, the max-tech efficiency level for vented gas clothes dryers would correspond to inlet air pre-heating.

As discussed above, DOE also believes that the low cost of the standby power design options should result in these technologies being included in the initial efficiency levels above the baseline. As a result, DOE revised the order of the design options and efficiency levels presented in the preliminary analyses. As discussed above in this section, DOE previously incorporated incremental standby power levels into integrated efficiency levels above which electronic controls would be required as part of the active mode design option changes. At that point, DOE incorporated the incremental standby power levels where it determined them to be most cost effective. For today's final rule, DOE applied the standby power levels immediately above the baseline level because they were determined to be the most cost-effective design option. The revised order of design options are shown below in Table IV.23 through

Table IV.28. DOE also noted that for the integrated efficiency levels where electronic controls are not required for the design changes, the standby power level changes would impact only those clothes dryers that consume standby power, that is, those products with electronic controls. As a result, DOE analyzed baseline efficiency products available on the market, and weighted the efficiency improvement and incremental manufacturing cost based on the percentage of baseline efficiency products that have electronic controls.[36] For the integrated efficiency levels for which electronic controls would be required as part of the active mode design changes, DOE assumed that the standby power levels and incremental manufacturing costs affected 100 percent of clothes dryer models.

Table IV.23 through Table IV.28 shows the cost-efficiency results, along with the technologies DOE analyzed for each efficiency level to develop incremental manufacturing costs. Details of the cost-efficiency analysis and descriptions of the technologies associated with each design change are presented in chapter 5 of the direct final rule TSD.

TABLE IV.23—COST-EFFICIENCY RELATIONSHIP FOR VENTED ELECTRIC STANDARD CLOTHES DRYERS

Integrated efficiency level (CEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (3.55)	DOE Standard + 2.0 W Standby	$0
1 (3.56)	DOE Standard + 1.5 W Standby	0.68
2 (3.61)	DOE Standard + 0.08 W Standby	0.82
3 (3.73)	IEL 2 + Change in Airflow Patterns, Dedicated Heater Duct, Open-Cylinder Drum	8.74
4 (3.81)	IEL 3 + 2-Stage Modulating Heat	50.67
5 (4.08)	IEL 4 + Inlet Air Pre-Heating	88.89
6 (5.42)	Heat Pump + 0.08 W Standby	280.54

TABLE IV.24—COST-EFFICIENCY RELATIONSHIP FOR VENTED ELECTRIC COMPACT (120V) CLOTHES DRYERS

Integrated efficiency level (CEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (3.43)	DOE Standard + 2.0 W Standby	$0
1 (3.48)	DOE Standard + 1.5 W Standby	0.68
2 (3.61)	DOE Standard + 0.08 W Standby	0.82
3 (3.72)	IEL 2 + Change in Airflow Patterns, Dedicated Heater Duct, Open-Cylinder Drum	21.46
4 (3.80)	IEL 3 + 2-Stage Modulating Heat	62.76
5 (4.08)	IEL 4 + Inlet Air Pre-Heating	109.31
6 (5.41)	Heat Pump + 0.08 W Standby	267.48

TABLE IV.25—COST-EFFICIENCY RELATIONSHIP FOR VENTED ELECTRIC COMPACT (240V) CLOTHES DRYERS

Integrated efficiency level (CEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (3.12)	DOE Standard + 2.0 W Standby	$0
1 (3.16)	DOE Standard + 1.5 W Standby	0.68
2 (3.27)	DOE Standard + 0.08 W Standby	0.82
3 (3.36)	IEL 2 + Change in Airflow Patterns, Dedicated Heater Duct, Open-Cylinder Drum	21.46
4 (3.48)	IEL 3 + 2-Stage Modulating Heat	62.76
5 (3.60)	IEL 4 + Inlet Air Pre-Heating	109.31
6 (4.89)	Heat Pump + 0.08 W Standby	267.48

TABLE IV.26—COST-EFFICIENCY RELATIONSHIP FOR VENTED GAS CLOTHES DRYERS

Integrated efficiency level (CEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (3.14)	DOE Standard + 2.0 W Standby	$0
1 (3.16)	DOE Standard + 1.5 W Standby	0.68
2 (3.20)	DOE Standard + 0.08 W Standby	0.82
3 (3.30)	IEL 2 + Change in Airflow Patterns, Dedicated Heater Duct, Open-Cylinder Drum	9.12
4 (3.42)	IEL 3 + 2-Stage Modulating Heat	72.32
5 (3.61)	IEL 4 + Inlet Air Pre-Heating	109.98

[36] DOE's review of currently available models with baseline efficiency showed that roughly 74 percent of models have electronic controls.

TABLE IV.27—COST-EFFICIENCY RELATIONSHIP FOR VENTLESS ELECTRIC COMPACT (240V) CLOTHES DRYERS

Integrated efficiency level (CEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (2.55)	Baseline + 2.0 W Standby	$0
1 (2.59)	Baseline + 1.5 W Standby	0.93
2 (2.69)	Baseline + 0.08 W Standby	1.11
3 (2.71)	IEL 2 + Change in Airflow Patterns, Open-Cylinder Drum	26.42
4 (2.80)	IEL 3 + 2-Stage Modulating Heat	57.80
5 (4.03)	Heat Pump + 0.08 W Standby	242.36

TABLE IV.28—COST-EFFICIENCY RELATIONSHIP FOR VENTLESS ELECTRIC COMBINATION WASHER/DRYERS

Integrated efficiency level (CEF), *lb/kWh*	Technology	Incremental manufacturing cost
Baseline (2.08)	Baseline + 2.0 W Standby	$0
1 (2.35)	Baseline + 2.0 W Standby + Baseline Automatic Termination	1.51
2 (2.38)	IEL 1 + 1.5 W Standby	2.44
3 (2.46)	IEL 2 + 0.08 W Standby	2.62
4 (2.56)	IEL 3 + 2-Stage Modulating Heat	31.69
5 (3.69)	Heat Pump + 0.08 W Standby	297.54

b. Room Air Conditioners

During the preliminary analysis, DOE performed the room air conditioner engineering analysis as follows:

• Reverse engineering and teardown for 21 room air conditioners across 6 product classes.

• Interviews with room air conditioner manufacturers to obtain greater insight into design strategies and their associated costs to improve efficiency, including designs incorporating R–410A refrigerant.

• Energy modeling for room air conditioner designs using R–410A refrigerant.

DOE selected teardown products covering the range of available efficiency levels at a group of selected capacities. The products selected for teardown were designed for HCFC–22 refrigerant because DOE conducted this work before the January 1, 2010 phaseout of this refrigerant for new products was required. 74 FR 66450 (Dec. 19, 2009) DOE modeled the 21 HCFC–22 teardown units to calibrate the model before modeling the R–410A efficiency levels. DOE also identified one R–410A room air conditioner during the preliminary analysis and analyzed it in the reverse engineering analysis.

From these analyses, DOE produced R–410A cost-efficiency curves for each of the analyzed product classes. Details of the engineering analysis are provided in the direct final rule TSD chapter 5.

DOE received several comments from interested parties on its approach to the engineering analysis, as described below. Stakeholders commented on (1) the availability of R–410A products and data for incorporation into the engineering analysis, and (2) limitations on the maximum size of room air conditioners.

Conversion to R–410a

During the preliminary analysis public meeting, DOE requested comments on the approach for the engineering analysis for room air conditioners, specifically on the use of both energy modeling and manufacturer cost modeling. DOE explained that this was the best approach for the preliminary engineering analysis. An efficiency level analysis based on only teardowns of specific products at different efficiency levels would have been based on HCFC–22 and would not have been representative of the R–410A products that would be available on the compliance date for the rule.

ACEEE suggested that DOE's analysis should be updated due to the transition from HCFC–22 refrigerant (ACEEE, No. 24 at p. 4). ACEEE and the California Utilities recommended that DOE revise its analysis using current R–410A models for product teardowns, as it would enable DOE to more accurately determine the energy use of new room air conditioners (ACEEE, No. 24 at p. 4; California Utilities, No. 31 at p. 17). In addition, the California Utilities recommended that DOE conduct testing of products that contain R–410A refrigerant. (California Utilities, No. 31 at p. 17)

During the preliminary analysis phase of this rulemaking, DOE indicated that there was only one R–410A product available on the market for analysis. Subsequently, however, DOE examined information associated with commercialized R–410A products and made appropriate adjustments based on the new information, as described below.

In the engineering analysis supporting today's final rule, DOE purchased and conducted teardowns on four R–410A products to update and validate the analysis performed during the preliminary analysis. Table IV.29 lists the R–410A products used. DOE focused this effort on the largest and most efficient units.

TABLE IV.29—R–410A ROOM AIR CONDITIONERS SELECTED FOR TEARDOWN

Product class	Capacity *Btu/hr*	EER
1	5000	9.7
2	6,000	12.0
3	12,000	10.8
5B	28,500	8.5

The new information obtained from the four R–410A product teardowns, and examination of product information of available R–410A products, confirmed that the baseline product designs, design option costs, and design pathways chosen during the preliminary analysis, developed based on teardowns of HCFC–22 units, provided accurate results for calculating the cost-efficiency curves for R–410A designs.

SCE noted that a study conducted by NIST for split systems indicated that R–410A dropped in efficiency compared with R–22 only in systems with condensing temperatures above 95 °F.

(SCE, Public Meeting Transcript, No. 21.4 at p. 69)

DOE notes that its modeling of room air conditioners indicates that they operate with condensing temperatures between 110 °F and 130 °F under DOE test conditions, depending on the sizes of the heat exchangers. DOE's analysis confirms that the impact of the switch to R–410A is more severe as condensing temperatures increase above 95 °F, and that additional improvements in efficiency (larger heat exchangers, more efficient components, and similar improvements) are required to reach comparable efficiencies to HCFC–22. Energy modeling of R–410A and HCFC–22 room air conditioners shows that a system modeled with HCFC–22 experiences an efficiency reduction if a "drop-in" of R–410A is considered (that is, switch refrigerant and make no other system changes).

As discussed previously, DOE conducted the engineering analysis based on use of R–410A refrigerant. DOE sought information on the performance of R–410A rotary compressors of varying efficiency levels for all of the products under analysis. In many cases, the range of efficiency for which compressor vendors were able to provide performance data was limited. Because conducting the analysis generally required knowledge not just of design point capacity and EER, DOE requested performance data for a representative range of evaporating and condensing conditions. In some cases, the trends of compressor performance as a function of operating conditions were extrapolated from the trends exhibited by a compressor of the same refrigerant of nearly the same capacity. During the preliminary analysis, DOE considered the available performance data for R–410A rotary compressors, noting that discussions with compressor vendors revealed that many vendors were still developing their R–410A compressor lines and could only provide preliminary data. The compressors for which performance data was available varied significantly in EER, depending on their capacity. DOE did not consider increases in compressor efficiency as a design option, because no higher-efficiency compressor data was available.

The California Utilities commented that concern over the cost and availability of R–410A compressors may be mitigated as designs and efficiency of these compressors improve, and as the market grows and availability of compressors increases. (California Utilities, No. 31 at p. 17) EEI asked whether DOE conducted testing on R–410A compressors during its analysis. (EEI, Public Meeting Transcript, No. 21.4 at pp. 67–68)

DOE did not conduct tests on R–410A compressors during the engineering analysis, but has no reason to believe that the manufacturers' performance data is incorrect. During the final rule analyses, however, DOE obtained additional data regarding R–410A compressor performance and did consider EER improvement, as described below.

During interviews conducted during the final rule phase of today's final rule, individual manufacturers reported that vendor selections of R–410A rotary compressors were still limited, and that compressor vendors, where they had once offered up to three different efficiency tiers of compressors, now only offered one or two tiers. One manufacturer reported a need to source from many different vendors to achieve performance goals. Individual manufacturers identified 10 EER as the maximum available efficiency for R–410A compressors, but reported testing of higher efficiency compressors.

DOE also reviewed R–410A compressor options available on compressor vendors' Web sites, and also contacted compressor vendors to discuss their current R–410A compressor options.

In the analysis for today's final rule, DOE added a design option to its engineering analysis for increasing compressor efficiency to the identified maximum compressor EER level.

During the preliminary analysis, DOE sought information on the performance of R–410A rotary compressors of varying efficiency levels for all of the products under analysis. In many cases, the range of efficiency for which vendors provided performance data for R–410A compressors was limited. In most cases, compressor vendors had developed sufficiently for use in products compressors at only one efficiency level at each of the relevant capacities that DOE examined. These efficiency levels varied widely, depending on the available compressors. Due to the lack of maturity of the R–410A rotary compressor market at that time, DOE could not confidently project that higher efficiency levels would be made available.

During the final rule analysis, DOE again reviewed the R–410A compressor market and the available compressors and found that many more R–410A rotary compressor options at varying efficiency levels had been developed. The highest available nominal EER for R–410A rotary compressors with capacities less than 18,000 Btu/h is 10 EER, while the highest available EER for compressors with capacities greater than 18,000 Btu/h is 10.3 EER. Interviews with individual manufacturers supported these observations.

Consequently, DOE has concluded that 10 EER is a reasonable maximum available EER for rotary R–410A compressors in capacities suitable for product classes 1 (room air conditioners without reverse cycle, with louvered sides, and capacity less than 6,000 Btu/h); 3 (room air conditioners without reverse cycle, with louvered sides, and capacities 8,000 to 13,999 Btu/h); 8A (room air conditioners without reverse cycle, without louvered sides, and capacities 8,000 to 10,999 Btu/h); and 8B (room air conditioners without reverse cycle, without louvered sides, and capacities 11,000 to 13,999 Btu/h). Also, DOE concluded that 10.3 EER is a reasonable maximum available EER for rotary R–410A compressors in capacities suitable for product classes 5A (room air conditioners without reverse cycle, with louvered sides, and capacities 20,000 to 27,999 Btu/h) and 5B (room air conditioners without reverse cycle, with louvered sides, and capacity 28,000 Btu/h or more). Thereby, DOE selected 10.0 EER as the maximum EER compressor level for the analysis of product classes 1, 3, 8A, and 8B; and 10.3 EER as the maximum compressor level for the analysis of product classes 5A and 5B.

During the analysis for today's final rule, in cases where compressor data was unavailable for the two maximum EER levels selected by DOE (as discussed above), the trends of compressor performance as a function of operating conditions were extrapolated. Compressor performance was extrapolated from the trends exhibited by a compressor currently offered on the market that used the same refrigerant of nearly the same capacity. DOE extrapolated compressor data for 10 EER compressors from similar compressors with ratings ranging from 9.4 EER to 9.7 EER, and compressor data for 10.3 EER compressor from similar compressor with 10 EER ratings. DOE noted the rapid pace of development of R–410A compressors (over the course of this rulemaking); manufacturer interviews suggested that this rapid development is on-going and is likely to continue. Thus, the data suggests that manufacturers will be able to incorporate R–410A rotary compressors of capacities for which data was not available into air conditioners by the new energy standard's compliance date in 2014. DOE notes that compressors at the selected max-tech EER levels (for some capacity levels analyzed) are already available on the market, and some products may already use these compressors. DOE has determined that such compressors are currently manufactured at many more capacity levels than were observed during the preliminary analysis. Additional details of this analysis are available in chapter 5 of the direct final rule TSD.

The greater availability of rotary compressors also caused DOE to eliminate consideration of scroll compressors. DOE had used scroll compressors as a design option during the preliminary analysis. However, the higher EER of high-capacity rotary compressors that are now available shifts the economic attractiveness of scroll compressor technology such that it is no longer cost effective.

Size Increases

In the preliminary analysis, DOE considered chassis size increases to increase the efficiency of window units, which corresponded to product classes 1, 3, and 5. DOE believes increases in coil frontal area and package size are among the primary factors contributing to EER improvements in the higher-efficiency teardown units for product classes 1, 3, and 5.

DOE selected baseline, medium, and large chassis sizes based on the range of sizes of available room air conditioners. DOE did not consider chassis size increases beyond the range of available products, and considered both the physical volume and the weight of the unit. DOE performed cost modeling and energy modeling of these larger chassis sizes to calculate cost and efficiency impacts due to chassis size increases, based on product teardowns.

During the preliminary analysis public meeting, DOE requested comment on the approach for determining appropriate maximum sizes for different product classes and capacities. DOE received stakeholder comments on both non-louvered room air conditioner sizes and louvered room air conditioner sizes.

Non-Louvered Room Air Conditioner Sizes

PG&E commented that the size of through-the-wall room air conditioners (products without louvers) would not necessarily be constrained if allowed to project into the outdoor space. (PG&E, Public Meeting Transcript, No. 21.4 at p. 77) In response, GE stated that existing wall sleeves do not allow for additional growth in depth, and through-the-wall units are typically slid into an existing wall sleeve. (GE, Public Meeting Transcript, No. 21.4 at p. 77) To achieve additional depth, the existing wall sleeve would need to be replaced. AHAM also noted that while additional heat exchanger coils may increase efficiency, placing these coils too deep within the unit will actually decrease the heat transfer efficiency. (AHAM, No. 25 at p. 7)

DOE did not consider chassis size growths as a design option for product class 8 (room air conditioners without reverse cycle, without louvered sides, and capacities 8,000 to 13,999 Btu/h) in the preliminary analysis. According to manufacturer interviews, the majority of non-louvered products are replacement products that must fit into existing building sleeves. Building sleeves are often built into the existing structure and are fixed components. Replacing them would require altering the size of the opening, which would generally be cost-prohibitive. Due to these constraints, replacement products must fit into existing sleeves, which clearly limit product height and width. Increases in product depth can be limited by the design of the sleeve, and consumers may be unwilling to accept products that extend further into the interior. DOE also notes that any increases in product depth would present very limited potential in improvement, because it would not allow for the unit's heat exchangers to grow in width or height.

For these reasons, DOE has chosen to retain the preliminary analysis assumption for non-louvered products that size increase cannot be used to increase efficiency.

Louvered Room Air Conditioner Sizes

DOE received the following comments from stakeholders on room air conditioner sizes for louvered products. AHAM commented that there are a range of product depths and weights, which may suggest that increased depths and weights may be feasible. (AHAM, No. 25 at pp. 6–7) AHAM noted, however, that UL requirements are an issue when considering increases in room air conditioner depth, as the units require that mounting brackets be designed to ensure that the room air conditioner remains in the window. Ensuring that these brackets are used in each installation can be a potential safety concern, in particular for smaller units installed by consumers. *Id.* AHAM also noted that smaller products (especially those in product classes 1 (room air conditioners without reverse cycle, with louvered sides, and capacities less than 6,000 Btu/h) and 2 (room air conditioners without reverse cycle, with louvered sides, and capacities 6,000 to 7,999 Btu/h)) would be most negatively impacted by an increase in weight. AHAM indicated that the Occupational Safety and Health Administration (OSHA) recommends an additional person for lifting and installing products weighing over 50 lbs. AHAM stated that the 50-lb. limit is expected to influence consumer acceptance of these products. *Id.*

NPCC recommended that DOE compare the maximum unit dimensions in each analyzed product class to the dimensions of the highest efficiency model available on the market. (NPCC, No. 32 at pp. 4–5) NPCC recommended that, if these two product dimensions are similar, DOE assume that all units can be equally as large. NPCC also recommended that, if the market unit is smaller than the unit proposed by DOE, that DOE determine whether a redesign of the proposed unit would eliminate the size constraint. (Id.) DOE received no additional stakeholder comments addressing maximum acceptable product sizes for louvered products.

DOE has chosen to use the 50-lb. weight limitation for product class 1 (room air conditioners without reverse cycle, without louvered sides, and capacities less than 6,000 Btu/h). The National Institute for Occupational Safety and Health (NIOSH) and OSHA guidance recommends against handling loads greater than 50 lbs. for a single person. NIOSH lists among its hazard evaluation checklist the handling of loads exceeding 50 lbs. as a risk factor used to identify potential problems.[37] OSHA, in its "Ergonomics eTool: Solutions for Electrical Contractors," states that lifting loads heavier than 50 lbs will increase the risk of injury, and recommends use of more than one person to lift weights larger than 50 lbs.[38] These guidelines calling for additional personnel for product lifting represent distinct changes in consumer utility for products that currently weigh less than 50 lbs. This would not be true for products that already exceed this limit. DOE notes that all but the smallest room air conditioners weigh more than 50 lbs. The baseline R–410A designs of the analyses were all determined to have weights greater than this limit, except for product class 1 (room air conditioners without reverse cycle, with louvered sides, and capacities less than 6,000 Btu/h). DOE adjusted the analysis for product class 1 to limit its weight to 50 lbs., but did not make similar adjustments for any of the other product classes. Additional details regarding these adjustments for the product class

[37] *http://www.cdc.gov/niosh/docs/2007-131/.*

[38] *http://www.osha.gov/SLTC/etools/electricalcontractors/materials/heavy.html.*

1 analysis is presented in chapter 5 of the direct final rule TSD.

For the other product classes with louvered sides, the maximum height and width considered is consistent with these dimensions for max-tech available products. These are the dimensions that determine that available size for heat exchangers; DOE's analysis of product classes with louvered sides contains heat exchangers with the same dimensions as max-tech available units. DOE observed that all max-tech products for room air conditioners are produced primarily by one manufacturer, and that the depth of these max-tech available products was much greater in proportion to other dimensions than the depths observed in other manufacturers' products. DOE's analysis indicated that depths consistent with the proportions observed in these other manufacturers' non-max-tech products are sufficient to provide max-tech performance. In particular, DOE's analysis indicated that the smaller depth was enough to achieve the requisite condenser airflow, enabling appropriate heat transfer by the larger heat exchangers. Thus, DOE's analyses did not use the larger product depths observed in the max-tech available products. Instead, DOE used smaller product depths, consistent with the proportions observed in other products. This approach was adopted for product classes 3 (room air conditioners without reverse cycle, with louvered sides, and capacities 8,000 to 13,999 Btu/h); 5A (room air conditioners without reverse cycle, with louvered sides, and capacities 20,000 to 27,999 Btu/h); and 5B (room air conditioners without reverse cycle, with louvered sides, and capacities 28,000 Btu/h or more). Additional details of this analysis are available in chapter 5 of the direct final rule TSD.

Engineering Analysis Adjustments

A summary table of the key adjustments made to the product class structure and the engineering analysis during the final rule phase of the rulemaking is presented in Table IV.30.

TABLE IV.30—SUMMARY OF KEY ADJUSTMENTS TO THE ENGINEERING ANALYSIS FOR ROOM AIR CONDITIONERS

Parameter	Preliminary	Changes for the direct final rule
Product Classes	No changes considered	Split of product classes 5 and 8 into two product classes each (5A, 5B, 8A, 8B) based on stakeholder comments.
Compressor Efficiency	Based on available compressor data during preliminary analysis.	Max-efficiency increased to 10 EER for product classes 1, 3, 8A, and 8B, and 10.3 EER for product classes 5A and 5B.
50 lbs Limit	Not considered	Introduced a 50 lb weight limit for the analysis of design options for product class 1.
Chassis Sizes for Louvered Products	Based on analysis of HCFC–22 units	Adjusted based on additional market research and teardowns of R–410A units.
Scroll Compressors	Considered for product class 5 analysis	Not considered, since they provide no additional improvement over 10.3 EER rotary compressors, and are much more expensive. This design option is less cost-effective than the design options selected by DOE for analysis, so it was not considered.

D. Markups Analysis

The markups analysis develops appropriate markups in the distribution chain to convert the estimates of manufacturer cost derived in the engineering analysis to consumer prices. At each step in the distribution channel, companies mark up the price of the product to cover business costs and profit margin. DOE estimated the markups associated with the main parties in the distribution channel. For clothes dryers and room air conditioners, these are manufacturers and retailers.

DOE developed an average manufacturer markup by examining the annual Securities and Exchange Commission (SEC) 10–K reports filed by four publicly traded manufacturers primarily engaged in appliance manufacturing and whose combined product range includes residential clothes dryers and room air conditioners.

For retailers, DOE developed separate markups for baseline products (baseline markups) and for the incremental cost of more-efficient products (incremental markups). Incremental markups are coefficients that relate the change in the manufacturer sales price of higher-efficiency models to the change in the retailer sales price.

Commenting on the preliminary TSD, AHAM filed comments that criticized DOE's application of "incremental" markups to the incremental manufacturer selling price of products more efficient than the baseline products. (AHAM, No. 25 at p. 3) In Exhibit B accompanying this comment, AHAM stated that (1) DOE provides no empirical evidence to validate that retailers obtain only incremental markups on products with greater features and costs; and (2) DOE is asserting a normative approach without any support showing that its model reflects actual retail practices. These comments criticized two of the key assumptions in DOE's theoretical construct: (1) That the costs incurred by appliance retailers can be divided into costs that vary in proportion to the MSP (variable costs), and costs that do not vary with the MSP (fixed costs); (2) that retailer prices vary in proportion to retailer costs included in the balance sheets.

Regarding the first assumption, AHAM stated that DOE has offered no evidence that the fixed/variable cost mix of a retailer has anything to do in practice with the markups that will be earned by a retailer on products that meet a new energy conservation standard. It added that DOE uses an incorrect analogy to HVAC contractors as a basis for considering the costs of a retailer, and that DOE did not analyze the actual drivers of retail costs. The retail cost structure has considerably different characteristics than those of an HVAC contractor. AHAM stated that DOE has not presented any data or analysis that would yield a fixed versus variable cost allocation applicable to retailers. Regarding DOE's second assumption, AHAM stated that DOE's approach depends on the presence of a relatively high level of competition in the retail industry. AHAM presented data showing that the four firm concentration ratio (FFCR) of the sectors that sell major appliances ranges from 42 to 65 percent, which does not support DOE's assumption of a high level of competition in the retail industry.[39]

In conclusion, AHAM viewed DOE's incremental markup approach as lacking a credible theoretical underpinning and demonstrated reliability and asserted that the data required for the approach are not available. AHAM stated that DOE should return to its traditional practice of using average markups for both the baseline products and for the added costs of efficiency improvements. In AHAM's view, the stability of markups in the retailing sectors leads to the reasonable inference that such markups will continue and apply to higher-efficiency products in the future when they become the bulk of sales under amended standards. (AHAM, No. 34, Exhibit B, p. 12)

In response to the above comments, DOE extensively reviewed its incremental markup approach. DOE assembled and analyzed relevant data from other retail sectors and found that empirical evidence is lacking with respect to appliance retailer markup practices when a product increases in cost due to increased efficiency or other factors. DOE understands that real-world retailer markup practices vary depending on market conditions and on the magnitude of the change in cost of goods sold (CGS) associated with an increase in appliance efficiency.

Given this uncertainty with respect to actual markup practices in appliance retailing, DOE uses an approach that reflects two key concepts. First, changes in the efficiency of the appliances sold are not expected to increase retailers' economic profits. Thus, DOE calculates markups/gross margins to allow cost recovery for retailers (including changes in the cost of capital) without changes in company profits. Second, efficiency improvements only impact some distribution costs. DOE sets markups to cover only the variable costs expected to change with efficiency.

Market competition is another reason why DOE believes that profit margins would not change in a significant way. Regarding AHAM's assertion that the degree of competition in appliance retailing is not sufficient to support DOE's model, DOE believes that AHAM's measure of competition is inaccurate. AHAM measured the FFCR of three retail channels: Electronics and appliance stores, building material and supplies dealers, and general merchandise stores. These values represent competitiveness within each sector, but clothes dryers and room air conditioners are sold across all three sectors, preventing major retailers in each sector from exercising significant market power. To properly measure the competitiveness within appliance retailing, DOE believes that one should measure the FFCR for only the appliance subsector within the above channels and accordingly estimated the "appliance sales" FFCR as equal to the sector FFCR times the percent of appliance sales within each sector. DOE estimated that these sub-sector FFCRs are under the 40 percent threshold. Furthermore, "Household Appliance Stores," a subsector of the electronics and appliance stores sector that specifically represents appliance retailers, rather than computer or other electronics stores, has an FFCR of 17 percent, signifying an unconcentrated sector.

DOE's separation of operating expenses into fixed and variable components to estimate an incremental markup follows from the above concepts. In separating retailer costs, DOE did not directly use information from the HVAC contractor industry. Instead, DOE defined fixed expenses as including labor and occupancy expenses because these costs are not likely to increase as a result of a rise in CGS due to amended efficiency standards. All other expenses, as well as the net profit, are assumed to vary in proportion to the change in CGS. DOE's method results in an outcome in which retailers are assumed to cover their costs while maintaining their profit margins when the CGS of appliances changes. DOE seeks additional information from interested parties to help refine its allocation approach.

Regarding AHAM's observation about the relative stability of average markups for the major retail channels that sell home appliances, DOE believes that the usefulness of this information for estimating markups on specific product lines is limited. The markups implied by gross margin at the level of major retail channels[40] are averaged over multiple product lines and many different store types. The empirical data at this level do not provide useful guidance for estimating what happens to the markup on specific products when their costs change. Applying the same markup as CGS increases, as AHAM recommends, would mean that the increase in CGS associated with higher-efficiency products would translate into higher retail gross margins for that product line. Because the majority of operating expenses would not be affected by the increase in CGS, the result would be an increase in net profit as a share of sales. While such an outcome could occur in the short run, DOE believes that competitive forces in the market would tend to decrease the profit margin over time.

Based on the above considerations, DOE has decided to continue to apply an incremental markup to the incremental MSP of products with higher efficiency than the baseline products. As part of its review, DOE developed a new breakdown into fixed and variable components using the latest expense data provided by the U.S. Census for Electronics and Appliance Stores, which cover 2002. The newly-derived incremental markup, which would be applied to an incremental change in CGS, is 1.17, which is slightly higher than the value of 1.15 that DOE used in the preliminary analysis. Chapter 6 of the direct final rule TSD provides a description of both the method and its current application using the aforementioned data.

E. Energy Use Analysis

DOE's analysis of the energy use of clothes dryers and room air conditioners estimated the energy use of these products in the field, that is, as they are actually used by consumers. The energy use analysis provided the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from DOE's adoption of amended standards. In contrast to the DOE test procedure, which provides a measure of the energy use, energy efficiency or annual operating cost of a covered product during a representative average use cycle or period of use, the energy use analysis seeks to capture the range of operating conditions for clothes dryers and room air conditioners in U.S. homes.

To determine the field energy use of products that would meet possible amended standard levels, DOE used data from the EIA's 2005 RECS, which was the most recent such survey

[39] The FFCR represents the market share of the four largest firms in the relevant sector. Generally, an FFCR of less than 40 percent indicates that a sector is not concentrated and an FFCR of more than 70 percent indicates that a sector is highly concentrated.

[40] The channels for which AHAM provided gross margin data for 1993–2007 are electronics and appliance stores, general merchandise stores, and building material and supplies dealers. According to AHAM, these channels accounted for 43 percent, 31 percent and 17 percent of major appliance sales in 2007, respectively.

available at the time of DOE's analysis.[41] RECS is a national sample survey of housing units that collects statistical information on the consumption of and expenditures for energy in housing units along with data on energy-related characteristics of the housing units and occupants. RECS provides sufficient information to establish the type (product class) of clothes dryer or room air conditioner used in each household. As a result, DOE was able to develop household samples for each of the considered product classes. DOE developed a separate building sample for commercial-sector use of room air conditioners and accounted for the distinct features of room air conditioner utilization in commercial buildings.

A more detailed description of DOE's energy use analysis for clothes dryers and room air conditioners is contained in chapter 7 of the direct final rule TSD.

1. Clothes Dryers

For clothes dryers with a specific efficiency, the annual energy consumption depends on the annual number of cycles. In the preliminary analysis, DOE used a distribution of values with an average of 283 cycles/year based on RECS data. Whirlpool stated that a range of 278–300 annual dryer cycles is reasonable, based on P&G data which indicate 278 annual dryer cycles, and internal data which indicate 288 annual dryer cycles. (Whirlpool, No. 22 at p. 3) AHAM stated that P&G data indicate 278 annual dryer loads, which verifies the RECS data. (AHAM, No. 25 at p. 9) DOE acknowledges the above comments and has retained the approach used in the preliminary analysis, which resulted in an average of 283 cycles/year, for its final rule analysis. This average value matches the number of cycles/yr in the most current DOE clothes dryers test procedure and is within the range of the values submitted by the commenters.

In the preliminary analysis, DOE estimated that clothes dryers take on average 60 minutes to complete a cycle. EEI stated that DOE should consider manufacturer data, consumer reports, or data from other third parties to determine typical cycle time for clothes dryers. (EEI, Public Meeting Transcript, No. 21.4 at pp. 106–107) ALS stated that cycle time should be derived based on RMC, assuming that a sensor will be included in all future models. (ALS, Public Meeting Transcript, No. 21.4 at pp. 110–111) NRDC stated that there is a 20-minute variation in cycle time, based on whether the sensors work accurately. (NRDC, Public Meeting Transcript, No. 21.4 at p. 106) The NRDC/ECOS report stated that a typical drying cycle is much different than the constant drying cycle duration fixed at 60 minutes that is used in the LCC. (NRDC, No. 30 at p. 11)

DOE acknowledges that there is variation in cycle time and that it is dependent on the RMC and the sensors' accuracy. In the final rule analysis, DOE revised the cycle time to match the most current DOE test procedure average value of 30 minutes. Overall, the cycle time has very little impact on the calculation of energy use because it is only used for the determination of standby energy use.

In the preliminary analysis, DOE assigned an RMC value to each sample unit using a distribution of clothes washer RMC values from the CEC directory[42] ranging from 30 percent to 61 percent, with an average of 46 percent. In response, AHAM suggested DOE use a RMC value of 47 percent because it is representative of products likely to be sold in the 2015 timeframe. (AHAM, No. 25 at pp. 9–10) Whirlpool stated that they support the use of AHAM data, which indicate a shipment-weighted average RMC of 47 percent. (Whirlpool, No. 22 at p. 4)

In its analysis for the final rule, DOE incorporated new information about the RMC value developed during DOE's recent clothes dryers test procedure rulemaking. In response to comments on the clothes dryers test procedure NOPR, DOE issued an SNOPR in which it proposed a revision of the average RMC value. FR 75 37594 (June 29, 2010). The revision addresses the fact that the RMC values listed in the CEC directory are multiplied by a correction factor and therefore do not represent the actual cloth moisture content at the end of the clothes washer spin cycle. In keeping with this revision, for the final rule analysis DOE used a distribution of clothes washer RMC values from the CEC directory multiplied by a correction factor to match the average RMC value of 57.5 percent assumed in the proposed test procedure.

In the preliminary analysis, DOE assigned load weights to each sample household by developing a distribution based on the CEC directory. The average load weights for standard-size units ranged from 5.1 lbs. to 10 lbs., with a mean value of 8.1 lbs.

AHAM stated that the shipment-weighted residential clothes washer drum volume for standard size products in 2008 was 3.24 ft^3, which corresponds to an average load size of 8.15 lbs., which is consistent with the value proposed by DOE, using the alternative CEC approach. AHAM also stated that the load size should be 4.70 lbs. for compact clothes dryers, based on the shipment-weighted drum volume of 1.5 ft^3. (AHAM, No. 25 at p. 10) BSH stated that load size should increase linearly with drum size. (BSH, No. 23 at p. 5) The NRDC/ECOS Report suggested that the values used in the preliminary analysis may be too low. It stated that today's dryers can comfortably accommodate loads between 10 and 17 lbs., and that there are more dryer models on the market today between 7 and 8 ft^3 than there are models smaller than 7 ft^3. (NRDC, No. 30 at p. 35)

In its analysis for the final rule, DOE used the average load size value of 8.45 lbs. from the TP Final Rule. To represent a range of load size values in the field, DOE used a distribution of load sizes ranging from 3.80 to 13.7 lbs., with a mean value of 8.45 lbs. Chapter 7 of the TSD presents the details of the DOE's load size analysis.

DOE received several comments recommending that it use the same values for number of cycles, RMC, and load weights in both the engineering analysis and the LCC and PBP analysis, and that it revise the test procedure to reflect the values used in its analysis. (AHAM, No. 25 at pp. 9–10; Whirlpool, No. 22 at pp. 3–4) The California Utilities stated that DOE should consider all changes in the test procedure in additional analysis of clothes dryer energy use. (California Utilities, No. 31 at p. 13)

For its LCC and payback period analysis DOE developed distributions of values for number of cycles, RMC, and load weights that reflect its best estimate of the range of practices found in U.S. homes. In the engineering analysis, DOE uses the test procedure to evaluate the relative improvement in energy efficiency provided by different design options. As discussed in section III.A, DOE has modified the clothes dryer test procedure to reflect current field conditions, and these changes are also incorporated in the analysis for the final rule.

In the preliminary analysis, DOE estimated an average energy use of 519 kWh per year for the baseline vented electric standard clothes dryer. ACEEE stated that DOE should revisit the approach to determining annual energy consumption, and it noted that the baseline average unit energy consumption (UEC) of 519 kWh/year in DOE's analysis is much lower than the values found in field studies and

[41] For information on RECS, *see http://www.eia.doe.gov/emeu/recs/.*

[42] California Energy Commission. Appliance Efficiency Database: Clothes Washers. July 2010. URL: *http://www.appliances.energy.ca.gov/.*

metered evaluations of clothes dryer models. (ACEEE, No. 24 at p. 2) The California Utilities stated that a Florida Solar Energy Center survey found that field-average UEC for electric standard clothes dryers was around 900 kWh/year, the 2001 RECS lists 1079 kWh/year, and a 1999 Progress Energy Florida study shows 885 kWh/year. They noted that these numbers are significantly higher than DOE's average UEC. (California Utilities, No. 31 at p. 12)

As described above, DOE made several changes to its approach for estimating clothes dryer energy use for the final rule (increased initial RMC value and clothes dryer load size). As a result, the average annual energy use for the baseline vented electric clothes dryer derived for the final rule is 718 kWh. This value is lower than those found in the surveys mentioned above primarily because it reflects more recent clothes washer technology and clothes dryer utilization than the surveys discussed in the comment. In particular, this value reflects the lower initial RMC associated with newer clothes washers and the lower number of clothes dryer cycles per year seen in recent P&G data and 2005 RECS data. The value from 2001 RECS was derived using conditional demand analysis that utilized assumptions based on the previous clothes dryer test procedure. The Florida surveys date from 1999, when initial RMC and annual number of dryer cycles were higher significantly higher than the values used in the final rule analysis. In addition, the sample size of these surveys is small and not necessarily representative of the nation.

In the preliminary analysis, DOE considered the impact of clothes dryer operation on home heating and cooling loads. A clothes dryer releases heat to the surrounding environment. If the dryer is located indoors, its use will tend to slightly reduce the heating load during the heating season and slightly increase the cooling load during the cooling season. DOE believed that the effect is the same for all of the considered efficiency levels because the amount of air passing through the clothes dryer does not vary, and thus it did not include this factor in its preliminary analysis.

ACEEE, NRDC, NEEP and NPCC and the California Utilities stated that DOE should consider the impact on space conditioning loads from clothes dryer use. (ACEEE, No. 24 at p. 2; NRDC, No. 26 at p. 2; NEEP, No. 27 at p. 3; NPCC, No. 32 at p. 3; California Utilities, No. 31 at p. 9) The California Utilities stated that the HVAC load created by dryers can amount to as much as 3 kWh/cycle. (California Utilities, No. 31 at p. 9)

As discussed in section III.A.1, DOE believes that accounting for the effects of clothes dryers on HVAC energy use in a DOE test procedure is inconsistent with the EPCA requirement that a test procedure measure the energy efficiency, energy use, or estimated annual operating cost of a covered product. As a result, DOE did not consider the impact of standards on HVAC energy use, is permissible under 42 U.S.C. 6295(o) in developing the energy conservation standards established in today's direct final rule.

To calculate this impact, DOE first estimated whether the clothes dryer in a RECS sample home is located in conditioned space (referred to as indoors) or in unconditioned space (such as garages, unconditioned basements, outdoor utility closets, or attics). Based on the 2005 RECS and the 2009 American Housing Survey (AHS), DOE assumed that 50 percent of vented standard electric and gas dryers are located indoors, while 100 percent of compact and ventless clothes dryers are located indoors. For these installations, DOE utilized the results from a European Union study about the impacts of clothes dryers on home heating and cooling loads to determine a the appropriate factor to apply to the total clothes dryer energy use.[43] This study reported that for vented dryers there is a factor of negative 3 to 9 percent (average 6 percent) and for ventless dryers there is a factor of positive 7 to 15 percent (average 11 percent). For the reasons stated earlier, DOE assumed that the effect is the same for all considered efficiency levels.

2. Room Air Conditioners

For room air conditioners with a specific size and EER, the annual energy use depends on the annual hours of operation. In the preliminary analysis, for units in the residential sector, DOE calculated the number of operating hours for each room air conditioner in the residential sample using the reported energy use for room air conditioning in the 2005 RECS, along with estimates of the EER of the room air conditioner(s) in each sample home. DOE based the latter on the reported age of the unit and historical data on shipment-weighted average EER.

For units used in the commercial sector, DOE calculated the number of operating hours for each room air conditioner in the commercial sample by establishing a relationship between cooling degree-days and operating hours for a number of building types and building schedule combinations. DOE assumed that a room air conditioner is operated when the outdoor air conditions are above the comfort zone described by ANSI/ASHRAE Standard 55–2004 Thermal Environmental Conditions for Human Occupancy. For a given location, the number of annual hours above the ASHRAE Standard 55 comfort zone varies by building operating schedule, which refers to the time that a building is in operation.

AHAM stated that it opposes the use of RECS and CBECS data to estimate energy consumption of room air conditioners in the LCC and payback period calculations, and it requested confirmation that DOE's estimates for both residential and commercial room air conditioner use are realistic. (AHAM, No. 25 at pp. 8–9) AHAM questioned the validity of DOE's analysis for residential use of room air conditioners. AHAM stated that RECS data do not provide information on room air conditioner capacity or a direct measurement of room air conditioner energy use. (AHAM, No. 25 at p. 2) AHAM also questioned DOE's estimate of the capacity of the unit (or units) based on the reported total cooled area, as well as the approach DOE used to distribute the capacity sizes among the various product classes evaluated. (AHAM, No. 25 at pp. 8–9)

Regarding the use of RECS data to estimate the capacity of the unit (or units), DOE believes that the reported total cooled area is an important indicator of the capacity of the unit (or units). The reason is that for room air conditioners this is the primary sizing criteria used by manufacturers, contractors, and programs such as ENERGY STAR. Therefore, DOE continued to use reported total cooled area to estimate the room air conditioner capacity. To improve the accuracy of the estimate, for the final rule DOE also considered additional factors that are likely to influence the capacity selection: The number of occupants, local weather, and building characteristics such as envelope insulation and shading. In addition, for the final rule analysis DOE revised its criteria for assigning room air conditioner units for the RECS household sample associated with each product class. DOE took into consideration AHAM's suggestion and did not assign smaller-size units in the sample for the largest product class.

In addition to the above changes, DOE applied an adjustment to the values for annual operating hours derived from the

[43] Rüdenauer, Ina and Gensch, Carl-Otto. *Energy demand of tumble dryers with respect to differences in technology and ambient conditions.* Report commissioned by European Committee of Domestic Equipment Manufacturers (CECED). January 13, 2004.

2005 RECS to account for the warmer-than-average weather in 2005. (DOE used long-term national average cooling degree-day values as a basis for the adjustment). DOE also adjusted the values to account for the fact that the stock of homes in 2014 is likely to have slightly more floor area and have better insulation than homes in 2005. DOE based the adjustment on projections in *AEO2010.* These modifications are described in chapter 7 of the direct final rule TSD.

Regarding DOE's use of CBECS for estimating the commercial use of room air conditioners, AHAM stated that (1) DOE made substantial assumptions regarding the number of room air conditioners per commercial application and the room air conditioner capacities employed at these locations; and (2) it appears that DOE, to obtain enough data for statistical analysis, overlapped the units in each product class. (That is, units calculated as having > 20,000 Btu/hr capacity have also been included in the analysis of the < 6,000 Btu/hr and 8,000–13,999 Btu/hr product classes.) It stated that the latter approach is misleading and unacceptable. (AHAM, No. 25 at p. 3)

DOE believes that the assumptions made in the preliminary analysis are consistent with the CBECS and AHAM shipments data that are available for evaluating commercial use of room air conditioners. Therefore, DOE retained the approach used in the preliminary analysis for the final rule analysis. Regarding the overlapping of units among product classes, DOE believes that its approach is reasonable given that there is no information available on the number of air conditioner units in a building, so a building could have one or more units in any of the considered product classes.

AHAM stated that DOE's approach for estimating room air conditioner energy use is not consistent with the law, which requires that the test procedure be used to determine energy use and energy savings. (AHAM, No. 25 at p. 2) AHAM elaborated on this statement and made arguments that can be summarized as follows (AHAM, No. 25 at pp. 7–8):

1. While use of RECS data has proven useful over the years to provide general guidance to DOE on residential energy use, this is the first time that DOE proposes to use it to estimate actual energy consumption in the field and to justify a new energy efficiency standard;

2. It is inconsistent for DOE to use RECS data and statistical regression techniques to estimate energy use for determining the life cycle cost and payback period used to justify an appliance standard, while it uses the applicable test procedure as the sole source of energy use data for purposes of determining compliance with the standard.

3. Reliance on the test procedure for the energy data used in LCC and payback period calculations to set new appliance standards is the tried and true method that has a clear statutory basis.

4. The law on labeling prohibits manufacturers, distributors, and retailers from making energy use representations about their products based on anything other than the results of a test procedure, so it is irrational if DOE's analysis makes energy claims that sellers cannot make.

AHAM also stated that DOE should use 750 annual operating hours (the value in the current test procedure) to maintain consistency while additional surveys or testing are completed to determine a representative number of annual operating hours. (AHAM, No. 25 at p. 9)

In response, DOE notes that EPCA specifies particular uses of the applicable test procedure, such as when DOE ascertains whether the consumer costs associated with the purchase of a product that complies with the proposed standard level is less than three times the value of the energy savings the consumer will receive during the first year of ownership. (42 U.S.C. 6295(o)(2)(B)(iii)) This calculation is separate from the payback periods calculated in the LCC and payback period analysis. The latter analysis helps DOE to evaluate two of the factors that EPCA directs DOE to consider in determining whether an energy conservation standard for a particular covered product is economically justified. The first of these is the economic impact of potential standards on the manufacturers and the consumers of the covered products. (42 U.S.C. 6295(o)(2)(B)(i)(I)) The second factor is the savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered products which are likely to result from the imposition of the standard. (42 U.S.C. 6295(o)(2)(B)(i)(II))

To evaluate economic impacts on consumers and the savings in operating costs as accurately as possible, DOE needs to determine the energy savings that are likely to result from a given standard. Such a determination requires knowledge of the range of actual use of covered products by consumers. Because it is a recent nationally-representative survey of U.S. households, RECS provides information that helps DOE to determine such use. In addition, DOE uses RECS data because it is consistent with the guidance contained in 10 CFR part 430, subpart C, appendix A—"Procedures, Interpretations and Policies for Consideration of New or Revised Energy Conservation Standards for Consumer Products." Specifically, section 11 of appendix A lists variation in consumer impacts as one of the principles for the analysis of impacts on consumers. Because RECS provides considerable information about each household in the sample, it allows DOE to evaluate factors that contribute to variation in the energy use of covered products. In turn, this allows DOE to estimate the fraction of consumers that will benefit from standards at various efficiency levels.

Consistent with the EPCA and DOE's regulatory guidance, DOE has used RECS data in a variety of ways over the past decade. In most cases, DOE has used the relevant DOE test procedure or a similar procedure as the basis for the energy use calculation, and used RECS data to provide a range for key input variables concerning the operation of covered products. Examples include the standards rulemaking for water heaters concluded in 2001 (66 FR 4474 (Jan. 17, 2001)), and the recently-concluded rulemaking that amended standards for water heaters. 75 FR 20112, 20112–20236 (Apr. 16, 2010). In both rulemakings, DOE used data for each of the households in the RECS sample to estimate the amount of household daily hot water use, and to specify certain factors that affect water heater operating conditions. Additionally, DOE's 2001 final rule for central air conditioners and heat pumps relied on annual energy use based on the annual end-use energy consumption values in RECS. 66 FR 7070, 7170–7200 (Jan. 22, 2001). DOE determined that basing the energy use on RECS household data provided an accurate measure of the savings possible from more-efficient equipment, and accounted for variability due to climatic conditions and consumer behavior.

Regarding AHAM's suggestion that DOE should use the test procedure only to estimate energy use for the purposes of its analysis of standards, DOE notes that test procedures must be designed to produce test results which measure energy efficiency, energy use or estimated annual operating cost of a covered product during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(3)) For the purposes of evaluating two of the factors that EPCA directs DOE to consider in determining whether an energy conservation standard for covered products is economically justified, determining energy use based on only a representative average use cycle or period of use does not provide an accurate measure of the range of possible energy savings. Thus, doing so would not be consistent with EPCA and the above-cited guidance of appendix A to subpart C of part 430.

In addition, EPCA requires that manufacturers and DOE use the DOE test procedures prescribed pursuant to 42 U.S.C. 6293 in determining compliance. Determining compliance requires a metric that provides repeatable and consistent results for appliances in a given product class, a purpose best served by the test procedure. Similarly, energy labeling of appliances is designed to provide consumers with information that allows comparison of the technical performance of different products with respect to energy efficiency. Measurement of such performance is best conducted with a standard metric such as the applicable test procedure. The LCC and PBP analysis, in contrast, seeks to estimate the impact of alternative standard levels on consumers. This requires an evaluation of variation in energy use in the field, which is provided by analysis of the RECS data.

DOE included a "rebound effect" in its analysis of room air conditioner energy use. A rebound effect could occur when a piece of equipment that is more efficient is used more intensively, so that the expected energy savings from the efficiency improvement may not fully materialize. A rebound effect of 10 percent implies that 90 percent of the expected energy savings from more efficient equipment will actually occur. Based on the data available,[44] DOE incorporated a rebound effect of 15 percent for room air conditioners in the analysis for the final rule.

F. Life-Cycle Cost and Payback Period Analyses

DOE conducts LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for clothes dryers and room air conditioners. The LCC is the total consumer expense over the life of a product, consisting of purchase and installation costs plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product. The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost (normally higher) due to a more stringent standard by the change in average annual operating cost (normally lower) that results from the standard.

For any given efficiency level, DOE measures the PBP and the change in LCC relative to an estimate of the base-case appliance efficiency levels. The base-case estimate reflects the market in the absence of new or amended energy conservation standards, including the market for products that exceed the current energy conservation standards.

For each considered efficiency level in each product class, DOE calculated the LCC and PBP for a nationally representative set of housing units. For the preliminary analysis and the analysis for today's rule, DOE developed household samples from the 2005 RECS. For each sample household, DOE determined the energy consumption for the clothes dryer or room air conditioner and the appropriate electricity or natural gas price. By developing a representative sample of households, the analysis captured the variability in energy consumption and energy prices associated with the use of residential clothes dryers and room air conditioners. DOE developed a separate building sample for commercial-sector use of room air conditioners and accounted for the distinct features of room air conditioner utilization in commercial buildings.

Inputs to the calculation of total installed cost include the cost of the product—which includes manufacturer costs, manufacturer markups, retailer and distributor markups, and sales taxes—and installation costs. Inputs to the calculation of operating expenses include annual energy consumption, energy prices and price projections, repair and maintenance costs, product lifetimes, discount rates, and the year that compliance with standards is required. DOE created distributions of values for some inputs, with probabilities attached to each value, to account for their uncertainty and variability. DOE used probability distributions to characterize product lifetime, discount rates, and sales taxes.

The computer model DOE uses to calculate the LCC and PBP, which incorporates Crystal Ball (a commercially available software program) relies on a Monte Carlo simulation to incorporate uncertainty and variability into the analysis. The Monte Carlo simulations randomly sample input values from the probability distributions and clothes dryer and room air conditioner user samples. The model calculated the LCC and PBP for products at each efficiency level for 10,000 housing units per simulation run. Details of the spreadsheet model, and of all the inputs to the LCC and PBP analyses, are contained in chapter 8 of the direct final rule TSD and its appendices.

Table IV.31 summarizes the approach and data DOE used to derive inputs to the LCC and PBP calculations. The table provides the data and approach DOE used for the preliminary TSD, as well as the changes made for today's direct final rule. The subsections that follow discuss the initial inputs and methods and the changes DOE made for the final rule.

TABLE IV.31—SUMMARY OF INPUTS AND METHODS IN THE LCC AND PBP ANALYSIS *

Inputs	Preliminary TSD	Changes for the final rule
Installed Costs		
Product Cost	Derived by multiplying manufacturer cost by manufacturer and retailer markups and sales tax, as appropriate.	Used a product-specific price/cost adjustment factor based on experience curves that forecasts changes in price relative to inflation in the over-all economy.

[44] S. Sorrell, J. Dimitropoulos, and M. Sommerville Empirical estimates of the direct rebound effect: A review *Energy Policy,* 2009 37, pp. 1356–71.

TABLE IV.31—SUMMARY OF INPUTS AND METHODS IN THE LCC AND PBP ANALYSIS *—Continued

Inputs	Preliminary TSD	Changes for the final rule
Installation Costs	Based on RS Means, assumed no change with efficiency level.	Based on RS Means; included additional installation cost for heat pump dryers and higher-efficiency room air conditioners due to their larger dimensions and weight.
Operating Costs		
Annual Energy Use	Clothes Dryers: Used DOE test procedure with data on cycles from the 2005 RECS, market data on RMC, and load weights from test procedure.	Clothes Dryers: Same approach, but RMC and load weight revised to account for proposed changes in DOE test procedure.
	Room Air Conditioners: Based on calculation of operating hours for each 2005 RECS sample unit.	Room Air Conditioners: No change.
Energy Prices	Electricity (clothes dryers): Based on EIA's Form 861 data for 2007.	Electricity (clothes dryers): Updated using Form 861 data for 2008.
	Electricity (room air conditioners): Used utility tariff data to develop monthly marginal electricity prices for each sample household.	Electricity (room air conditioners): No change.
	Natural gas: Based on EIA's Natural Gas Monthly data for 2007.	Natural gas: Updated using Natural Gas Monthly data for 2009.
	Variability: Regional energy prices determined for 13 regions for clothes dryers; tariffs determined for sample households for room air conditioners.	Variability: No change.
Energy Price Trends	Forecasted using *AEO2009* price forecasts	Forecasts updated using *AEO2010.*
Repair and Maintenance Costs	Not included	Derived annualized maintenance and repair frequencies and costs per service call based on RS Means and equipment cost.
Present Value of Operating Cost Savings		
Product Lifetime	Estimated using survey results from RECS (1990, 1993, 1997, 2001, 2005) and the U.S. Census American Housing Survey (2005, 2007), along with historic data on appliance shipments.	No change.
	Variability: Characterized using Weibull probability distributions.	
Discount Rates	Identified all possible debt or asset classes that might be used to purchase the considered appliances, or might be affected indirectly. Primary data source was the Federal Reserve Board's SCF ** for 1989, 1992, 1995, 1998, 2001, 2004 and 2007.	No change.
Compliance Date	2014	No change.

* References for the data sources mentioned in this table are provided in the sections following the table or in chapter 8 of the direct final rule TSD.

** Survey of Consumer Finances.

As discussed in section IV.E, DOE takes into account the rebound effect associated with more efficient room air conditioners. The take-back in energy consumption associated with the rebound effect provides consumers with increased value (for example, a cooler or warmer indoor environment). The net impact on consumers is thus the sum of the change in the cost of owning the room air conditioner (that is, life-cycle cost) and the increased value for the more comfortable indoor environment. The consumer effectively pays for the increased value of a more comfortable environment in his or her utility bill. Because the monetary cost of this added value is equivalent to the value of the foregone energy savings, the economic impacts on consumers measured in the LCC analysis are the same regardless of the rebound effect.

1. Product Cost

To calculate consumer product costs, DOE multiplied the manufacturer selling prices developed in the engineering analysis by the supply-chain markups described above (along with sales taxes). DOE used different markups for baseline products and higher-efficiency products because, as discussed previously, DOE applies an incremental markup to the MSP increase associated with higher efficiency products.

On February 22, 2011, DOE published a Notice of Data Availability (NODA, 76 FR 9696) stating that DOE may consider improving regulatory analysis by addressing equipment price trends. Consistent with the NODA, DOE examined historical producer price indices (PPI) for room air conditioners and household laundry equipment and found a consistent, long-term declining real price trend for both products. Consistent with the method proposed in the NODA, DOE used experience curve fits to forecast a price scaling index to forecast product costs into the future for this rulemaking. DOE also considered the public comments that were received in response to the NODA and refined the evaluation of its experience curve trend forecasting estimates. Many commenters were supportive of DOE moving from an assumption-based equipment price trend forecasting method to a data-driven methodology for forecasting price trends. Other commenters were skeptical that DOE could accurately forecast price trends given the many variables and factors that can complicate both the estimation and the interpretation of the numerical price trend results and the relationship between price and cost. DOE evaluated these concerns and determined that retaining the assumption-based approach of a constant real price trend was not consistent with the historical data for the products covered in this rule though this scenario does represent a reasonable upper bound on the future equipment price trend. DOE also performed an initial evaluation of the possibility of other factors complicating the estimation of the long-term price trend, and developed a range of potential price trend values that were consistent with the available data and justified by the amount of data available to DOE. DOE recognizes that its price trend forecasting methods are likely to be modified as more data and information becomes available to enhance the statistical certainty of the trend estimate and the completeness of the model. Additional data should enable an improved evaluation of the potential impacts of more of the factors that can influence equipment price trends over time.

To evaluate the impact of the uncertainty of the price trend estimates, DOE performed price trend sensitivity calculations in the national impact analysis to examine the dependence of the analysis results—specifically annualized net national benefits—on different analytical assumptions. DOE also included a zero real price trend assumption as a sensitivity scenario representing an upper bound on the forecast price trend DOE found that for the selected standard levels the benefits outweighed the burdens under all scenarios.

A more detailed discussion of price trend modeling and calculations is provided in Appendix 8–J of the TSD.

2. Installation Cost

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the equipment. For the preliminary analysis, DOE derived baseline installation costs for clothes dryers and room air conditioners from data in the RS Means 2008. DOE found no evidence that installation costs would be impacted with increased efficiency levels. Commenting on DOE's assumption, Whirlpool stated that heat pump dryers would be considerably heavier than conventional dryers, leading to increased installation costs. (Whirlpool, No. 22 at p. 4) AHAM made a similar comment. (AHAM, Public Meeting Transcript, No. 21.4 at pp. 89–90)

For the final rule analysis, DOE included an additional installation cost for heat pump dryers due to their larger dimensions and weight. DOE added 0.5 hour of additional labor (or about $20) to the installation cost. For room air conditioners, DOE also added additional labor hours for higher efficiency equipment with significant larger dimensions and/or weight based on RS Means labor hour estimates for room air conditioners with different capacities.

3. Annual Energy Consumption

For each sampled household, DOE determined the energy consumption for a clothes dryer or room air conditioner at different efficiency levels using the approach described above in section IV.E.

4. Energy Prices

For clothes dryers, DOE derived average annual energy prices for 13 geographic areas consisting of the nine U.S. Census divisions, with four large states (New York, Florida, Texas, and California) treated separately. For Census divisions containing one of these large states, DOE calculated the regional average excluding the data for the large state.

DOE calculated average residential electricity prices for each of the 13 geographic areas using data from EIA's Form EIA–861 Database (based on "Annual Electric Power Industry Report").[45] DOE calculated an average annual regional residential price by: (1) Estimating an average residential price for each utility (by dividing the residential revenues by residential sales); and (2) weighting each utility by the number of residential consumers it served in that region. For the preliminary TSD, DOE used the data for 2007. The final rule analysis updated the data for 2008, the most recent data available.

DOE calculated average residential natural gas prices for each of the 13 geographic areas using data from EIA's "Natural Gas Monthly." [46] DOE calculated average annual regional residential prices by: (1) Estimating an average residential price for each state; and (2) weighting each state by the number of residential consumers. For the preliminary TSD, DOE used EIA data for 2007. The final rule analysis updated the data for 2009, the most recent data available.

For the preliminary analysis, for room air conditioners DOE used utility tariff data to develop monthly marginal electricity prices for each sample household used in the LCC analysis. The marginal prices were calculated by taking account of the difference between the household's electricity expenditures for the base case electricity use and for a candidate standard level, in combination with the associated change in energy use expected as a result of a particular standard level. The price used was based on the default (non-TOU) tariffs, because TOU tariffs are optional and very few customers opt for such rates. DOE then applied the monthly prices to the estimated electricity use by the room air conditioner in each corresponding month. This approach applies summer rates to the estimated consumption in summer months. DOE also used tariff data to develop marginal electricity prices for each commercial building in the LCC sample. DOE used the same approach for today's final rule.

5. Energy Price Projections

To estimate energy prices in future years for the preliminary TSD, DOE multiplied the above average regional energy prices by the forecast of annual average residential energy price changes in the Reference Case from *AEO2009*.[47] *AEO2009* forecasted prices through 2030. For today's proposed rule, DOE updated its energy price forecasts using *AEO2010,* which has an end year of 2035.[48] To estimate the price trends after 2035, DOE used the average annual rate of change in prices from 2020 to 2035.

6. Maintenance and Repair Costs

Repair costs are associated with repairing or replacing components that have failed in the appliance, whereas maintenance costs are associated with maintaining the operation of the equipment. In its preliminary analysis, DOE did not have information suggesting that these costs would change with higher efficiency levels.

[45] Available at: *http://www.eia.doe.gov/cneaf/electricity/page/eia861.html.*

[46] Available at: *http://www.eia.gov/oil_gas/natural_gas/data_publications/natural_gas_monthly/ngm.html.*

[47] The spreadsheet tool that DOE used to conduct the LCC and PBP analyses allows users to select price forecasts from either *AEO's* High Economic Growth or Low Economic Growth Cases. Users can thereby estimate the sensitivity of the LCC and PBP results to different energy price forecasts.

[48] U.S. Energy Information Administration. *Annual Energy Outlook 2010.* Washington, DC. April 2010.

Commenting on DOE's approach, AHAM stated that repair costs are typically estimated using a 1:1 ratio with part costs, so if component costs increase by 10 percent, repair costs are expected to also increase by 10 percent. AHAM stated that DOE should incorporate these higher repair costs into its analysis of clothes dryers and room air conditioners to provide a more representative evaluation of total consumer cost for higher efficiency products. (AHAM, No. 25 at p. 12)

For clothes dryers, Whirlpool stated that the repair and maintenance costs generally do not vary by efficiency, but for heat pump dryers, this assumption is not valid. Whirlpool stated that new technologies such as these would cost two to three times more to repair than conventional dryers due to their complex nature and the cost of disconnecting and reconnecting water sources. (Whirlpool, No. 22 at p. 4) AHAM stated that maintenance costs generally will not vary by efficiency level, but a heat pump clothes dryer is expected to have higher maintenance costs because of the heat pump and the addition of refrigerant. AHAM stated that maintenance for these units would be similar to that for standard air conditioning equipment or heat pump water heaters. (AHAM, No. 25 at p. 11)

For the final rule analysis, DOE modified the maintenance and repair costs for both clothes dryers and room air conditioners. For clothes dryers, DOE derived annualized maintenance and repair frequencies based on Consumer Reports data on repair and maintenance issues for clothes dryers during the first 4 years of ownership. DOE estimated that on average 1.5 percent of electric and 1.75 percent of gas clothes dryers are maintained or repaired each year. Based on RS Means Facilities Maintenance & Repair 2010 Cost Data,[49] DOE also estimated that an average service call and any necessary repair or maintenance takes about 2.5 hours. DOE further estimated that the average material cost is equal to one-half of the equipment cost. The values for cost per service call were then annualized by multiplying by the frequencies and dividing by the average equipment lifetime of 16 years.

For room air conditioners, based on data on repair frequencies for central air conditioners, DOE assumed that repair frequencies are low and increase for the higher-capacity units due to their more expensive equipment cost. DOE assumed that 1 percent of small sized units (below 6,000 Btu/hr), 2.5 percent of medium sized units (8,000 to 14,000 Btu/hr), and 5 percent of large sized units (above 20,000 Btu/hr) are maintained or repaired each year. Based on the above-cited RS Means data, DOE also estimated that an average service call and any necessary repair or maintenance takes about 1 hour for small and medium-sized units and 2 hours for large units. DOE further estimated that the average material cost is equal to one-half of the incremental equipment cost. The values for cost per service call were then annualized by multiplying by the frequencies and dividing by the average equipment lifetime of 10.5 years.

7. Product Lifetime

Because the lifetime of appliances varies depending on utilization and other factors, DOE develops a distribution of lifetimes from which specific values are assigned to the appliances in the samples. In the preliminary analysis, DOE conducted an analysis of actual lifetime in the field using a combination of shipments data, the stock of the considered appliances, and responses in RECS on the age of the appliances in the homes. The data allowed DOE to estimate a survival function, which provides a distribution of lifetimes. This analysis yielded an average lifetime of approximately 16 years for clothes dryers and approximately 10.5 years for room air conditioners.

For clothes dryers, the ECOS report (prepared for NRDC) stated that the typical lifetime of a clothes dryer is about 12 years. (NRDC, No. 30 at p. 8) AHAM stated that DOE should modify average clothes dryer lifetime to 13 years because both Appliance Magazine and confidential industry data support that value. (AHAM, No. 25 at p. 11) Whirlpool stated that Appliance Magazine shows 12 years as the expected lifetime for clothes dryers, which is largely consistent with their internal estimates. (Whirlpool, No. 22 at p. 5)

For the final rule analysis, DOE retained the approach used to estimate clothes dryer lifetime in the preliminary analysis because it relies on field data, and because the sources used by Appliance Magazine and the confidential industry data were unavailable for analysis by DOE.

For room air conditioners, AHAM stated that the average lifetime of 10.5 years from the preliminary analysis appears reasonable, and is consistent with the value of 10 years reported by Appliance Magazine. (AHAM, No. 25 at p. 11) AHAM stated, however, that there could be a very large difference in room air conditioner lifetime between product classes. (AHAM, Public Meeting Transcript, No. 21.4 at p. 126) While DOE acknowledges that there may be differences in room air conditioner lifetime among the product classes, DOE continued to use the same lifetime distribution for all room air conditioner product classes because it is not aware of any data that would provide a basis for using different lifetimes.

See chapter 8 of the direct final rule TSD for further details on the method and sources DOE used to develop product lifetimes.

8. Discount Rates

In the calculation of LCC, DOE applies discount rates to estimate the present value of future operating costs. DOE estimated a distribution of residential discount rates for clothes dryers and room air conditioners, and also estimated a distribution of commercial discount rates for commercial users of room air conditioners. *See* chapter 8 in the direct final rule TSD for further details on the development of consumer discount rates.

a. Residential Discount Rates

In its preliminary analysis, to establish residential discount rates for the LCC analysis, DOE identified all debt or asset classes that might be used to purchase refrigeration products, including household assets that might be affected indirectly. It estimated the average percentage shares of the various debt or asset classes for the average U.S. household using data from the Federal Reserve Board's "Survey of Consumer Finances" (SCF) for 1989, 1992, 1995, 1998, 2001, 2004, and 2007. Using the SCF and other sources, DOE then developed a distribution of rates for each type of debt and asset to represent the rates that may apply in the year in which amended standards would take effect. DOE assigned each sample household a specific discount rate drawn from one of the distributions. The average rate across all types of household debt and equity, weighted by the shares of each class, is 5.1 percent. DOE used the same approach for today's final rule.

b. Commercial Discount Rates

In its preliminary analysis, DOE derived discount rates for commercial-sector customers from the cost of capital of publicly-traded firms in the sectors that purchase room air conditioners. The firms typically finance equipment purchases through debt, equity capital, or both. DOE estimated the cost of the firms' capital as the weighted average of

[49] Available at: *http://rsmeans.reedconstructiondata.com/60300.aspx.*

the cost of equity financing and the cost of debt financing for recent years for which data were available (2001 through 2008). The estimated average discount rate for companies that purchase room air conditioners is 5.7 percent. DOE used the same approach for today's final rule.

9. Compliance Date of Amended Standards

DOE is required by consent decree to publish a final rule establishing any amended energy conservation standards by June 30, 2011. In the absence of any adverse comment on today's direct final rule that may provide a reasonable basis for withdrawing the rule, compliance with amended standards for clothes dryers and room air conditioners will be required on April 21, 2014. DOE calculated the LCC and PBP for clothes dryers and room air conditioners as if consumers would purchase new products in the year compliance with the standard is required. If adverse comment that may provide a reasonable basis for withdrawing the rule is received, DOE will proceed with the NOPR published elsewhere in today's **Federal Register**, and compliance with any amended standards would be required 3 years after the date of publication of any final standards. As noted above, DOE is required by consent decree to publish a final rule establishing any amended standards by June 30, 2011.

10. Base Case Efficiency Distribution

To accurately estimate the share of consumers that would be affected by a standard at a particular efficiency level, DOE's LCC analysis considered the projected distribution of product efficiencies that consumers purchase under the base case (that is, the case without new energy efficiency standards). DOE refers to this distribution of product of efficiencies as a base-case efficiency distribution.

In the preliminary analysis, DOE primarily relied on data submitted by AHAM to estimate the efficiency distributions in recent years for each of the product classes that were analyzed in the LCC and PBP analysis. DOE assumed that these market shares would remain constant through 2014. Whirlpool supported DOE's approach to forecast base-case market shares. (Whirlpool, No. 22 at p. 5)

For the final rule analysis, DOE retained the approach used in the preliminary analysis for clothes dryers. For room air conditioners, however, DOE modified its approach for estimating base-case efficiency distributions for the final rule analysis based on historical trends of penetration of ENERGY STAR models. DOE believes that this data support a constant growth rate of energy efficiency of 0.25 percent per year. For further information on DOE's estimate of base-case efficiency distributions, see chapter 8 of the direct final rule TSD.

11. Inputs To Payback Period Analysis

The payback period is the amount of time it takes the consumer to recover the additional installed cost of more efficient products, compared to baseline products, through energy cost savings. The simple payback period does not account for changes in operating expense over time or the time value of money. Payback periods are expressed in years. Payback periods that exceed the life of the product mean that the increased total installed cost is not recovered in reduced operating expenses.

The inputs to the PBP calculation are the total installed cost of the equipment to the customer for each efficiency level and the average annual operating expenditures for each efficiency level. The PBP calculation uses the same inputs as the LCC analysis, except that discount rates are not used.

12. Rebuttable-Presumption Payback Period

As noted above, EPCA, as amended, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy (and, as applicable, water) savings during the first year that the consumer will receive as a result of the standard, as calculated under the test procedure in place for that standard. (42 U.S.C. 6295(o)(2)(B)(iii)) For each considered efficiency level, DOE determined the value of the first year's energy savings by calculating the quantity of those savings in accordance with the applicable DOE test procedure, and multiplying that amount by the average energy price forecast for the year in which compliance with the amended standard would be required. The results of the rebuttable payback period analysis are summarized in section V.B.1.c of this notice.

G. National Impact Analysis—National Energy Savings and Net Present Value Analysis

The NIA assesses the national energy savings (NES) and the NPV of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels. ("Consumer" in this context refers to consumers of the product being regulated.) DOE calculates the NES and NPV based on projections of annual appliance shipments, along with the annual energy consumption and total installed cost data from the energy use and LCC analyses. For the final rule analysis, DOE forecasted the energy savings, operating cost savings, product costs, and NPV of consumer benefits for products sold from 2014 through 2043.

DOE evaluates the impacts of new and amended standards by comparing base-case projections with standards-case projections. The base-case projections characterize energy use and consumer costs for each product class in the absence of new or amended energy conservation standards. DOE compares these projections with projections characterizing the market for each product class if DOE adopted new or amended standards at specific energy efficiency levels (that is, the TSLs or standards cases) for that class. For the base case forecast, DOE considers historical trends in efficiency and various forces that are likely to affect the mix of efficiencies over time. For the standards cases, DOE also considers how a given standard would likely affect the market shares of efficiencies greater than the standard.

DOE uses an MS Excel spreadsheet model to calculate the energy savings and the national consumer costs and savings from each TSL. The direct final rule TSD and other documentation that DOE provides during the rulemaking help explain the models and how to use them, and interested parties can review DOE's analyses by changing various input quantities within the spreadsheet. The NIA spreadsheet model uses typical values as inputs (as opposed to probability distributions).

For the current analysis, the NIA used projections of energy prices and housing starts from the *AEO2010* Reference case. In addition, DOE analyzed scenarios that used inputs from the *AEO2010* Low Economic Growth and High Economic Growth cases. These cases have higher and lower energy price trends compared to the Reference case, as well as higher and lower housing starts, which result in higher and lower appliance shipments to new homes. NIA results based on these cases are presented in appendix 10–A of the direct final rule TSD.

Table IV–32 summarizes the inputs and key assumptions DOE used for the NIA analysis for the preliminary analysis and the changes to the analyses for the direct final rule. Discussion of these inputs and changes follows the table. See chapter 10 of the direct final rule TSD for further details.

TABLE IV.32—SUMMARY OF INPUTS AND KEY ASSUMPTIONS FOR THE NATIONAL IMPACT ANALYSIS

Inputs	Preliminary TSD	Changes for the proposed rule
Shipments	Annual shipments from shipments model	No change in approach.
Compliance Date of Standard	2014	No change.
Base-Case Forecasted Efficiencies	For clothes dryers and room air conditioners, efficiency distributions are maintained unchanged during the forecast period.	For clothes dryers, no change in basic approach; modified efficiency distributions based on new information. For room air conditioners, used an efficiency trend based on historical market data.
Standards-Case Forecasted Efficiencies	For clothes dryers and air conditioners, used a "roll-up" scenario.	For clothes dryers, no change in basic approach; modified efficiency distributions based on new information. For room air conditioners, used a "roll-up + shift" scenario to establish the distribution of efficiencies.
Annual Energy Consumption per Unit	Annual weighted-average values as a function of CEF * (clothes dryers) and SWCEER ** (room air conditioners).	No change.
Total Installed Cost per Unit	Annual weighted-average values as a function of CEF * (clothes dryers) and SWCEER ** (room air conditioners).	No change.
Annual Energy Cost per Unit	Annual weighted-average values as a function of the annual energy consumption per unit and energy prices.	No change.
Repair and Maintenance Cost per Unit	Annual values as a function of efficiency level	No change.
Energy Prices	*AEO2009* forecasts (to 2035) and extrapolation through 2043.	Updated using *AEO2010* forecasts.
Energy Site-to-Source Conversion Factor	Varies yearly and is generated by NEMS–BT	No change.
Discount Rate	Three and seven percent real	No change.
Present Year	Future expenses discounted to 2011, when the final rule is published.	No change.

* Combined Energy Factor
** Shipments-Weighted (stand by) Combined Energy Efficiency Ratio.

1. Shipments

Forecasts of product shipments are needed to calculate the national impacts of standards on energy use, NPV, and future manufacturer cash flows. DOE develops shipment forecasts based on an analysis of key market drivers for each considered product. In DOE's shipments model, shipments of products are driven by new construction, stock replacements, and other types of purchases. The shipments models take an accounting approach, tracking market shares of each product class and the vintage of units in the existing stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in-service product stocks for all years. The age distribution of in-service product stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock. DOE also considers the impacts on shipments from changes in product purchase price and operating cost associated with higher energy efficiency levels.

Commenting on the preliminary analysis, Whirlpool stated that clothes dryer base case shipments will not grow linearly as DOE assumes. Clothes dryers are a highly saturated product today, and homes without dryers are generally multi-family units that lack sufficient space for these products. Whirlpool stated that saturation of clothes dryers will not change. Hence, growth in this product category cannot exceed the growth of the housing stock. (Whirlpool, No. 22 at p. 7)

For the final rule analysis, DOE reviewed its approach for forecasting dryer purchases for first-time owners, which include consumers that currently do not have a dryer and consumers in new homes who purchase a dryer. To better account for constraints on purchase, such as those mentioned by Whirlpool, DOE reduced its estimate of the number of purchases by first-time owners. As a result, its forecast for the final rule analysis shows shipments growing more slowly over the forecast period (an average of 0.8 percent per year) than in the forecast in the preliminary analysis. The average growth rate of 0.8 percent is slightly less than the average annual growth rate in the number of households projected in *AEO2010* (1.0 percent in 2008–2035).

To estimate the effects on product shipments from increases in product price projected to accompany amended standards at higher efficiency levels, DOE applied a price elasticity parameter. It estimated this parameter with a regression analysis that used purchase price and efficiency data specific to residential refrigerators, clothes washers, and dishwashers over the period 1980–2002. The estimated "relative price elasticity" incorporates the impacts from purchase price, operating cost, and household income, and it also declines over time. DOE estimated shipments in each standards case using the relative price elasticity along with the change in the relative price between a standards case and the base case.

For details on the shipments analysis, see chapter 9 of the direct final rule TSD.

2. Forecasted Efficiency in the Base Case and Standards Cases

A key component of the NIA is the trend in energy efficiency forecasted for the base case (without new or amended standards) and each of the standards cases. Section IV.F.10 described how DOE developed a base-case energy efficiency distribution (which yields a shipment-weighted average efficiency) for each of the considered product classes for the first year of the forecast period. To project the trend in efficiency over the entire forecast period, DOE considered recent trends and programs such as ENERGY STAR. For clothes dryers, DOE assumed no improvement of energy efficiency in the base case and held the base-case energy efficiency distribution constant throughout the forecast period. For room air conditioners, DOE applied a constant growth rate of energy efficiency of 0.25 percent per year, based on historical trends of penetration of ENERGY STAR products.

To estimate efficiency trends in the standards cases, DOE has used "roll-up" and/or "shift" scenarios in its standards rulemakings. Under the roll-up scenario, DOE assumes: (1) Product efficiencies in the base case that do not meet the standard level under consideration would roll-up to meet the new standard level; and (2) product efficiencies above the standard level under consideration would not be affected. Under the shift scenario, DOE re-orients the distribution above the new minimum energy conservation standard.

In the preliminary analysis, DOE used a roll-up scenario in developing its forecasts of efficiency trends in the standards cases. The California Utilities stated that DOE should consider a "roll-up and market shift" scenario for room air conditioners in standards cases because, if the ENERGY STAR level is revised above the new standard, it may create a market incentive that increases the share of higher efficiency products. (California Utilities, No. 31 at p. 19)

DOE agrees that amended standards for room air conditioners would likely result in changes to ENERGY STAR levels that would increase the share of products with energy efficiency above the standard based on the historical data reviewed for room air conditioners. Therefore, for the final rule analysis, DOE applied a "roll-up and shift" scenario that accounts for such increase in share. For clothes dryers, DOE retained the approach used in the preliminary analysis for the final rule. For further details about the forecasted efficiency distributions, see chapter 10 of the direct final rule TSD.

3. National Energy Savings

For each year in the forecast period, DOE calculates the NES for each standard level by multiplying the stock of equipment affected by the energy conservation standards by the per-unit annual energy savings. As discussed in section IV.E, DOE incorporated the rebound effect utilized in the energy use analysis into its calculation of national energy savings for room air conditioners.

To estimate the national energy savings expected from appliance standards, DOE uses a multiplicative factor to convert site energy consumption (at the home or commercial building) into primary or source energy consumption (the energy required to convert and deliver the site energy). These conversion factors account for the energy used at power plants to generate electricity and losses in transmission and distribution, as well as for natural gas losses from pipeline leakage and energy used for pumping. For electricity, the conversion factors vary over time due to projected changes in generation sources (that is, the power plant types projected to provide electricity to the country). The factors that DOE developed are marginal values, which represent the response of the system to an incremental decrease in consumption associated with appliance standards.

In the preliminary analysis, DOE used annual site-to-source conversion factors based on the version of NEMS that corresponds to *AEO2009.* For today's rule, DOE updated its conversion factors based on the NEMS that corresponds to *AEO2010,* which provides energy forecasts through 2035. For 2036–2043, DOE used conversion factors that remain constant at the 2035 values.

Section 1802 of the Energy Policy Act of 2005 (EPACT 2005) directed DOE to contract a study with the National Academy of Science (NAS) to examine whether the goals of energy efficiency standards are best served by measurement of energy consumed, and efficiency improvements, at the actual point-of-use or through the use of the full-fuel-cycle, beginning at the source of energy production. (Pub. L. 109–58 (August 8, 2005)). NAS appointed a committee on "Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards" to conduct the study, which was completed in May 2009. The NAS committee defined full-fuel-cycle energy consumption as including, in addition to site energy use, the following: energy consumed in the extraction, processing, and transport of primary fuels such as coal, oil, and natural gas; energy losses in thermal combustion in power generation plants; and energy losses in transmission and distribution to homes and commercial buildings.[50]

In evaluating the merits of using point-of-use and full-fuel-cycle measures, the NAS committee noted that DOE uses what the committee referred to as "extended site" energy consumption to assess the impact of energy use on the economy, energy security, and environmental quality. The extended site measure of energy consumption includes the energy consumed during the generation, transmission, and distribution of electricity but, unlike the full-fuel-cycle measure, does not include the energy consumed in extracting, processing, and transporting primary fuels. A majority of the NAS committee concluded that extended site energy consumption understates the total energy consumed to make an appliance operational at the site. As a result, the NAS committee recommended that DOE consider shifting its analytical approach over time to use a full-fuel-cycle measure of energy consumption when assessing national and environmental impacts, especially with respect to the calculation of greenhouse gas emissions. The NAS committee also recommended that DOE provide more comprehensive information to the public through labels and other means, such as an enhanced Web site. For those appliances that use multiple fuels (such as water heaters), the NAS committee indicated that measuring full-fuel-cycle energy consumption would provide a more complete picture of energy consumed and permit comparisons across many different appliances, as well as an improved assessment of impacts.

In response to the NAS committee recommendations, DOE issued, on August 20, 2010 a Notice of Proposed Policy proposing to incorporate a full-fuel cycle analysis into the methods it uses to estimate the likely impacts of energy conservation standards on energy use and emissions. FR 75 51423. Specifically, DOE proposed to use full-fuel-cycle (FFC) measures of energy and greenhouse gas (GHG) emissions, rather than the primary (extended site) energy measures it currently uses. Additionally, DOE proposed to work collaboratively with the Federal Trade Commission (FTC) to make FFC energy and GHG emissions data available to the public to enable consumers to make cross-class comparisons. On October 7th, DOE held an informal public meeting to discuss and receive comments on its planned approach. The Notice, a transcript of the public meeting and all public comments received by DOE are available at:

[50] The National Academies, Board on Energy and Environmental Systems, Letter to Dr. John Mizroch, Acting Assistant Secretary, U.S. DOE, Office of EERE from James W. Dally, Chair, Committee on Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards, May 15, 2009.

http://www.regulations.gov/search/Regs/home.html#docketDetail?R=EERE-2010-BT-NOA-0028. DOE intends to develop a final policy statement on these subjects and then take steps to begin implementing that policy in future rulemakings and other activities.

4. Net Present Value of Consumer Benefit

The inputs for determining the NPV of the total costs and benefits experienced by consumers of the considered appliances are: (1) Total annual installed cost, (2) total annual savings in operating costs, and (3) a discount factor. DOE calculates net savings each year as the difference between the base case and each standards case in total savings in operating costs and total increases in installed costs. DOE calculates operating cost savings over the life of each product shipped in the forecast period.

DOE multiplies the net savings in future years by a discount factor to determine their present value. For the preliminary analysis and today's final rule, DOE estimated the NPV of appliance consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget (OMB) to Federal agencies on the development of regulatory analysis.[51] The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the "societal rate of time preference," which is the rate at which society discounts future consumption flows to their present value.

As noted above, DOE is accounting for the rebound effect associated with more efficient room air conditioners in its determination of national energy savings. The take-back in energy consumption associated with the rebound effect provides consumers with increased value (that is, a cooler or warmer indoor environment). The net impact on consumers is thus the sum of the change in the cost of owning the room air conditioner (that is, life-cycle cost) and the increased value for the more comfortable indoor environment. The consumer effectively pays for the increased value of a more comfortable environment in his or her utility bill. Because the monetary cost of this added value is equivalent to the value of the foregone energy savings, the economic impacts on consumers, as measured in the NPV are the same regardless of the rebound effect.

[51] OMB Circular A–4 (Sept. 17, 2003), section E, "Identifying and Measuring Benefits and Costs. Available at: *http://www.whitehouse.gov/omb/memoranda/m03-21.html.*

5. Benefits From Effects of Standards on Energy Prices

Reduction in electricity consumption associated with amended standards for clothes dryers and room air conditioners could reduce the electricity prices charged to consumers in all sectors of the economy and thereby reduce their electricity expenditures. In chapter 2 of the preliminary TSD, DOE explained that, because the power industry is a complex mix of fuel and equipment suppliers, electricity producers and distributors, it did not plan to estimate the value of potentially reduced electricity costs for all consumers associated with amended standards for refrigeration products. In response, NEEP urged DOE to quantify electricity demand reductions achieved by these updated standards in financial terms. (NEEP, No. 27 at p. 1)

For this rule, DOE used NEMS–BT to assess the impacts of the reduced need for new electric power plants and infrastructure projected to result from standards. In NEMS–BT, changes in power generation infrastructure affect utility revenue requirements, which in turn affect electricity prices. DOE estimated the impact on electricity prices associated with each considered TSL. Although the aggregate benefits for electricity users are potentially large, there may be negative effects on some of the actors involved in electricity supply, particularly power plant providers and fuel suppliers. Because there is uncertainty about the extent to which the benefits for electricity users from reduced electricity prices would be a transfer from actors involved in electricity supply to electricity consumers, DOE has concluded that, at present, it should not give a heavy weight to this factor in its consideration of the economic justification of new or amended standards. DOE is continuing to investigate the extent to which electricity price changes projected to result from standards represent a net gain to society.

H. Consumer Subgroup Analysis

In analyzing the potential impact of new or amended standards on consumers, DOE evaluates the impact on identifiable subgroups of consumers (such as low-income households) that may be disproportionately affected by a national standard. DOE evaluates impacts on particular subgroups of consumers primarily by analyzing the LCC impacts and PBP for those particular consumers from alternative standard levels. For this rule, DOE analyzed the impacts of the considered standard levels on low-income consumers and senior citizens. Section V.B.1.b summarizes the results of the consumer subgroup analysis, and chapter 11 in the direct final rule TSD describes the analysis method.

I. Manufacturer Impact Analysis

The following sections address the various steps taken to analyze the impacts of the amended standards on manufacturers. These steps include conducting a series of analyses, interviewing manufacturers, and evaluating the comments received from interested parties during this rulemaking.

1. Overview

In determining whether an amended energy conservation standard for residential clothes dryers and room air conditioners subject to this rulemaking is economically justified, DOE is required to consider "the economic impact of the standard on the manufacturers and on the consumers of the products subject to such standard." (42 U.S.C. 6295(o)(2)(B)(i)(I)) The statute also calls for an assessment of the impact of any lessening of competition as determined by the Attorney General that is likely to result from the adoption of a standard. (42 U.S.C. 6295(o)(2)(B)(i)(V)) DOE conducted the MIA to estimate the financial impact of amended energy conservation standards on manufacturers of clothes dryers and room air conditioners, and to assess the impacts of such standards on employment and manufacturing capacity.

The MIA is both a quantitative and qualitative analysis. The quantitative part of the MIA relies on the Government Regulatory Impact Model (GRIM), an industry cash-flow model customized for the clothes dryer and room air conditioners covered in this rulemaking. See section IV.I.2 below, for details on the GRIM analysis. The qualitative part of the MIA addresses factors such as product characteristics, characteristics of particular firms, and market trends. The qualitative discussion also includes an assessment of the impacts of standards on manufacturer subgroups. The complete MIA is discussed in chapter 12 of the direct final rule TSD. DOE conducted the MIA in the three phases described below.

a. Phase 1, Industry Profile

In Phase 1 of the MIA, DOE prepared a profile of the clothes dryers and room air conditioner industries based on the market and technology assessment prepared for this rulemaking. Before initiating the detailed impact studies, DOE collected information on the present and past structure and market characteristics of each industry. This information included market share data, product shipments, manufacturer markups, and the cost structure for various manufacturers. The industry profile includes: (1) Further detail on the overall market and product characteristics; (2) estimated manufacturer market shares; (3) financial parameters such as net plant, property, and equipment; selling, general and administrative (SG&A) expenses; cost of goods sold, and other similar information; and (4) trends in the number of firms, market, and product characteristics. The industry profile included a top-down cost analysis of manufacturers in each industry that DOE used to derive preliminary financial inputs for the GRIM (such as revenues, depreciation, SG&A, and research and development (R&D) expenses). DOE also used public sources of information to further calibrate its initial characterization of each industry, including Security and Exchange Commission 10–K filings,[52] Standard & Poor's stock reports,[53] and corporate annual reports. DOE supplemented this public information with data released by privately held companies.

b. Phase 2, Industry Cash Flow Analysis

Phase 2 focused on the financial impacts of potential amended energy conservation standards on each industry as a whole. Amended energy conservation standards can affect manufacturer cash flows in three distinct ways: (1) By creating a need for increased investment, (2) by raising production costs per unit, and (3) by altering revenue due to higher per-unit prices and/or possible changes in sales volumes. DOE used the GRIMs to perform two cash-flow analyses: One for the clothes dryers industry and one for room air conditioners. In performing these analyses, DOE used the financial values derived during Phase 1 and the shipment assumptions from the NIA.

c. Phase 3, Sub-Group Impact Analysis

Using average cost assumptions to develop an industry-cash-flow estimate may not adequately assess differential impacts of amended energy conservation standards among manufacturer subgroups. For example, small manufacturers, niche players, or manufacturers exhibiting a cost structure that differs significantly from the industry average could be more negatively affected. To address this possible impact, DOE used the results of the industry characterization analysis in Phase 1 to group manufacturers that exhibit similar production and cost structure characteristics. During the manufacturer interviews, DOE discussed financial topics specific to each manufacturer and obtained each manufacturer's view of the industry as a whole.

DOE reports the MIA impacts of amended energy conservation standards by grouping together the impacts on manufacturers of certain product classes. While DOE did not identify any other subgroup of manufacturers of clothes dryers or room air conditioners that would warrant a separate analysis, DOE specifically investigated impacts on small business manufacturers. See section VI.B for more information.

2. GRIM Analysis

DOE uses the GRIM to quantify the changes in cash flow that result in a higher or lower industry value. The GRIM analysis is a standard, annual cash-flow analysis that incorporates manufacturer costs, manufacturer selling prices, shipments, and industry financial information as inputs, and models changes in costs, distribution of shipments, investments, and manufacturer margins that would result from amended energy conservation standards. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning with the base year of the analysis, 2011 (which accounts for the investments needed to bring products into compliance by 2014), and continuing to 2043. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. For clothes dryers and room air conditioners, DOE uses a real discount rate of 7.2 percent for all products.

DOE used the GRIM to calculate cash flows using standard accounting principles and to compare changes in INPV between a base case and various TSLs (the standards cases). The difference in INPV between the base and standards cases represents the financial impact of the amended standard on manufacturers. DOE collected this information from a number of sources, including publicly available data and interviews with a number of manufacturers (described in the next section). Additional details about the GRIM can be found in chapter 12 of the direct final rule TSD.

a. GRIM Key Inputs

Manufacturer Production Costs

DOE used the manufacturer production costs (MPCs) calculated in the engineering analysis for each efficiency level for the year 2009, as described in section IV.C above, and further detailed in chapter 5 of the direct final rule TSD. For both clothes dryers and room air conditioners, DOE calculated the 2009 MPCs using cost models based on product tear downs. The cost models also provide a breakdown of MPCs into material, labor, overhead, and depreciation. Manufacturing a higher-efficiency product is typically more expensive than manufacturing a baseline product due to the use of more complex components and higher-cost raw materials. The changes in the MPCs of the analyzed products can affect revenues, gross margins, and cash flow of the industry, making these product cost data key GRIM inputs for DOE's analysis.

Base-Case Shipments Forecast

The GRIM estimates manufacturer revenues based on total unit shipment forecasts and the distribution of these values by efficiency level. Changes in the efficiency mix at each standard level affect manufacturer finances. For this analysis, the GRIM uses the NIA shipments forecasts from 2011 to 2043, the end of the analysis period.

In the shipments analysis, DOE also estimated the distribution of efficiencies in the base case for all product classes. For clothes dryers, DOE held the base-case energy efficiency distribution constant throughout the forecast period. For the room air conditioner industry, DOE assumed a migration of the market toward higher efficiency over time. See section IV.G.1, above, for additional details.

Product and Capital Conversion Costs

Amended energy conservation standards will cause manufacturers to incur conversion costs to bring their production facilities and product designs into compliance. For the MIA, DOE classified these costs into two major groups: (1) Product conversion costs and (2) capital conversion costs. Product conversion costs are investments in research, development, testing, marketing, and other non-capitalized costs focused on making product designs comply with the amended energy conservation standard. Capital conversion costs are investments in property, plant, and equipment to adapt or change existing production

[52] Available online at *http://www.sec.gov*.

[53] Available online at *http://www2.standardandpoors.com*.

facilities so that new product designs can be fabricated and assembled.

For both clothes dryers and room air conditioners, DOE based its conversion cost estimates that would be required to meet each TSL on information obtained from manufacturer interviews, the design pathways analyzed in the engineering analysis, and market information about the number of products that would require modification at each efficiency level. Because no energy label is currently prescribed for clothes dryers, and because clothes dryers are not part of the ENERGY STAR program, the best source of clothes dryer efficiency information is the CEC product database. DOE segmented each product on the CEC Web site into its appropriate product class using energy source, drum capacity, voltage, and combination unit information. DOE then searched manufacturer Web sites and numerous retail Web sites to determine which clothes dryers were current products. DOE assigned each product currently produced into efficiency levels using the reported energy factor. Finally, DOE assigned each of these products into product lines, classifying each group of products made by same manufacturer with identical drum capacities and energy factors into the same product line.

DOE calculated the product and capital conversion costs at each efficiency level for every product class by multiplying the total number of product lines that fell below the required efficiency by an estimate of the conversion costs to reach that efficiency level. DOE calculated the total product development required at each efficiency level by estimating the necessary engineering resources required to implement the design options in the engineering analysis at the efficiency level across a product line. DOE calculated the total capital conversion costs required at each efficiency level by estimating the additional equipment and changes to existing equipment that would be required to implement the design option in the engineering analysis at that efficiency level across a product line.

While DOE's calculation of conversion costs for room air conditioners was similar to the calculation of conversion costs for clothes dryers, DOE used a slightly different approach to determine the number of product lines at each efficiency level. DOE used the CEC appliance database to determine what models currently exist on the market for room air conditioners and verified these current products through manufacturer and retail Web sites. DOE eliminated products in the database that were discontinued due to the recent refrigerant switch to R–410A. DOE segmented each product from the CEC database into its appropriate product class using cooling capacity, the existence of louvers, and type of room air conditioner. DOE assigned each product currently produced into efficiency levels using the reported EER. Finally, DOE determined a representative distribution of the industry by extrapolating the information for manufacturers for which it had complete efficiency information to account for the product lines of all manufacturers.

Like its method for clothes dryers, DOE calculated the industry wide conversion costs by multiplying the number of product lines in each product class that fell below the required efficiency by its estimate of the product and capital conversion costs. DOE's estimate was based on the design options at each efficiency level in the engineering analysis. DOE's per line product conversion costs were calculated by estimating the product development time required to make the design change across a product family. For component switch outs, DOE assumed that design changes for components that interacted with other parts of the room air conditioner would be more costly than one-for-one switch outs because these components would require greater engineering effort to be adapted into new product designs. For capital conversion costs, DOE assumed based on manufacturer feedback that the only design changes that would require changes to existing equipment were larger chassis volumes, evaporator changes, and condenser changes.

DOE's estimates of the total capital conversion and production conversion costs for clothes dryer and room air conditioners by TSL can be found in section V.B.2 of today's direct final rule. The estimates of the total capital conversion and product conversion costs by product class and efficiency level can be found in chapter 12 of the direct final rule TSD.

b. GRIM Scenarios

Clothes Dryer Standards-Case Shipment Forecasts

The GRIM used the shipments developed in the NIA for clothes dryers. To determine efficiency distributions for the standards case, DOE used a roll-up scenario. In this scenario, products that fall below the amended energy conservation standard are assumed to "roll-up" to the new standard in 2014. DOE also assumed there was a relative price elasticity in the clothes dryers market, meaning amended energy conservation standards that increase the first cost of clothes dryers would result in lower total shipments. *See* section IV.G.1 of this direct final rule, and chapter 10 of the direct final rule TSD for more information on the clothes dryer standards-case shipment scenarios.

Room Air Conditioner Standards-Case Shipment Forecasts

The GRIM used the shipments developed in the NIA for room air conditioners. As stated in IV.I.2.a, the base case shipments assume that there is a migration over time to more efficient products based on historical trends of penetration of ENERGY STAR products. In the standards case, DOE used a "roll-up + shift" scenario. In this scenario, DOE assumed that amended standards for room air conditioners would likely result in changes to ENERGY STAR levels that would increase the share of products with energy efficiency above the standard. DOE also assumed there was a relative price elasticity in the room air conditioner market, meaning that amended energy conservation standards that increase the first cost of room air conditioners would result in lower total shipments. See section IV.G.1 of this direct final rule and chapter 10 of the direct final rule TSD for more information on the room air conditioner standards-case shipment scenarios.

Markup Scenarios

In the GRIM, DOE used the MSPs calculated in the engineering analysis for each product class and efficiency level. MSPs include direct manufacturing production costs (that is, labor, material, and overhead estimated in DOE's MPCs) and all non-production costs (that is, SG&A, R&D, and interest), along with profit. For clothes dryers, DOE did not separate shipping costs from the manufacturer markup because shipping costs are not a function of the design options analyzed. The MSP for clothes dryers is equal to the MPC times the manufacturer markup. For room air conditioners, DOE separated the shipping costs from the markup multiplier for the analysis to explicitly account for the design options that would result in higher shipping costs due to weight increases. DOE calculated the MSP for room air conditioners by multiplying the MPC by the manufacturer markup and adding shipping costs.

For the MIA, DOE modeled two standards-case markup scenarios to represent the uncertainty regarding the potential impacts on prices and profitability for manufacturers following the implementation of amended energy conservation standards: (1) A flat markup scenario, and (2) a preservation of operation profit scenario. Modifying these markups from the base case to the standards cases yields different sets of impacts on manufacturers' changing industry revenue and cash flow.

The flat markup scenario assumes that the cost of goods sold for each product is marked up by a flat percentage to cover standard SG&A expenses, R&D expenses, and profit. The flat markup scenario uses the baseline manufacturer markup (discussed in chapter 6 of the direct final rule TSD) for all products in both the base case and the standards case. To derive this percentage, DOE evaluated publicly available financial information for manufacturers of major household appliances whose product offerings include clothes dryers and room air conditioners. DOE also requested feedback on this value during manufacturer interviews. This scenario represents the upper bound of industry profitability in the standards case because under this scenario, manufacturers are able to fully pass through additional costs due to standards to their customers.

DOE also modeled a lower bound profitability scenario. In this scenario, the manufacturer markups are lowered such that, in the standards case, manufacturers are able to maintain only the base-case total operating profit in absolute dollars, despite higher product costs and investment. DOE implemented this scenario in GRIM by lowering the manufacturer markups at each TSL to yield approximately the same earnings before interest and taxes in the standards case in the year after the compliance date of the amended standards as in the base case. For clothes dryers in the preservation of operating profit scenario, DOE assumed that the industry wide impacts would occur under the new minimum efficiency levels. DOE altered the markups only for the minimally compliant products in this scenario, with margin impacts not occurring for products that already exceed the amended energy conservation standard. For room air conditioners, DOE assumed that the margin impacts would affect the minimally compliant products at the amended energy conservation standards and the next highest efficiency level. The NIA analyzed an efficiency migration in both the base case and the standards case due to the assumption that manufacturers will produce increasingly more efficient room air conditioners as ENERGY STAR levels for these products change over time. Therefore, under amended energy conservation standards the shipment weighted average efficiency increases from the new minimum standard to higher efficiency levels. DOE assumed this market shift caused by standards would impact margins on products that also become the de facto minimally efficient product over time. For both clothes dryers and room air conditioners, the preservation of operating profit represents the lower bound of industry profitability following amended energy conservation standards because under this scenario, higher production costs and the investments required to comply with the amended energy conservation standard do not yield additional operating profit.

While DOE used the same markup scenarios for clothes dryers and room air conditioners, DOE captured different concerns for each industry by modeling the preservation of operating profit scenario. For clothes dryers, manufacturers were particularly concerned about the inability to markup the full cost of production. Because there is currently no energy label requirement or ENERGY STAR program for clothes dryers, the lack of consumer information makes it more difficult for customers to calculate individual payback and energy savings. Consequently, the manufacturing cost for more efficient clothes dryers could not be fully marked up because energy efficiency, unlike price and other features, is not a factor in the purchasing decision of most consumers. Manufacturers also cited the highly competitive market, the concentrated retail market that represents the majority of sales, and price points that are fixed partly by paired washing machines as other reasons that additional production costs would not yield higher profits in the standards case. For room air conditioners, manufacturers stated that higher production costs could severely harm profitability. Manufacturers already earn very little profit on the small, high-volume window units due to the enormous price pressure retailers exert because of their purchasing power, and due to fierce competition within the room air conditioner industry. Manufacturers accept lower absolute profit on these units with the expectation of making a larger per unit profit on other more costly products. They also do so because maintaining high production volumes of these units allows manufacturers to keep factories utilized and to achieve purchasing economies. In addition, because many purchases are impulse buys during periods of atypically warm weather for products that are used sparingly, any increase in first cost could impact these types of sales. Therefore, manufacturers were skeptical that customers would accept the full additional cost of production.

3. Discussion of Comments

During the March 2010 public meeting, interested parties commented on the assumptions and results of the manufacturer impacts presented in the preliminary analysis. Oral and written comments discussed several topics, including the classification of small business manufacturers, the cumulative regulatory burden on manufacturers, the impact of R–410A conversion, and direct employment impacts. DOE addresses these comments below.

a. Small Businesses

In the preliminary analysis, DOE stated it did not identify any small business manufacturers of residential clothes dryers but that it did identify at least one room air conditioner manufacturer that was designated as a small business by the U.S. Small Business Administration criteria. DOE requested comment on this assertion. AHAM stated that it agreed with DOE's assessment regarding the number of small businesses for room air conditioners and clothes dryers. (AHAM, No. 25 at p. 12) Whirlpool similarly stated that it did not know of any qualifying small businesses for residential clothes dryers. (Whirlpool, No. 22 at p. 4) HTC, however, stated that it is a small business registered under the Central Contracting Registration and the appropriate NAICS code for the residential clothes dryers covered by this rulemaking (335224—household laundry equipment manufacturers). HTC requested consideration by DOE as a small business and asserted that it would be negatively impacted if DOE decided not to include its technologies in the standards for residential clothes dryers (HTC, No. FDMS DRAFT 0068 at pp. 6, 10)

For clothes dryers, DOE notes that it could not locate HTC as a small business on the SBA Web site (*http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm*) or under the Central Contracting Registration (*https://www.bpn.gov/CCRSearch/Search.aspx*). DOE does not question HTC's assertion that it is a small business, but DOE does not believe that HTC would be directly impacted by this rule. HTC has developed a technology that can be incorporated into clothes dryers. DOE acknowledges in section IV.A.5.a that HTC's technology is a potential design option but also notes this technology is not commercially available. DOE does not believe this rulemaking would affect HTC's ability to commercialize or sell its technology. Therefore, DOE does not believe HTC will be impacted by this rulemaking.

For room air conditioners, DOE amends its conclusion of the number of small manufacturers in today's direct final rule. The one manufacturer previously identified by DOE as a small business was since acquired by a company and exceeds the 750-employee threshold under NAICS code 333415 (air conditioning and warm air heating equipment manufacturers and commercial and industrial refrigeration equipment manufacturers). As such, DOE believes there are no qualifying small business manufacturers in the room air conditioner industry.

For more information on the potential impact on small business manufacturers, see section VI.B.

b. Cumulative Regulatory Burden

Several interested parties responded to DOE's request for comment during the preliminary analysis period on regulations that could impose a burden on manufacturers of clothes dryers and room air conditioners. BSH stated that DOE should consider potential greenhouse gas regulations and the EPA ban on hydrochlorofluorocarbon (HCFC) refrigerants in new products since these regulations are relevant for heat pump clothes dryers. (BSH, No. 23 at p. 5) In contrast, NPCC stated that DOE should not include the cost of converting to alternative refrigerants such as R–410A in its manufacturer impact analysis for room air conditioners since the HCFC ban has already taken effect. (NPCC, No. 32 at p. 4)

DOE acknowledges that the phase-out of hydrofluorocarbons (HFC) or similar refrigerants could necessitate changes to heat pump clothes dryers if current products offered on the market have to be redesigned. DOE also notes that the most efficient electric clothes dryers on the U.S. market today do not use heat pump technology, so a change in the available refrigerants would not currently impact products on the U.S. market. Because heat pump technology passed the screening criteria, it is analyzed as in technology that could increase the efficiency of residential clothes dryers. DOE has analyzed heat pump clothes dryers as the max-tech units for electric clothes dryer product classes. In its engineering analysis for these relevant product classes, DOE assumed that these products would utilize refrigerants that are currently available on the market. However, DOE does not include the impacts of a potential change in available refrigerant for heat pump clothes dryers because it would be speculative to predict the passage of legislation or the outcome of future rulemakings that would alter available refrigerants.

In response to the inclusion of the ban on HCFC refrigerants, DOE notes that the ban is relevant to both heat pump clothes dryer manufactures and room air conditioner manufacturers. The ban on R–22 became effective on January 1, 2010, so all products currently produced must comply with this regulation. This ban, which required manufacturers to cease using virgin R–22 in new equipment, necessitated substantial product design changes and capital investments. DOE accounts for these design changes in its engineering analysis by basing its analysis for room air conditioners on the use of R–410A refrigerant, as described in section IV.C.2.b. This allows DOE to capture the impacts of the refrigerant change on product cost and efficiency.

The ban also caused manufacturers to incur significant product and capital conversion costs. Manufacturers had to redesign units for new compressors and other new components and conduct extensive testing, and in some cases manufacturers devoted full-time engineering resources to this conversion for up to 2 years. Additionally, manufacturers had to purchase new heat exchanger equipment and make other capital investments. DOE did not include the costs of converting to alternative refrigerants in the GRIM because these changes were not driven by the standards established in today's final rule. DOE describes the HCFC ban in further detail as part of the cumulative regulatory burden in chapter 12 of the direct final rule TSD.

Several manufacturers also responded to DOE's request for comment on the UL fire safety regulation for clothes dryers. Whirlpool stated that this regulation has no effect on energy efficiency, but added that DOE should include it as a regulatory burden. (Whirlpool, No. 22 at p. 2) BSH noted that the regulation takes effect in 2013. (BSH, No. 23 at p. 6) ALS speculated that each clothes dryer manufacturer will have its own concerns about this regulation and its impacts. (ALS, Public Meeting Transcript, No. 21.4 at p. 154) HTC stated that it has successfully passed UL 2158 safety guidelines for electric clothes dryers and requested consideration of this compliance. (HTC, No. FDMS DRAFT 0068 at p. 7)

DOE appreciates this input on the UL fire safety regulations for clothes dryers. While DOE did not receive enough information to calculate the cost of changes to baseline clothes dryers to comply with UL 2158 in the engineering analysis, DOE agrees with Whirlpool that this regulation would not impact energy efficiency and consequently would not change the incremental costs calculated in the engineering analysis. While the UL 2158 is not a Federal regulation, UL certification is a *de facto* requirement for selling products in the U.S. because of local building codes requiring all installed products meet safety regulations and to avoid litigation. DOE included the conversion costs for manufacturers to comply with UL 2158 as part of the cumulative regulatory burden.

Additional information on the cumulative regulatory burden on clothes dryer and room air conditioner manufacturers is included in chapter 12 of the direct final rule TSD, including details on how DOE treated the conversion costs for the UL 2158 regulation.

c. Employment Impacts

Two interested parties commented on DOE's characterization of the domestic employment impacts for room air conditioner manufacturers. EEI stated that if DOE concluded no room air conditioner production remains in the United States, there should be no domestic impacts on employment. EEI stated that further analysis may be necessary to capture impacts on these manufacturers. (EEI, Public Meeting Transcript, No. 21.4 at pp. 31–34) To follow up on this issue, GE stated that revenue from non-domestic manufacturing helps fund the R&D and domestic production of other products that room air conditioner manufacturers produce. Therefore, the effects of room air conditioner manufacturing spill over into other industries. (GE, Public Meeting Transcript, No. 21.4 at pp. 33–34)

DOE's direct employment impact assessment focuses on domestic employment impacts. These employment impacts are calculated in the GRIM based on the domestic expenditures and labor content of room air conditioner production. Because all room air conditioners are manufactured abroad, any change in labor content resulting from amended standards would impact labor requirements in non-domestic facilities and would not be quantified in DOE's direct employment impact assessment. While many room air conditioner manufacturers produce other products and a company's revenues in one industry may impact its overall revenues and operations, DOE does not analyze spillover effects among different business segments in its direct employment impact assessment. DOE does analyze indirect employment impacts in the domestic economy in section IV.J.

4. Manufacturer Interviews

DOE interviewed manufacturers representing more than 90 percent of clothes dryer sales and approximately 50 percent of room air conditioner sales. These interviews were in addition to those DOE conducted as part of the engineering analysis. DOE used these interviews to tailor the GRIM to incorporate unique financial characteristics for each industry. All interviews provided information that DOE used to evaluate the impacts of potential amended energy conservation standards on manufacturer cash flows, manufacturing capacities, and employment levels. See appendix 12–A of the direct final rule TSD for additional information on the MIA interviews.

The following sections describe the most significant issues identified by manufacturers.

a. Clothes Dryer Key Issues

Test Procedure

Manufacturers indicated that a key concern for this rulemaking was ensuring that the test procedure accurately measured actual energy use. In particular, manufacturers indicated that proposed changes to the RMC value and the average number of annual cycles needed to be updated. Manufacturers indicated that without these changes, consumers could be negatively impacted by amended energy conservation standards because clothes dryers have a limited number of improvements that would be cost effective for most consumers.

UL Fire Containment Standard

Most manufacturers indicated that they had not fully investigated the exact technical changes that will be required to meet the UL fire containment regulation (UL 2158). However, manufacturers were concerned that this regulation would require changes to all their products around the same time that they would be required to meet the amended energy conservation standard. Most manufacturers agreed that even if the exact approach of meeting UL 2158 is different or unknown by individual manufactures, DOE should still treat the regulation as an overall burden.

Heat Pump Technology

Manufacturers indicated that the high capital conversion and product conversion costs for clothes dryers at the second gap fill levels or the maximum available units were significant and would represent a substantial burden. Manufacturers also indicated that the pathways to meeting those levels, while potentially costly, were well-defined, proven in the market, and could be made within their existing production facilities. Manufacturers also indicated, however, that heat pump technology at the max-tech levels for electric product classes would represent a significant departure from current products and add significantly to the product and capital conversion costs. A heat pump standard would require a total renovation of existing facilities. The changes required to manufacture heat pumps would require revamping most existing production equipment and redesigning a new platform. The capital conversion costs would include equipment for new drum lines, assembly line testing equipment, stamping equipment for cabinets, and other production equipment to manufacturer the sealed systems. In addition to the large development costs to develop new platforms, manufacturers would have the additional expense of developing the sealed system. Other increases to the product development costs for heat pump clothes dryers that concerned manufacturers were the significant retraining costs for their servicers and the marketing costs to educate consumers and ensure they accept the new technology. With the substantial change that would be required to develop, manufacture, and educate consumers about heat pump clothes dryers, manufacturers were concerned they might not be able to make all the required changes with a 3-year lead time between the announcement of the final rule and the compliance date of the amended energy conservation.

Manufacturers also indicated that an energy conservation standard at a level that effectively required a heat pump clothes dryer would force them to consider off-shoring any remaining production in the United States. Besides the significant capital and product conversion costs, manufacturers indicated that the much higher labor content of a heat pump clothes dryer would put additional pressure on moving production out of the United States. Finally, manufacturers believed that repair and maintenance costs would increase if an energy conservation standard effectively required heat pump clothes dryers. Repair and maintenance costs would increase due to the more expensive components, potential lint management problems, and some manufacturers' inexperience with the technology.

Impacts on Profitability

Manufacturers indicated that an amended energy conservation standard would likely impact profits in the clothes dryer market. Because there is currently no energy label requirement and no ENERGY STAR program for clothes dryers, manufacturers indicated that, unlike clothes washers, efficiency does not command any premium in the market (either in percentage or absolute terms). Because it is difficult to communicate any energy benefit to consumers, it is very unlikely that they could benefit from higher production costs caused by amended energy conservation standards.

In addition, manufacturers indicated that the large incremental cost jumps at some of the higher efficiency levels, including heat pump clothes dryers, were unlikely to be fully passed on to their customers. Beside the inability to show the energy benefit of the products, manufacturers indicated that the concentrated number of players in the retail market would put pressure on all manufacturers to keep costs down in response to amended energy conservation standards. Manufacturers also indicated that many of their sales are from pairs of clothes washers and dryers that have similar price points. If the cost of clothes dryers increased, manufacturers felt that retailers would not accept any price increase to keep the retail prices of the matched pair similar.

b. Room Air Conditioner Key Issues

Impact on Manufacturer Profitability

Several manufacturers stated that they expect amended energy conservation standards to negatively impact the profitability of room air conditioners. Higher component, tooling, and development costs for more efficient products would increase MPCs, but manufacturers believed these higher costs could not necessarily be passed on to consumers due to the nature of the industry. A few large retailers dominate the industry and exert downward pressure on prices. Retailers demand low prices because consumers have come to expect room air conditioners at particular price points. For example, consumers expect many product offerings of product class 1 for under $100, and retailers have successfully maintained that price point through competitive bidding. This has resulted in price pressure on the most popular units as manufacturers accept lower absolute profit on those units in the hopes of making a larger per unit profit on other more costly products. Many room air conditioner purchases are weather-dependent, so consumers could easily forgo the purchase of a room air conditioner unit altogether if prices increased. Consequently, manufacturers believed that cost increases would be at least partly absorbed by manufacturers to keep retail prices from rising sharply.

If amended energy conservation standards led to a significant reduction in profitability, some manufacturers could exit the market (as a number of large players have in recent years). Many manufacturers source room air conditioner lines from overseas and do not own the production equipment. This arrangement would allow manufacturers to exit the industry without stranded assets.

Impact on Product Utility

Manufacturers believed a negative profitability impact could also indirectly affect product utility. Several manufacturers indicated that other features that do not affect efficiency could be removed or component quality could be sacrificed to meet amended standard levels and maintain product prices at levels that would be acceptable to consumers.

Manufacturers also expressed concern that the energy savings from more stringent energy conservation standards would not be great enough to justify passing through the added costs to consumers. Currently, manufacturers bundle higher efficiency with other desirable features to justify higher prices for ENERGY STAR models. According to manufacturers, if amended standards caused prices to increase, the lower operating costs would not justify higher prices because the energy savings would be low compared to the initial price of the unit. Therefore, the increased cost of meeting the amended efficiency requirements may cause manufacturers to reduce the number of features to retain a reasonable price point.

The value of future ENERGY STAR levels is also a concern for manufacturers. Many retailers and other distribution channels require ENERGY STAR products. Because the features bundled with ENERGY STAR products are the selling point to consumers, manufacturers were concerned that a higher ENERGY STAR level after amended standards would result in products with fewer features.

Manufacturers also stated that the financial burden of developing products to meet amended energy conservation standards has an opportunity cost due to limited capital and R&D dollars. Investments incurred to meet amended energy conservation standards reflect foregone investments in innovation and the development of new features that consumers value and on which manufacturers earn higher absolute profit.

Component Availability

Several manufacturers stated they were concerned about component availability. Compressor availability since the conversion to R–410A was the main problem cited by manufacturers. Some manufacturers stated that component suppliers do not give priority to room air conditioning because the market is exclusive to North America and smaller than some of the other markets they supply. Since the conversion R–410A, manufacturers noted the total production capacity of compressor suppliers has not fully rebounded. In addition, compressor suppliers have yet to offer the same range of compressor capacities and efficiency tiers.

Size Constraints

A number of manufacturers expressed concerns about physical limitations of how large room air conditioners could grow. Most residential buildings have standardized window openings. Because a large portion of air conditioners are installed in these standardized openings, products must still fit in these typical windows after they have been redesigned. Manufacturers were largely concerned that the limited opportunity for growth also limited opportunities for efficiency improvements. Increasing the size of units also presents a problem for smaller air conditioners, which typically operate at under 10,000 Btu/hr. Much of the appeal of these units is that they can be lifted and installed by one person. Increasing the size of these units would greatly alter the market and may cause consumers to purchase less efficient portable air-conditioning units.

Manufacturers mentioned refrigerant charge as another reason why room air conditioners are constrained by size. If manufacturers used increased coil size and a smaller compressor capacity to improve efficiency, the larger heat exchangers combined with the reduced nominal compressor capacity could lead to a system refrigerant charge amount that exceeds the recommended level. Exceeding recommended charge levels could damage the compressor, thereby limiting the extent of efficiency improvements associated with coil size growth. To counteract the increase in charge levels, some manufacturers have used smaller tubing in their heat exchangers. However, North American suppliers are not currently properly equipped to support smaller tube sizes and might not be willing to make the investment required to do so.

Several manufacturers stated that size is also a concern because moving from a smaller chassis to larger chassis would cause material costs to increase dramatically due to more costly components and the potential capital costs required for development. If the adopted standards required significant rather than incremental increases in efficiency, the largest units in each capacity range would likely have to move to the next largest or a new chassis in order to meet the required efficiency levels. This is a notable concern for capacities above 28,000 Btu/hr because manufacturers could choose to no longer offer these product lines due to the conversion cost.

Numerous manufacturers stated that size constraints pose a problem for non-louvered units in particular. Non-louvered units inherently have less room for efficiency improvement because they need to fit into the existing sleeves in buildings. They are also constrained by air flow, increasing the depth does not result in significant efficiency gains because air on the condenser side must still flow through the rear face. Additionally, increasing depth creates a product that is less aesthetically pleasing and could decrease the available space in the room.

Product Switching

Some manufacturers noted that higher consumer prices after an amended energy conservation standard could result in product switching along the upper capacity boundaries of a product class if efficiency requirements are not implemented proportionally across product classes. For example, if after energy conservation standards are amended the first cost of units in product class 1 is not proportionally lower than units in product class 3, consumers who would have purchased product class 1 units are likely to purchase less efficient, slightly higher capacity units in product class 3. Without a significant price differential between product classes, consumers would be more likely to buy units with higher capacity, potentially lowering the calculated energy savings.

J. Employment Impact Analysis

DOE considers employment impacts in the domestic economy as one factor in selecting a proposed standard.

Employment impacts consist of direct and indirect impacts. Direct employment impacts are any changes in the number of employees of manufacturers of the appliance products that are the subject of this rulemaking, their suppliers, and related service firms. Indirect employment impacts are changes in national employment that occur due to the shift in expenditures and capital investment caused by the purchase and operation of more efficient appliances. The MIA discussed above in Section IV.I. addresses the direct employment impacts that concern manufacturers of clothes dryers and room air conditioners. The employment impact analysis addresses the indirect employment impacts.

Indirect employment impacts from standards consist of the net jobs created or eliminated in the national economy, other than in the manufacturing sector being regulated, due to: (1) Reduced spending by end users on energy; (2) reduced spending on new energy supply by the utility industry; (3) increased spending on new products to which the new standards apply; and (4) the effects of those three factors throughout the economy. DOE expects the net monetary savings from standards to be redirected to other forms of economic activity. DOE also expects these shifts in spending and economic activity to affect the demand for labor in the short term, as explained below.

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sectoral employment statistics developed by the Labor Department's Bureau of Labor Statistics (BLS).[54] The BLS regularly publishes its estimates of the number of jobs per million dollars of economic activity in different sectors of the economy, as well as the jobs created elsewhere in the economy by this same economic activity. Data from BLS indicate that expenditures in the utility sector generally create fewer jobs (both directly and indirectly) than expenditures in other sectors of the economy. There are many reasons for these differences, including wage differences and the fact that the utility sector is more capital intensive and less labor intensive than other sectors.[55]

[54] Data on industry employment, hours, labor compensation, value of production, and the implicit price deflator for output for these industries are available upon request by calling the Division of Industry Productivity Studies (202–691–5618) or by sending a request by e-mail to *dipsweb@bls.gov*. Available at: *http://www.bls.gov/news.release/prin1.nr0.htm.*

[55] See: Bureau of Economic Analysis. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* 1192. U.S. Department of Commerce: Washington, DC.

Energy conservation standards have the effect of reducing consumer utility bills. Because reduced consumer expenditures for energy likely lead to increased expenditures in other sectors of the economy, the general effect of efficiency standards is to shift economic activity from a less labor-intensive sector (*i.e.,* the utility sector) to more labor-intensive sectors (*e.g.,* the retail and service sectors). Thus, based on the BLS data alone, DOE believes net national employment will increase due to shifts in economic activity resulting from amended standards for clothes dryers and room air conditioners.

For the standard levels considered in today's direct final rule, DOE estimated indirect national employment impacts using an input/output model of the U.S. economy called Impact of Sector Energy Technologies (ImSET). ImSET is a spreadsheet model of the U.S. economy that focuses on 187 sectors most relevant to industrial, commercial, and residential building energy use.[56] ImSET is a special purpose version of the "U.S. Benchmark National Input-Output" (I–O) model, which has been designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer-based I–O model with structural coefficients to characterize economic flows among the 187 sectors. ImSET's national economic I–O structure is based on a 2002 U.S. benchmark table, specially aggregated to the 187 sectors. DOE estimated changes in expenditures using the NIA spreadsheet. Using ImSET, DOE then estimated the net national, indirect employment impacts by sector of potential amended efficiency standards for clothes dryers and room air conditioners.

For more details on the employment impact analysis and the results of this analysis, see direct final rule TSD chapter 13.

K. Utility Impact Analysis

The utility impact analysis estimates several important effects on the utility industry of the adoption of new or amended standards. For this analysis, DOE used the NEMS–BT model to generate forecasts of electricity consumption, electricity generation by plant type, and electric generating capacity by plant type, that would result from each TSL. DOE obtained the energy savings inputs associated with efficiency improvements to considered products from the NIA. DOE conducts the utility impact analysis as a scenario that departs from the latest *AEO* Reference case. In the analysis for today's rule, the estimated impacts of standards are the differences between values forecasted by NEMS–BT and the values in the *AEO2010* Reference case.

[56] J.M. Roop, M.J. Scott, and R.W. Schultz. *ImSET 3.1: Impact of Sector Energy Technologies.* 2009. Pacific Northwest National Laboratory: Richland, WA. PNNL–18412. Available at: *http://www.pnl.gov/main/publications/external/technical_reports/PNNL-18412.pdf.*

As part of the utility impact analysis, DOE used NEMS–BT to assess the impacts on electricity prices of the reduced need for new electric power plants and infrastructure projected to result from the considered standards. In NEMS–BT, changes in power generation infrastructure affect utility revenue requirements, which in turn affect electricity prices. DOE estimated the change in electricity prices projected to result over time from each TSL. For further discussion, see section IV.G.5.

For more details on the utility impact analysis and the results of this analysis, see chapter 14 of the direct final rule TSD.

L. Environmental Assessment

Pursuant to the National Environmental Policy Act and the requirements of 42 U.S.C. 6295(o)(2)(B)(i)(VI), DOE prepared an environmental assessment (EA) of the impacts of the standards for clothes dryers and room air conditioners in today's direct final rule, which it has included as chapter 15 of the direct final rule TSD. DOE found that the environmental effects associated with the standards for clothes dryers and room air conditioners were not significant. Therefore, DOE issued a Finding of No Significant Impact (FONSI) pursuant to NEPA, the regulations of the Council on Environmental Quality (40 CFR parts 1500–1508), and DOE's regulations for compliance with NEPA (10 CFR part 1021). The FONSI is available in the docket for this rulemaking.

In the EA, DOE estimated the reduction in power sector emissions of CO_2, NO_X, and Hg using the NEMS–BT computer model. In the EA, NEMS–BT is run similarly to the *AEO* NEMS, except that clothes dryer and room air conditioner energy use is reduced by the amount of energy saved (by fuel type) due to each TSL. The inputs of national energy savings come from the NIA spreadsheet model, while the output is the forecasted physical emissions. The net benefit of each TSL in today's direct final rule is the difference between the forecasted emissions estimated by NEMS–BT at each TSL and the *AEO 2010* Reference Case. NEMS–BT tracks CO_2 emissions using a detailed module that provides results with broad coverage of all sectors and inclusion of interactive effects. Because the on-site operation of gas clothes dryers requires use of fossil fuels and results in emissions of CO_2, NO_X and sulfur dioxide (SO_2), DOE also accounted for the reduction in these emissions due to standards at the sites where these appliances are used.

DOE has determined that SO_2 emissions from affected fossil fuel fired combustion devices (also known as Electric Generating Units (EGUs)) are subject to nationwide and regional emissions cap and trading programs that create uncertainty about the standards' impact on SO_2 emissions. Title IV of the Clean Air Act, 42 U.S.C. 7401–7671q, sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous states and the District of Columbia (DC). SO_2 emissions from 28 eastern States and DC are also limited under the Clean Air Interstate Rule (CAIR, 70 FR 25162 (May 12, 2005)), which created an allowance-based trading program. Although CAIR has been remanded to the EPA by the U.S. Court of Appeals for the District of Columbia (DC Circuit), see *North Carolina* v. *EPA,* 550 F.3d 1176 (DC Cir. 2008), it remains in effect temporarily, consistent with the DC Circuit's earlier opinion in *North Carolina* v. *EPA,* 531 F.3d 896 (DC Cir. 2008). On July 6, 2010, EPA issued the Transport Rule proposal, a replacement for CAIR, which would limit emissions from EGUs in 32 states, potentially through the interstate trading of allowances, among other options. 75 FR 45210 (Aug. 2, 2010).

The attainment of the emissions caps is typically flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. Under existing EPA regulations, and under the Transport Rule if it is finalized, any excess SO_2 emission allowances resulting from the lower electricity demand caused by the imposition of an efficiency standard could be used to permit offsetting increases in SO_2 emissions by any regulated EGU. However, if the standard resulted in a permanent increase in the quantity of unused emission allowances, there would be an overall reduction in SO_2 emissions from the standards. While there remains some uncertainty about the ultimate effects of efficiency standards on SO_2 emissions covered by the existing cap and trade system, the NEMS–BT modeling system that DOE uses to forecast emissions reductions currently indicates that no physical reductions in power sector emissions would occur for SO_2.

A cap on NO_X emissions, affecting electric generating units in the CAIR region, means that standards on clothes dryers and room air conditioners may have little or no physical effect on NO_X emissions in the 28 eastern States and the DC covered by CAIR, or any states covered by the proposed Transport Rule if the Transport Rule is finalized. The standards would, however, reduce NO_X emissions in those 22 States not affected by the CAIR. As a result, DOE used NEMS–BT to forecast emission reductions from the standards considered for today's direct final rule.

Similar to emissions of SO_2 and NO_X, future emissions of Hg would have been subject to emissions caps. In May 2005, EPA issued the Clean Air Mercury Rule (CAMR). 70 FR 28606 (May 18, 2005). CAMR would have permanently capped emissions of mercury for new and existing coal-fired power plants in all States by 2010. However, on February 8, 2008, the DC Circuit issued its decision in *New Jersey* v. *Environmental Protection Agency,* in which it vacated CAMR. 517 F.3d 574 (DC Cir. 2008). EPA has decided to develop emissions standards for power plants under the Clean Air Act (Section 112), consistent with the DC Circuit's opinion on the CAMR. *See http://www.epa.gov/air/mercuryrule/pdfs/certpetition_withdrawal.pdf.* Pending EPA's forthcoming revisions to the rule, DOE is excluding CAMR from its environmental assessment. In the absence of CAMR, a DOE standard would likely reduce Hg emissions and DOE plans to use NEMS–BT to estimate these emission reductions. However, DOE continues to review the impact of rules that reduce energy consumption on Hg emissions, and may revise its assessment of Hg emission reductions in future rulemakings.

The operation of gas clothes dryers requires use of fossil fuels and results in emissions of CO_2, NO_X, and SO_2 at the sites where these appliances are used. NEMS–BT provides no means for estimating such emissions. DOE calculated the effect of the standards in today's rule on the above site emissions based on emissions factors derived from the literature.

Commenting on the preliminary TSD, AHAM stated that if DOE includes values for CO_2 reductions, it should also include CO_2 emissions that result indirectly from changes in a standard, including increased manufacturing emissions, increased transportation emissions, and reduced carbon emissions from peak load reductions. (AHAM, No. 25 at p. 12) In response, DOE notes that the inputs to the EA for national energy savings come from the NIA. In the NIA, DOE accounts for only the primary energy savings associated with considered standards. In so doing, EPCA directs DOE to consider (when determining whether a standard is economically justified) "the total projected amount of energy * * * savings likely to result directly from the imposition of the standard." 42 U.S.C. 6295(o)(2)(B)(i)(III) DOE interprets "directly from the imposition of the standard" to include energy used in the generation, transmission, and distribution of fuels used by appliances. In addition, DOE is evaluating the full-fuel-cycle measure, which includes the energy consumed in extracting, processing, and transporting primary fuels (see section IV.G.3). Both DOE's current accounting of primary energy savings and the full-fuel-cycle measure are directly linked to the energy used by appliances. In contrast, energy used in manufacturing and transporting appliances is a step removed from the energy used by appliances. Thus, DOE did not consider such energy use in either the NIA or the EA. DOE did include CO_2 emissions reductions resulting from projected impacts of revised standards on electricity demand.

M. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of this direct final rule, DOE considered the estimated monetary benefits likely to result from the reduced emissions of CO_2 NO_X that are expected to result from each of the TSLs considered. In order to make this calculation similar to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in the forecast period for each TSL. This section summarizes the basis for the monetary values used for each of these emissions and presents the benefits estimates considered.

For today's direct final rule, DOE is relying on a set of values for the social cost of carbon (SCC) that was developed by an interagency process. A summary of the basis for these values is provided below, and a more detailed description of the methodologies used is provided in appendix 15–A of the direct final rule TSD.

1. Social Cost of Carbon

Under Executive Order 12866, agencies must, to the extent permitted by law, "assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs." The purpose of the SCC estimates presented here is to allow agencies to incorporate the monetized social benefits of reducing CO_2 emissions into cost-benefit analyses of regulatory actions that have small, or "marginal," impacts on cumulative global emissions. The estimates are presented with an acknowledgement of the many uncertainties involved and with a clear understanding that they should be updated over time to reflect increasing knowledge of the science and economics of climate impacts.

As part of the interagency process that developed these SCC estimates, technical experts from numerous agencies met on a regular basis to consider public comments, explore the technical literature in relevant fields, and discuss key model inputs and assumptions. The main objective of this process was to develop a range of SCC values using a defensible set of input assumptions grounded in the existing scientific and economic literatures. In this way, key uncertainties and model differences transparently and consistently inform the range of SCC estimates used in the rulemaking process.

a. Monetizing Carbon Dioxide Emissions

The SCC is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services. Estimates of the SCC are provided in dollars per metric ton of carbon dioxide.

When attempting to assess the incremental economic impacts of carbon dioxide emissions, the analyst faces a number of serious challenges. A recent report from the National Research Council [57] points out that any assessment will suffer from uncertainty, speculation, and lack of information about (1) future emissions of greenhouse gases, (2) the effects of past and future emissions on the climate system, (3) the impact of changes in climate on the physical and biological environment, and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise serious questions of science, economics, and ethics and should be viewed as provisional.

Despite the serious limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing carbon dioxide emissions. Consistent with the directive quoted above, the purpose of the SCC estimates presented here is to make it possible for agencies to incorporate the social benefits from reducing carbon dioxide emissions into cost-benefit analyses of regulatory actions that have small, or "marginal," impacts on cumulative global emissions. Most Federal regulatory actions can be expected to have marginal impacts on global emissions.

For such policies, the agency can estimate the benefits from reduced (or costs from increased) emissions in any future year by multiplying the change in emissions in that year by the SCC value appropriate for that year. The net present value of the benefits can then be calculated by multiplying each of these future benefits by an appropriate discount factor and summing across all affected years. This approach assumes that the marginal damages from increased emissions are constant for small departures from the baseline emissions path, an approximation that is reasonable for policies that have effects on emissions that are small relative to cumulative global carbon dioxide emissions. For policies that have a large (non-marginal) impact on global cumulative emissions, there is a separate question of whether the SCC is an appropriate tool for calculating the benefits of reduced emissions. DOE does not attempt to answer that question here.

At the time of the preparation of this notice, the most recent interagency estimates of the potential global benefits resulting from reduced CO_2 emissions in 2010, expressed in 2009$, were $4.9, $22.1, $36.3, and $67.1 per metric ton avoided. For emission reductions that occur in later years, these values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects,[58] although preference is given to consideration of the global benefits of reducing CO_2 emissions.

It is important to emphasize that the interagency process is committed to updating these estimates as the science and economic understanding of climate change and its impacts on society improves over time. Specifically, the interagency group has set a preliminary goal of revisiting the SCC values within 2 years or at such time as substantially updated models become available, and to continue to support research in this area. In the meantime, the interagency group will continue to explore the issues raised by this analysis and consider public comments as part of the ongoing interagency process.

b. Social Cost of Carbon Values Used in Past Regulatory Analyses

To date, economic analyses for Federal regulations have used a wide range of values to estimate the benefits associated with reducing carbon dioxide emissions. In the final model year 2011 CAFE rule, the Department of Transportation (DOT) used both a "domestic" SCC value of $2 per ton of CO_2 and a "global" SCC value of $33 per ton of CO_2 for 2007 emission reductions (in 2007 dollars), increasing both values at 2.4 percent per year.[59] *See Average Fuel Economy Standards Passenger Cars and Light Trucks Model Year 2011,* 74 FR 14196 (March 30, 2009); Final Environmental Impact Statement Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2011–2015 at 3–90 (Oct. 2008) (Available at: *http://www.nhtsa.gov/fuel-economy*). It also included a sensitivity analysis at $80 per ton of CO_2. A domestic SCC value is meant to reflect the value of damages in the United States resulting from a unit change in carbon dioxide emissions, while a global SCC value is meant to reflect the value of damages worldwide.

A 2008 regulation proposed by DOT assumed a domestic SCC value of $7 per ton of CO_2 (in 2006 dollars) for 2011 emission reductions (with a range of $0–$14 for sensitivity analysis), also increasing at 2.4 percent per year. *See Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2011–2015,* 73 FR 24352 (May 2, 2008); Draft Environmental Impact Statement Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2011–2015 at 3–58 (June 2008) (Available at: *http://www.nhtsa.gov/fuel-economy*). A regulation for packaged terminal air conditioners and packaged terminal heat pumps finalized by DOE in October of 2008 used a domestic SCC range of $0 to $20 per ton CO_2 for 2007 emission reductions (in 2007 dollars). 73 FR 58772, 58814 (Oct. 7, 2008) In addition, EPA's 2008 Advance Notice of Proposed Rulemaking for Greenhouse Gases

[57] National Research Council. *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.* National Academies Press: Washington, DC. 2009.

[58] It is recognized that this calculation for domestic values is approximate, provisional, and highly speculative. There is no a priori reason why domestic benefits should be a constant fraction of net global damages over time.

[59] Values per ton of CO_2 given in this section refer to metric tons.

identified what it described as "very preliminary" SCC estimates subject to revision. *See Regulating Greenhouse Gas Emissions Under the Clean Air Act,* 73 FR 44354 (July 30, 2008). EPA's global mean values were $68 and $40 per ton CO_2 for discount rates of approximately 2 percent and 3 percent, respectively (in 2006 dollars for 2007 emissions).

In 2009, an interagency process was initiated to offer a preliminary assessment of how best to quantify the benefits from reducing carbon dioxide emissions. To ensure consistency in how benefits are evaluated across agencies, the Administration sought to develop a transparent and defensible method, specifically designed for the rulemaking process, to quantify avoided climate change damages from reduced CO_2 emissions. The interagency group did not undertake any original analysis. Instead, it combined SCC estimates from the existing literature to use as interim values until a more comprehensive analysis could be conducted. The outcome of the preliminary assessment by the interagency group was a set of five interim values: Global SCC estimates for 2007 (in 2006 dollars) of $55, $33, $19, $10, and $5 per ton of CO_2.

These interim values represent the first sustained interagency effort within the U.S. government to develop an SCC for use in regulatory analysis. The results of this preliminary effort were presented in several proposed and final rules and were offered for public comment in connection with proposed rules, including the joint EPA–DOT fuel economy and CO_2 tailpipe emission proposed rules. See CAFE Rule for Passenger Cars and Light Trucks Draft EIS and Final EIS, cited above.

c. Current Approach and Key Assumptions

Since the release of the interim values, the interagency group reconvened on a regular basis to generate improved SCC estimates, which were used in this direct final rule. Specifically, the group considered public comments and further explored the technical literature in relevant fields.

The interagency group relied on three integrated assessment models (IAMs) commonly used to estimate the SCC: The FUND, DICE, and PAGE models.[60] These models are frequently cited in the peer-reviewed literature and were used in the last assessment of the Intergovernmental Panel on Climate Change. Each model was given equal weight in the SCC values that were developed.

Each model takes a slightly different approach to model how changes in emissions result in changes in economic damages. A key objective of the interagency process was to enable a consistent exploration of the three models while respecting the different approaches to quantifying damages taken by the key modelers in the field. An extensive review of the literature was conducted to select three sets of input parameters for these models: Climate sensitivity, socio-economic and emissions trajectories, and discount rates. A probability distribution for climate sensitivity was specified as an input into all three models. In addition, the interagency group used a range of scenarios for the socio-economic parameters and a range of values for the discount rate. All other model features were left unchanged, relying on the model developers' best estimates and judgments.

The interagency group selected four SCC values for use in regulatory analyses. Three values are based on the average SCC from three integrated assessment models, at discount rates of 2.5, 3, and 5 percent. The fourth value, which represents the 95th percentile SCC estimate across all three models at a 3-percent discount rate, is included to represent higher-than-expected impacts from temperature change further out in the tails of the SCC distribution. For emissions (or emission reductions) that occur in later years, these values grow in real terms over time, as depicted in Table IV–33.

TABLE IV–33—SOCIAL COST OF CO_2, 2010–2050

[In 2007 dollars per metric ton]

	Discount rate			
	5% Avg	3% Avg	2.5% Avg	3% 95th
2010	4.7	21.4	35.1	64.9
2015	5.7	23.8	38.4	72.8
2020	6.8	26.3	41.7	80.7
2025	8.2	29.6	45.9	90.4
2030	9.7	32.8	50.0	100.0
2035	11.2	36.0	54.2	109.7
2040	12.7	39.2	58.4	119.3
2045	14.2	42.1	61.7	127.8
2050	15.7	44.9	65.0	136.2

It is important to recognize that a number of key uncertainties remain, and that current SCC estimates should be treated as provisional and revisable since they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Research Council report mentioned above points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects. There are a number of concerns and problems that should be addressed by the research community, including research programs housed in many of the agencies participating in the interagency process to estimate the SCC.

The U.S. government intends to periodically review and reconsider estimates of the SCC used for cost-benefit analyses to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling. In this context, statements recognizing the

[60] The models are described in appendix 15–A of the final rule TSD.

limitations of the analysis and calling for further research take on exceptional significance. The interagency group offers the new SCC values with all due humility about the uncertainties embedded in them and with a sincere promise to continue work to improve them.

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the most recent values identified by the interagency process, adjusted to 2009$ using the GDP price deflator values for 2008 and 2009. For each of the four cases specified, the values used for emissions in 2010 were $4.9, $22.1, $36.3, and $67.1 per metric ton avoided (values expressed in 2009$). To monetize the CO_2 emissions reductions expected to result from amended standards for clothes dryers and room air conditioners in 2014–2043, DOE used the values identified in Table A1 of the "Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866," which is reprinted in appendix 16–A of the direct final rule TSD, appropriately adjusted to 2009$.[61] To calculate a present value of the stream of monetary values, DOE discounted the values in each of the four cases using the specific discount rate that had been used to obtain the SCC values in each case.

2. Valuation of Other Emissions Reductions

DOE investigated the potential monetary benefit of reduced NO_X emissions from the TSLs it considered. As noted above, amended energy conservation standards would reduce NO_X emissions in those 22 States that are not affected by the CAIR, in addition to the reduction in site NO_X emissions nationwide. DOE estimated the monetized value of NO_X emissions reductions resulting from each of the TSLs considered for today's direct final rule based on environmental damage estimates from the literature. Available estimates suggest a very wide range of monetary values, ranging from $370 per ton to $3,800 per ton of NO_X from stationary sources, measured in 2001$ (equivalent to a range of $447 to $4,591 per ton in 2009$).[62] In accordance with OMB guidance, DOE conducted two calculations of the monetary benefits derived using each of the economic values used for NO_X, one using a real discount rate of 3 percent and another using a real discount rate of 7 percent.[63]

DOE is aware of multiple agency efforts to determine the appropriate range of values used in evaluating the potential economic benefits of reduced Hg emissions. DOE has decided to await further guidance regarding consistent valuation and reporting of Hg emissions before it once again monetizes Hg in its rulemakings.

Commenting on the preliminary TSD, Whirlpool stated that CO_2 emissions should not be monetized because the market value cannot be readily determined, the impact is negligible, and it is already included in energy savings. (Whirlpool, No. 22 at p. 6) DOE acknowledges that the market value of future CO_2 emissions reductions is uncertain, and for this reason it uses a wide range of potential values, as described above. The impact of revised standards for room air conditioners and clothes dryers on future CO_2 emissions, described in section V.6 of this notice, is not negligible. In addition, the value of CO_2 emissions reductions is not included in energy cost savings because the energy prices that DOE used to calculate those savings do not include any taxes or other charges to account for the CO_2 emissions associated with the use of electricity or natural gas by the considered appliances.

V. Analytical Results

The following section addresses the results from DOE's analyses with respect to potential energy conservation standards for the products examined as part of this rulemaking. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for clothes dryers and room air conditioners, and the standards levels that DOE sets forth in today's direct final rule. Additional details regarding the analyses conducted by the agency are contained in the publicly available direct final rule TSD supporting this notice.

A. Trial Standard Levels

DOE analyzed the benefits and burdens of a number of TSLs for the products that are the subject of today's direct final rule. A description of each TSL DOE analyzed is provided below. DOE attempted to limit the number of TSLs considered for the final rule by excluding efficiency levels that do not exhibit significantly different economic or engineering characteristics from the efficiency levels already selected as a TSL. While DOE presents the results for only those efficiency levels in TSL combinations, DOE presents the results for all efficiency levels that it analyzed in chapter 10 of the direct final rule TSD.

Table V–1 presents the TSLs and the corresponding product class efficiency levels for clothes dryers. TSL 1 consists of the efficiency levels with the largest market share with a positive NPV (at a 3-percent discount rate). TSL 2 consists of the efficiency levels with the highest NPV (at a 3-percent discount rate). TSL 3 consists of the efficiency levels with the highest energy savings and a positive NPV (at a 3-percent discount rate). TSL 4 consists of the efficiency levels that reflect 5-percent efficiency increase above the baseline. TSL 4 also corresponds to the standards recommended by the Joint Petitioners. TSL 5 consists of non heat pump design efficiency levels with the highest energy savings. TSL 6 consists of the max-tech efficiency levels.

TABLE V–1—TRIAL STANDARD LEVELS FOR CLOTHES DRYERS

Product class	CEF					
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
Vented Electric Standard	3.56	3.61	3.73	3.73	4.08	5.42
Vented Electric Compact 120V	3.43	3.61	3.61	3.61	4.08	5.41
Vented Electric Compact 240V	3.12	3.27	3.27	3.27	3.60	4.89
Vented Gas	3.16	3.20	3.20	3.30	3.61	3.61
Ventless Electric Compact 240V	2.55	2.69	2.69	2.55	2.80	4.03
Ventless Electric Combination Washer/Dryer	2.08	2.56	2.56	2.08	2.56	3.69

[61] Table A1 presents SCC values through 2050. For DOE's calculation, it derived values after 2050 using the 3-percent per year escalation rate used by the interagency group.

[62] For additional information, refer to U.S. Office of Management and Budget, Office of Information and Regulatory Affairs. *2006 Report to Congress on the Costs and Benefits of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities.* 2006. Washington, DC.

[63] OMB, Circular A–4: Regulatory Analysis (Sept. 17, 2003).

Table V–2 presents the TSLs and the corresponding product class efficiency levels for room air conditioners. TSL 1 consists of the efficiency levels with the largest market share with a positive NPV (at a 3-percent discount rate). TSL 2 consists of the ENERGY STAR levels for each product class. TSL 3 consists of the efficiency levels with the highest NPV (at a 3-percent discount rate). TSL 4 consists of the efficiency levels set forth in the Joint Petition presented to DOE. TSL 5 consists of the efficiency levels with the highest energy savings and a positive NPV (at a 7-percent discount rate). TSL 6 consists of the max-tech efficiency levels.

TABLE V–2—TRIAL STANDARD LEVELS FOR ROOM AIR CONDITIONERS

Product class	CEER					
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
Group 1—includes PC 1	10.10	10.60	10.10	11.10	11.10	11.67
Group 2—includes PC 2, 3, 4, 11	10.70	10.70	10.90	10.90	11.50	11.96
Group 3—includes PC 5A, 9, 13	9.40	9.40	8.47	9.40	8.47	10.15
Group 4—includes PC 5B, 10	9.40	9.40	8.48	9.00	8.48	9.80
Group 5—includes PC 6, 7, 8A, 12	9.30	9.30	9.60	9.60	10.00	10.35
Group 6—includes PC 8B, 14, 15, 16	9.30	9.30	9.50	9.50	9.50	10.02

B. Economic Justification and Energy Savings

1. Economic Impacts on Individual Consumers

a. Life-Cycle Cost and Payback Period

Consumers affected by new or amended standards usually experience higher purchase prices and lower operating costs. Generally, these impacts on individual consumers are best captured by changes in life-cycle costs and by the payback period. Therefore, DOE calculated the LCC and PBP analyses for the potential standard levels considered in this rulemaking. DOE's LCC and PBP analyses provided key outputs for each TSL, which are reported by clothes dryer product class in Table V–3 through Table V–8, and by room air conditioner product class in Table V–9 through Table V–14. Each table includes the average total LCC and the average LCC savings, as well as the fraction of product consumers for which the LCC will either decrease (net benefit), or increase (net cost), or exhibit no change (no impact) relative to the base-case forecast. The last output in the tables is the median PBP for the consumer purchasing a design that complies with the TSL. DOE presents the median PBP because it is the most statistically robust measure of the PBP. The results for each potential standard level are relative to the efficiency distribution in the base case (no amended standards). DOE based the LCC and PBP analyses on the range of energy consumption under conditions of actual product use.

TABLE V–3—LCC AND PAYBACK PERIOD RESULTS FOR ELECTRIC STANDARD DRYERS

TSL	CEF	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1	3.56	$455	$867	$1,323	$0	0.7	97.6	1.7	3.9
2	3.61	456	856	1,311	2	0.3	78.7	21.0	0.2
3, 4	3.73	467	829	1,296	14	19.0	24.8	56.3	5.3
5	4.08	583	761	1,343	−30	75.3	1.0	23.7	19.1
6	5.42	879	580	1,459	−146	81.0	0.0	19.0	22.1

TABLE V–4—LCC AND PAYBACK PERIOD RESULTS FOR ELECTRIC COMPACT 120V DRYERS

TSL	CEF	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1	3.43	$470	$384	$854	n/a	0	100	0	n/a
2, 3, 4	3.61	471	369	840	$14	4.0	0.0	96.0	0.9
5	4.08	627	325	953	−99	95.5	0.0	4.5	36.1
6	5.41	875	243	1,118	−264	95.4	0.0	4.6	40.1

TABLE V–5—LCC AND PAYBACK PERIOD RESULTS FOR ELECTRIC COMPACT 240V DRYERS

TSL	CEF	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1	3.12	$470	$427	$896	n/a	0	100	0	n/a
2, 3, 4	3.27	471	411	882	$8	2.3	41.4	56.3	0.9
5	3.60	627	373	1,000	−99	93.3	4.2	2.5	45.1
6	4.89	875	272	1,147	−246	94.5	0.0	5.5	38.2

TABLE V–6—LCC AND PAYBACK PERIOD RESULTS FOR GAS DRYERS

TSL	CEF	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1	3.16	$554	$445	$999	n/a	0	100	0	n/a
2, 3	3.20	555	440	995	$0	0.5	92.9	6.6	2.2
4	3.30	555	427	983	2	0.3	84.5	15.2	0.5
5, 6	3.61	658	404	1,062	−69	87.7	10.5	1.8	73.3

TABLE V–7—LCC AND PAYBACK PERIOD RESULTS FOR VENTLESS 240V DRYERS

TSL	CEF	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1, 4	2.55	$1,093	$452	$1,545	n/a	0	100	0	n/a
2, 3	2.69	1,094	431	1,525	$20	0.0	0.0	100.0	0.9
5	2.80	1,176	411	1,587	−42	92.5	0.0	7.5	25.3
6	4.03	1,462	261	1,722	−177	88.5	0.0	11.5	26.9

TABLE V–8—LCC AND PAYBACK PERIOD RESULTS FOR VENTLESS COMBINATION WASHER/DRYERS

TSL	CEF	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1, 4	2.08	$1,533	$565	$2,098	n/a	0	100	0	n/a
2, 3, 5	2.56	1,579	446	2,025	$73	20.6	0.0	79.4	5.3
6	3.69	1,981	282	2,263	−166	82.4	0.0	17.6	22.4

TABLE V–9—LCC AND PAYBACK PERIOD RESULTS FOR ROOM AIR CONDITIONERS, < 6,000 Btu/h, WITH LOUVERS

TSL	CEER	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
1, 3	10.10	$361	$357	$718	$9	21.2	30.7	48.1	4.1
2	10.60	374	341	715	11	32.8	30.7	36.6	5.8
4, 5	11.10	393	326	719	7	64.6	1.2	34.2	8.6
6	11.67	472	311	784	−58	90.4	0.0	9.6	20.9

TABLE V–10—LCC AND PAYBACK PERIOD RESULTS FOR ROOM AIR CONDITIONERS, 8,000–13,999 Btu/h, WITH LOUVERS

TSL	CEER	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience: Net cost	No impact	Net benefit	Median
1, 2	10.70	$493	$557	$1,050	$16	9.3	60.5	30.2	0.0
3, 4	10.90	497	547	1,045	22	33.6	2.2	64.1	2.8
5	11.50	525	519	1,044	22	55.7	0.8	43.4	7.1
6	11.96	605	500	1,104	−38	77.3	0.5	22.2	14.7

TABLE V–11—LCC AND PAYBACK PERIOD RESULTS FOR ROOM AIR CONDITIONERS, 20,000–24,999 Btu/h, WITH LOUVERS

TSL	CEER	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience: Net cost	No impact	Net benefit	Median
3, 5	8.47	$857	$750	$1,607	n/a	0	100	0	n/a
1, 2, 4	9.40	887	672	1,559	$6	5.1	85.3	9.6	4.3
6	10.15	1,159	626	1,785	−214	97.6	2.1	0.3	73.8

TABLE V–12—LCC AND PAYBACK PERIOD RESULTS FOR ROOM AIR CONDITIONERS, >25,000 Btu/h, WITH LOUVERS

TSL	CEER	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience: Net cost	No impact	Net benefit	Median
3, 5	8.48	$979	$823	$1,802	n/a	0	100	0	n/a
4	9.00	1,019	777	1,796	$1	8.9	87.6	3.5	10.1
1, 2	9.40	1,058	739	1,797	1	11.0	85.3	3.7	10.3
6	9.80	1,313	712	2,025	−227	99.8	0.0	0.2	107.7

TABLE V–13—LCC AND PAYBACK PERIOD RESULTS FOR ROOM AIR CONDITIONERS, 8,000–10,999 Btu/h, WITHOUT LOUVERS

TSL	CEER	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience: Net cost	No impact	Net benefit	Median
1, 2	9.30	%495	$490	$986	$4	0.9	89.9	9.2	1.5
3, 4	9.60	498	476	974	13	12.3	25.2	62.5	2.1
5	10.00	512	454	966	20	38.0	5.6	56.3	4.9
6	10.35	615	440	1,055	−66	91.8	1.9	6.2	25.2

TABLE V–14—LCC AND PAYBACK PERIOD RESULTS FOR ROOM AIR CONDITIONERS, >11,000 Btu/h, WITHOUT LOUVERS

TSL	CEER	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience: Net cost	No impact	Net benefit	Median
1, 2	9.30	$590	$698	$1,288	$5	2.2	89.9	7.9	2.6
3, 4, 5	9.50	596	684	1,279	11	22.7	30.6	46.6	3.7
	9.80	611	660	1,271	18	36.0	17.3	46.6	5.3

TABLE V–14—LCC AND PAYBACK PERIOD RESULTS FOR ROOM AIR CONDITIONERS, >11,000 Btu/h, WITHOUT LOUVERS—Continued

TSL	CEER	Life-cycle cost *2009$*			LCC savings				Payback period *years*
		Installed cost	Discounted operating cost	LCC	Average savings *2009$*	Percent of households that experience			Median
						Net cost	No impact	Net benefit	
6	10.02	707	647	1,354	−64	92.6	0.0	7.3	25.9

b. Consumer Subgroup Analysis

As described in section IV.H, DOE determined the impact of the considered TSLs on low-income households and senior-only households.

Table V–15 and Table V–16 compare the average LCC savings at each efficiency level for the two consumer subgroups with the average LCC savings for the entire sample for each product class for clothes dryers and room air conditioners, respectively. DOE found that the average LCC savings for low-income households and senior-only households at the considered efficiency levels are not substantially different from the average for all households. Chapter 11 of the direct final rule TSD presents the complete LCC and PBP results for the two subgroups.

TABLE V–15—CLOTHES DRYERS: COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS

Electric standard				Vented 120V				Vented 240V			
CEF	Senior	Low-income	All	CEF	Senior	Low-income	All	CEF	Senior	Low-income	All
3.56	$0	$0	$0	3.48	$3	$3	$4	3.16	$2	$2	$2
3.61	2	2	2	3.61	14	13	14	3.27	9	8	8
3.73	7	12	14	3.72	−8	−5	−5	3.36	−8	−6	−5
3.81	−40	−30	−27	3.80	−63	−57	−56	3.48	−54	−47	−47
4.08	−62	−38	−30	4.08	−113	−99	−99	3.60	−110	−99	−99
5.42	−245	−170	−146	5.41	−306	−262	−264	4.89	−291	−243	−246
Gas				Ventless 240V				Ventless Combination			
CEF	Senior	Low-income	All	CEF	Senior	Low-income	All	CEF	Senior	Low-income	All
3.16	$0	$0	$0	2.59	$5	$5	$5	2.35	$49	$76	$75
3.20	2	2	2	2.69	20	19	20	2.38	54	80	79
3.30	−1	2	2	2.71	−14	−14	−13	2.46	68	93	93
3.41	−76	−69	−69	2.80	−49	−42	−42	2.56	41	73	73
3.61	−115	−100	−100	4.03	−234	−175	−177	3.69	−253	−162	−166

TABLE V–16—ROOM AIR CONDITIONERS: COMPARISON OF AVERAGE LCC SAVINGS FOR CONSUMER SUBGROUPS AND ALL HOUSEHOLDS

<6,000 Btu/h, with louvers				8,000–13,999 Btu/h, with louvers				20,000–24,999 Btu/h, with louvers			
CEER	Senior	Low-income	All	CEER	Senior	Low-income	All	CEER	Senior	Low-income	All
10.10	$5	$12	$9	10.20	$8	$10	$9	9.00	$1	$7	$3
10.60	4	17	11	10.70	13	18	16	9.40	3	13	6
11.10	−5	17	7	10.90	17	24	22	9.80	−17	8	−10
11.38	−17	9	−3	11.50	14	27	22	10.15	−223	−187	−214
11.67	−75	−44	−58	11.96	−49	−31	−38				
>25,000 Btu/h, with louvers				8,000–10,999 Btu/h, without louvers				>11,000 Btu/h, without louvers			
CEER	Senior	Low-income	All	CEER	Senior	Low-income	All	CEER	Senior	Low-income	All
9.00	$0	$4	$1	9.30	$4	$5	$4	9.30	$4	$6	$5
9.40	−1	7	1	9.60	11	15	13	9.50	9	13	11
9.80	−234	−209	−227	10.00	16	23	20	9.80	13	21	18
				10.35	−73	−62	−66	10.02	−71	−60	−64

c. Rebuttable Presumption Payback

As discussed above, EPCA provides a rebuttable presumption that an energy conservation standard is economically justified if the increased purchase cost for a product that meets the standard is less than three times the value of the first-year energy savings resulting from the standard. In calculating a rebuttable presumption payback period for the considered standard levels, DOE used discrete values rather than distributions for input values, and, as required by EPCA, based the energy use calculation on the DOE test procedures for the considered products. As a result, DOE calculated a single rebuttable presumption payback value, and not a distribution of payback periods, for each efficiency level. Table V–17 and Table V–18 present the average rebuttable presumption payback periods for those efficiency levels where the increased purchase cost for a product that meets a standard at that level is less than three times the value of the first-year energy savings resulting from the standard.

TABLE V–17—CLOTHES DRYERS: EFFICIENCY LEVELS WITH REBUTTABLE PAYBACK PERIOD LESS THAN THREE YEARS

Product class	CEF	PBP *(years)*
Electric standard	3.61	0.95
Electric compact 120V	3.48	2.49
	3.61	0.86
Electric compact 240V	3.16	2.57
	3.27	0.85
Gas	3.20	1.81
Ventless compact 240V	2.59	2.33
	2.69	0.83
Ventless combination washer/dryers	2.46	0.42
	2.46	0.68
	2.46	0.74

TABLE V–18—ROOM AIR CONDITIONERS: EFFICIENCY LEVELS WITH REBUTTABLE PAYBACK PERIOD LESS THAN THREE YEARS

Product class	CEER	PBP *(years)*
Room Air Conditioners (8000–13,999 Btu/h), with Louvers	10.2	1.1
	10.7	1.6
	10.9	1.8
Room Air Conditioners (20,000–24,999 Btu/h), with Louvers	9.0	0.9
	9.4	1.1
	9.8	1.9
Room Air Conditioners (>25,000 Btu/h), with Louvers	9.0	2.1
	9.4	2.4
Room Air Conditioners (8000–10,999 Btu/h), without Louvers	9.3	0.6
	9.6	0.7
	10.0	1.3
Room Air Conditioners (>11,000 Btu/h), without Louvers	9.3	1.3
	9.5	1.4
	9.8	1.9

While DOE examined the rebuttable-presumption criterion, it considered whether the standard levels considered for today's rule are economically justified through a more detailed analysis of the economic impacts of these levels pursuant to 42 U.S.C. 6295(o)(2)(B)(i). The results of this analysis serve as the basis for DOE to definitively evaluate the economic justification for a potential standard level (thereby supporting or rebutting the results of any preliminary determination of economic justification).

2. Economic Impacts on Manufacturers

DOE performed an MIA to estimate the impact of amended energy conservation standards on manufacturers of clothes dryers and room air conditioners. The section below describes the expected impacts on manufacturers at each TSL. Chapter 12 of the direct final rule TSD explains the analysis in further detail.

a. Industry Cash Flow Analysis Results

The tables below depict the financial impacts on manufacturers (represented by changes in INPV) and the conversion costs DOE estimates manufacturers would incur at each TSL. Each set of results below shows two tables of INPV impacts: The first table reflects the lower (less severe) bound of impacts and the second represents the upper bound. To evaluate this range of cash-flow impacts on each industry, DOE modeled two different scenarios using different markup assumptions. These assumptions correspond to the bounds of a range of market responses that DOE anticipates could occur in the standards case. Each scenario results in a unique set of cash flows and corresponding industry value at each TSL.

The INPV results refer to the difference in industry value between the base case and the standards case, which DOE calculated by summing the discounted industry cash flows from the base year (2011) through the end of the analysis period. The discussion also notes the difference in cash flow between the base case and the standards case in the year before the compliance date of potential amended energy conservation standards. This figure provides a proxy for the magnitude of the required conversion costs, relative to the cash flow generated by the industry in the base case.

Cash Flow Analysis Results for Clothes Dryers

To assess the lower (less severe) end of the range of potential impacts on the residential clothes dryer industry, DOE modeled the flat markup scenario. The flat markup scenario assumes that in the standards case manufacturers would be able to pass the higher productions costs required for more efficient products on to their customers. Specifically, the industry would be able to maintain its average base-case gross margin, as a percentage of revenue, despite higher product costs. In general, the larger the product price increases, the less likely manufacturers are to achieve the cash flow from operations calculated in this scenario because the less likely it is that manufacturers would be able to fully markup these larger cost increases.

To assess the higher (more severe) end of the range of potential impacts on the residential clothes dryer industry, DOE modeled the preservation of operating profit markup scenario. The scenario represents the upper end of the range of potential impacts on manufacturers because no additional operating profit is earned on the higher production costs, eroding profit margins as a percentage of total revenue.

DOE used the main NIA shipment scenario for the both the lower- and higher-bound MIA scenarios that were used to characterize the potential INPV impacts. The shipment forecast is an important driver of the INPV results below (Table V–19 and Table V–20). The main NIA shipment scenario includes a price elasticity effect, meaning higher prices in the standards case result in lower shipments. Lower shipments also reduce industry revenue, and, in turn, INPV.

TABLE V–19—MANUFACTURER IMPACT ANALYSIS FOR CLOTHES DRYERS—FLAT MARKUP SCENARIO

	Units	Base case	Trial standard level					
			1	2	3	4	5	6
INPV	*2009$ millions*	1,003.6	1,001.1	1,000.0	962.5	939.2	827.1	699.7
Change in INPV	*2009$ millions*		−2.6	−3.6	−41.13	−64.46	−176.5	−303.9
	%		−0.3%	−0.4%	−4.1%	−6.4%	−17.6%	−30.3%
Product Conversion Costs	*2009$ millions*		4	5	18	24	166	383
Capital Conversion Costs	*2009$ millions*		0	2	48	71	328	536
Total Conversion Costs	*2009$ millions*		4	7	66	95	494	919

TABLE V–20—MANUFACTURER IMPACT ANALYSIS FOR CLOTHES DRYERS—PRESERVATION OF OPERATING PROFIT MARKUP SCENARIO

	Units	Base case	Trial standard level					
			1	2	3	4	5	6
INPV	*2009$ millions*	1,003.6	1,001.0	998.7	948.2	923.0	606.2	273.6
Change in INPV	*2009$ millions*		−2.6	−4	−55.46	−80.63	−397.4	−730.0
	%		−0.3%	−0.5%	−5.5%	−8.0%	−39.6%	−72.7%
Product Conversion Costs	*2009$ millions*		4	5	18	24	166	383
Capital Conversion Costs	*2009$ millions*		0	2	48	71	328	536
Total Conversion Costs	*2009$ millions*		4	7	66	95	494	919

TSL 1 represents the baseline CEF for 120V electric compact clothes dryers (product class 2), 240V electric compact clothes dryers (product class 3), 240V compact ventless clothes dryers (product class 5), and electric combination ventless clothes dryers (product class 6). TSL 1 represents a CEF of 3.56 for standard-size vented electric clothes dryers (product class 1) and a CEF of 3.16 for gas vented clothes dryers (product class 4). At TSL 1, DOE estimates impacts on INPV to range −$2.55 million to −$2.62 million, or a change in INPV of −0.3 percent. At this proposed level, industry free cash flow is estimated to decrease by approximately 1.6 percent to $68.6 million, compared to the base-case value of $69.7 million in the year leading up to the proposed energy conservation standards.

The design options DOE analyzed for product class 1 and 4 include lowering standby power consumption only. Standby power changes would result in only minor changes to baseline products and would take a minimal effort by manufacturers to comply with the amended energy conservation standards. The standby power changes at TSL 1 would require relatively small product development efforts to reach the CEF levels and would not change the assembly of currently products, greatly limiting the necessary capital conversion costs. In addition, the design options for standby power do not add significant costs to existing products. Therefore, the impact on manufacturers is very small at TSL 1.

TSL 2 represents a CEF of 3.61 for product class 1, a CEF of 3.61 for product class 2, a CEF of 3.27 for product class 3, a CEF of 3.20 for product class 4, a CEF of 2.69 for product class 5, and a CEF of 2.56 for product class 6. At TSL 2, DOE estimates impacts on INPV to range −$3.6 million to −$4.9 million, or a change in INPV of −0.4 percent to −0.5 percent. At this proposed level, industry free cash flow is estimated to decrease by approximately 3.0 percent to $67.6 million, compared to the base-case value of $69.7 million in the year leading up to the proposed energy conservation standards.

The design options analyzed at TSL 2 for product classes 1 through 5 represent improvements to standby power consumption only. The changes required at TSL 2 would not greatly alter baseline products for these product classes because these analyzed design options are small component changes for standby power for product classes 1 through 5. The design options analyzed for product class 6 include changes to active mode power consumption. However, these active mode changes for product class 6 are also relatively minor and would take a minimal effort by manufacturers to comply with the amended energy conservation standards. For product class 6, the analyzed design option for active mode is automatic cycle termination technology which adds very little cost to the product and takes minimal capital and product conversion costs to implement. Because the changes for product class 1 through 5 only include standby power changes and the active mode changes for product class 6 are minor, the impact on manufacturers is very small at TSL 2.

The efficiency requirements for product classes 2 to 6 are the same at TSL 3 as at TSL 2. TSL 3, however, represents a further improvement to a CEF of 3.73 for product class 1. At TSL 3, DOE estimates impacts on INPV to range from −$41.1 million to −$55.5 million, or a change in INPV of −4.1 percent to −5.5 percent. At this proposed level, industry free cash flow is estimated to decrease by approximately 34.2 percent to $45.9

million, compared to the base-case value of $69.7 million in the year leading up to the proposed energy conservation standards.

The design options DOE analyzed for product class 1 include improvements to standby and active power consumption (airflow improvements, a dedicated heater duct, and an open cylinder drum). While the actual design path taken by manufacturers could vary at TSL 3, these technologies represent incremental improvements and are well known in the industry. The changes for design options analyzed for product class 1 would require both changes to production equipment and product development costs. These design options would not greatly alter the production process for product class 1 and could be made within most existing products. The conversion costs to implement these changes are also relatively low compared to the total value of the industry. The industry impacts would increase at TSL 3, however, because for product class 1, manufacturers would have to make changes for a large volume of the common standard-size electric models.

TSL 4 represents the baseline efficiency for product classes 5 and 6. TSL 4 also represents the same efficiency requirements for product classes 2 and 3 as TSL 2 and TSL 3. TSL 4 also has the same efficiency requirements for product class 1 as TSL 3, but represents a 3.30 CEF for product class 4. At TSL 4, DOE estimates impacts on INPV to range −$64.5 million to −$80.6 million, or a change in INPV of −6.4 percent to −8.0 percent. At this proposed level, industry free cash flow is estimated to decrease by approximately 49.8 percent to $35.0 million, compared to the base-case value of $69.7 million in the year leading up to the proposed energy conservation standards.

The impacts at TSL 4 are due primarily to the efficiency requirements for product classes 1 and 4 because all other product classes are at baseline efficiency or could be met with changes to standby power consumption. For both product classes 1 and 4, DOE analyzed changes to standby power consumption and the same improvements to active mode power consumption for both gas and electric units (airflow improvements, a dedicated heater duct, and an open cylinder drum). As with TSL 3, while the actual design path taken by manufacturers could vary at TSL 4, these technologies represent incremental improvements to most products and are well known in the industry. Industry impacts would increase at TSL 4, however, because for both product classes 1 and 4, the changes would require improvements in the most common standard-size gas and electric products on the market today. The changes for design options analyzed for product class 1 and 4 would require both changes to production equipment and product development costs. These design options would not greatly alter the production processes for either product class and could be made within most existing products. The conversion costs to implement these changes for both product class 1 and 4 are still relatively low compared to the total value of the industry.

TSL 5 represents a CEF of 4.08 for product class 1, a CEF of 4.08 for product class 2, a CEF of 3.60 for product class 3, a CEF of 3.61 for product class 4, a CEF of 2.80 for product class 5, and a CEF of 2.56 for product class 6. At TSL 5, DOE estimates impacts on INPV to range −$176.5 million to −$397.4 million, or a change in INPV of −17.6 percent to −39.6 percent. At this proposed level, industry free cash flow is estimated to decrease by approximately 249.7 percent to −$104.4 million, compared to the base-case value of $69.7 million in the year leading up to the proposed energy conservation standards.

Most of the impacts on INPV at TSL 5 are due to the efficiency requirements for product classes 1 through 4. Very few products on the market today meet the efficiency requirements at TSL 5, and for product classes 1 through 4, TSL 5 represents the most efficient units currently on the market. The design options DOE analyzed for these product classes included similar design options for all product classes as for product classes 1 and 4 at TSL 4 (airflow improvements, a dedicated heater duct, and an open cylinder drum) plus additional changes. In addition to airflow improvements, a dedicated heater duct, and an open cylinder drum, the design options analyzed by DOE also include modulating heat, inlet air preheating, and a more efficient fan motor. Out of all these design options used the reach the required efficiencies at TSL 5, inlet air preheating would require the most substantial changes to existing products because it would change the ducting system. This change would impact drum stamping equipment and, possibly, the fabrication of the cabinets for some product lines. The impacts also increase dramatically at TSL 5 due to the large increase in production costs for the additional design options beyond those needed to reach the required efficiencies at TSL 4. The large incremental costs result in lower shipments due to the price elasticity. These additional costs also cause a greater impact on INPV if manufactures are unable to earn additional profit on these added costs (under the preservation of operating profit markup scenario).

TSL 6 represents the max-tech level for all product classes. The max-tech level corresponds to a CEF of 5.42 for product class 1, a CEF of 5.41 for product class 2, a CEF of 4.89 for product class 3, a CEF of 3.61 for product class 4, a CEF of 4.03 for product class 5, and a CEF of 3.69 for product class 6. At TSL 6, DOE estimates impacts on INPV to range −$303.9 million to −$730.0 million, or a change in INPV of −30.3 percent to −72.7 percent. At this proposed level, industry free cash flow is estimated to decrease by approximately 467.5 percent to −$256.2 million, compared to the base-case value of $69.7 million in the year leading up to the proposed energy conservation standards.

At TSL 6, the efficiency requirements for all electric clothes dryers would effectively require a heat pump clothes dryer. Currently, there are no heat pump clothes dryers on the market in the United States. Manufacturing exclusively heat pump clothes dryers would be extremely disruptive to existing manufacturing facilities. A heat pump standard would require a total renovation of existing facilities and would force the industry to design completely new clothes dryer platforms. The capital conversion costs for these changes are extremely large—more than double the capital conversion costs calculated for these products to meet TSL 5. The product development costs to manufacturer heat pump clothes dryers also increase substantially because manufacturers must not only redesign clothes washer platforms, but also design the heat pump system. Manufacturers also indicated that training their service and installation network to use a completely different technology would be extremely costly, as would the cost to educate consumers. Finally, the impacts on INPV are also great at TSL 6 because the cost of a heat pump clothes dryer is more than double a minimally compliant clothes dryer in the market today. If manufactures are unable to earn additional profit on these production costs, profitability is severely impacted.

Cash Flow Analysis Results for Room Air Conditioners

To assess the lower (less severe) end of the range of potential impacts on the room air conditioner industry, DOE modeled the flat markup scenario. The flat markup scenario assumes that in the standards case manufacturers would be able to pass the higher productions costs required for more efficient products on to their customers. Specifically, the industry would be able to maintain its average base-case gross margin, as a percentage of revenue, despite higher product costs. In general, the larger the product price increases, the less likely manufacturers are to achieve the cash flow from operations calculated in this scenario because the less likely it is that manufacturers would be able to fully markup these larger cost increases.

To assess the higher (more severe) end of the range of potential impacts on the room air conditioner industry, DOE modeled the preservation of operating profit markup scenario. Through its discussion with manufacturers, DOE found that manufacturers are faced with significant market pressure to keep prices low. Consumers are accustomed to certain price points for room air conditioners, and they could forgo their purchases if prices increased significantly because many purchases are weather-dependent impulse buys. As a result, several key retailers exert their purchasing power to pressure manufacturers to offer product lines at low prices. Higher efficiency units that earn a premium in the base case are bundled with additional features that drive higher prices. Thus, manufacturers are skeptical that customers would accept higher prices for increased energy efficiency because it does not command higher margins in the current market. Under such a scenario, it follows that the large retailers that compose the relatively concentrated customer base of the industry would not accept manufacturers fully passing through the additional cost of improved efficiency because consumers would be wary of higher prices. Therefore, to assess the higher (more severe) end of the range of potential impacts, DOE modeled the preservation of operating profit markup scenario in which higher energy conservation standards result in lower manufacturer markups. This markup is applied to both the minimum standard level and the de facto minimally efficient products due to the modeled efficiency migration over time. This scenario models manufacturers' concerns that the higher costs of more efficient technology would harm profitability if the full cost increases cannot be passed on. The scenario represents the upper end of the range of potential impacts on manufacturers because no additional operating profit is earned on the investments required to meet the proposed amended energy conservation standards, while higher production costs erode profit margins and result in lower cash flows from operations.

DOE used the main NIA shipment scenario for the both the lower- and higher-bound MIA scenarios that were used to characterize the potential INPV impacts. The shipment forecast is an important driver of the INPV results below (Table V–21 and Table V–22). The main NIA shipment scenario includes a price elasticity effect, meaning higher prices in the standards case result in lower shipments. Lower shipments also reduce industry revenue, and, in turn, INPV.

TABLE V–21—MANUFACTURER IMPACT ANALYSIS FOR ROOM AIR CONDITIONERS—FLAT MARKUP SCENARIO

	Units	Base case	Trial standard level					
			1	2	3	4	5	6
INPV	*2009$ millions*	956.0	911.8	890.6	890.3	844.7	869.5	875.9
Change in INPV	*2009$ millions*		(44.2)	(65.4)	(65.7)	(111.3)	(86.6)	(80.2)
	%		−4.6%	−6.8%	−6.9%	−11.6%	−9.1%	−8.4%
Product Conversion Costs	*2009$ millions*		22	29	41	61	74	117
Capital Conversion Costs	*2009$ millions*		46	69	61	109	101	193
Total Conversion Costs	*2009$ millions*		68	98	102	171	176	310

TABLE V–22—MANUFACTURER IMPACT ANALYSIS FOR ROOM AIR CONDITIONERS—PRESERVATION OF OPERATING PROFIT MARKUP SCENARIO

	Units	Base case	Trial standard level					
			1	2	3	4	5	6
INPV	*2009$ millions*	956.0	871.1	843.3	843.6	778.4	771.6	611.5
Change in INPV	*2009$ millions*		(84.9)	(112.7)	(112.4)	(177.6)	(184.4)	(344.5)
	%		−8.9%	−11.8%	−11.8%	−18.6%	−19.3%	−36.0%
Product Conversion Costs	*2009$ millions*		22	29	41	61	74	117
Capital Conversion Costs	*2009$ millions*		46	69	61	109	101	193
Total Conversion Costs	*2009$ millions*		68	98	102	171	176	310

TSL 1 represents a CEER of 9.30 for product class 8A (without reverse cycle and without louvered sides—8,000 to 10,999 Btu/h) and product class 8B (without reverse cycle and without louvered sides—11,000 to 13,999 Btu/h); 9.40 for product class 5A (without reverse cycle and with louvered sides—20,000 to 24,999 Btu/h) and product class 5B (without reverse cycle and with louvered sides—25,000 Btu/h and more); 10.10 for product class 1 (without reverse cycle and with louvered sides—less than 6,000 Btu/h); and 10.70 for product class 3 (without reverse cycle and with louvered sides—8,000 to 13,999 Btu/h). At TSL 1, DOE estimates impacts on INPV to range from −$44.2 million to −$84.9 million, or a change in INPV of −4.6 percent to −8.9 percent. At this proposed level, industry free cash flow is estimated to decrease by approximately 27.7 percent to $62.4 million, compared to the base-case value of $86.3 million in the year leading up to the proposed energy conservation standards.

The INPV impacts at TSL 1 are relatively minor, in part because the vast majority of manufacturers produce units that exceed this level (such as, ENERGY STAR and other high efficiency units) in significant volumes. Approximately 60 percent of product class 3 shipments, 85 percent of product class 5A and 5B shipments, and 90 percent of product class 8A and 8B shipments currently meet this TSL. By contrast, the vast majority of product class 1 shipments are baseline units. Although most of the design options DOE analyzed at this proposed level are one-for-one component swaps, some more complex design options that would be required at TSL 1 necessitate more substantial changes. These design options that have a significant impact on conversion costs at TSL 1 are heat exchanger changes and increased chassis volumes. Changes to the condenser or evaporator require machinery for new dies for every product line and require greater design effort than component swaps. Increased chassis volumes require a complete redesign of the product and substantial tooling to make the unit larger. Although some room air conditioners, particularly those in product class 1, will require these changes at TSL 1, these changes would not be required across the entire industry because the majority of units in most product classes already meet TSL 1. As such, DOE estimated total product conversion costs of $22 million and capital conversion costs of $46 million, which is relatively low compared to the industry value of $956 million.

The efficiency requirements for product class 3, product class 5A, product class 5B, product class 8A, and product class 8B are the same at TSL 2 as TSL 1. Thus, the only change from TSL 1 occurs for product class 1, which requires a CEER of 10.60 at TSL 2. DOE estimates the INPV impacts at TSL 2 range from −$65.4 million to −$112.7 million, or a change in INPV of −6.8 percent to −11.8 percent. At this proposed level, the industry cash flow is estimated to decrease by approximately 40.5 percent to $51.4 million, compared to the base-case value of $86.3 million in the year leading up to the proposed energy conservation standard.

The additional impacts at TSL 2 relative to TSL 1 result from the further improvements manufacturers must make to meet a CEER of 10.6 for product class 1. Most units in product class 1 would need to increase their chassis size even further than at TSL 1 in order to meet TSL 2, resulting in estimated product and capital conversion costs of $29 million and $69 million, respectively.

TSL 3 represents different efficiency levels for every product class compared to TSL 2. TSL 3 represents the baseline CEERs of 8.47 and 8.48 for product classes 5A and 5B, respectively, meaning that no amended standards would be set and no impacts on INPV would occur. TSL 3 represents a CEER of 9.50 for product class 8B, 9.60 for product class 8A, 10.10 for product class 1, and 10.90 for product class 3. DOE estimates the INPV impacts at TSL 3 to range from −$65.7 million to −$112.4 million, or a change in INPV of −6.9 percent to −11.8 percent. At this proposed level, the industry cash flow is estimated to decrease by approximately 40.5 percent to $51.4 million, compared to the base-case value of $86.3 million in the year leading up to the standards.

At TSL 3, several product classes require design options that increase conversion costs. For product class 1, some units would require increased chassis volumes, though not as substantially as at TSL 2. For product class 3, all smaller units would require chassis changes, driving the majority of the conversion costs at TSL 3. For product classes 8A and 8B, some changes to the heat exchangers would be required. However, no conversion costs would be applied to product classes 5A and 5B, resulting in total product and capital conversion costs at TSL 3 of $41 million and $61 million, respectively.

TSL 4 represents the same efficiency requirements as TSL 3 for product classes 3, 8A, and 8B. For product class 5B, TSL 4 represents a CEER of 9.00. For product class 5A, TSL 4 represents a CEER of 9.40, and for product class 1, TSL 4 represents a CEER of 11.10. DOE estimates the INPV impacts at TSL 4 to range from −$111.3 million to −$177.6 million, or a change in INPV of −11.6 percent to −18.6 percent. At this proposed level, the industry cash flow is estimated to decrease by approximately 69.1 percent to $26.7 million, compared to the base-case value of $86.3 million in the year leading up to the proposed energy conservation standards.

At TSL 4, significant changes to the manufacturing process would be required. Product classes 1, 5A, and 5B would all require increased chassis volumes, and product classes 1 and 5A would also require heat exchanger changes. These design options drive increases of $20 million in product conversion costs and $48 million in capital conversion costs compared to TSL 3.

TSL 5 represents the same efficiency requirements as TSL 4 for product classes 1 and 8B. For product classes 5A and 5B, TSL 5 represents the baseline CEERs of 8.47 and 8.48, respectively, so all impacts of TSL 4 on these product classes, such as chassis changes, would not be required. For product class 8A, TSL 5 represents a CEER of 10.00, and for product class 3, TSL 5 represents a CEER of 11.50. DOE estimates the INPV impacts at TSL 5 to range from −$86.6 million to −$184.4 million, or a change in INPV of −9.1 percent to −19.3 percent. At this proposed level, the industry cash flow is estimated to decrease by approximately 69.3 percent to $26.5 million, compared to the base-case value of $86.3 million in the year leading up to the proposed energy conservation standards.

At TSL 5, impacts are negative under both scenarios due to the high conversion costs that exist at TSL 5. Although capital conversion costs would be $8 million lower at TSL 5 than at TSL 4 due to the removal of any capital costs associated with product classes 5A and 5B (despite higher capital costs for product class 3), product conversion costs are $13 million higher at TSL 5 compared to TSL 4 because a greater number of product lines would need to be redesigned at this level.

TSL 6 represents max-tech for all room air conditioners. The max-tech level corresponds to CEERs of 9.80, 10.02, 10.15, 10.35, 11.67, and 11.96 for product classes 5B, 8B, 5A, 8A, 1, and 3, respectively. DOE estimates the INPV impacts at TSL 6 to range from −$80.2 million to −$344.5 million, or a change in INPV of −8.4 percent to −36.0 percent. At this proposed level, the industry cash flow is estimated to decrease by 124.8 percent to −$21.4 million, compared to the base-case value of $86.3 million in the year leading up to the proposed energy conservation standards.

At TSL 6, all products would need to be fully redesigned, resulting in large product and capital conversion costs of $117 million and $193 million, respectively. These conversion costs are mostly driven by the high-volume product classes 1 and 3 and their associated chassis and heat exchanger changes.

b. Impacts on Employment

Clothes Dryer Employment Impacts

For clothes dryers, DOE used the GRIM to estimate the domestic labor expenditures and number of domestic production workers in the base case and at each TSL from 2011 to 2043. DOE used statistical data from the most recent U.S. Census Bureau's 2008

"Annual Survey of Manufacturers," the results of the engineering analysis, and interviews with manufacturers to determine the inputs necessary to calculate industry-wide labor expenditures and domestic employment levels. Labor expenditures for the manufacture of a product are a function of the labor intensity of the product, the sales volume, and an assumption that wages in real terms remain constant.

In the GRIM, DOE used the labor content of each product and the manufacturing production costs from the engineering analysis to estimate the annual labor expenditures in the clothes dryers and room air conditioner industries. DOE used Census data and interviews with manufacturers to estimate the portion of the total labor expenditures that is attributable to domestic labor.

The production worker estimates in this section only cover workers up to the line-supervisor level who are directly involved in fabricating and assembling a product within an Original Equipment Manufacturer (OEM) facility. Workers performing services that are closely associated with production operations, such as material handing with a forklift, are also included as production labor. DOE's estimates account only for production workers who manufacture the specific products covered by this rulemaking.

The employment impacts shown in Table V–23 represent the potential production employment that could result following amended energy conservation standards. The upper end of the results in this table estimates the total potential increase in the number of production workers after amended energy conservation standards. To calculate the total potential increase, DOE assumed that manufacturers continue to produce the same scope of covered products in domestic production facilities and domestic production is not shifted to lower-labor-cost countries. Because there is a real risk of manufacturers evaluating sourcing decisions in response to amended energy conservation standards, the lower end of the range of employment results in Table V–23 includes the estimated total number of U.S. production workers in the industry who could lose their jobs if all existing production were moved outside of the United States. While the results present a range of employment impacts following the compliance date of amended energy conservation standards, the discussion below also includes a qualitative discussion of the likelihood of negative employment impacts at the various TSLs. Finally, the employment impacts shown are independent of the employment impacts from the broader U.S. economy, which are documented in chapter 13 of the direct final rule TSD.

Using the GRIM, DOE estimates that in the absence of amended energy conservation standards, there would be 4,426 domestic production workers involved in manufacturing residential clothes dryers in 2014. Using 2008 Census Bureau data and interviews with manufacturers, DOE estimates that approximately three-quarters of clothes dryers sold in the United States are manufactured domestically. Table V–23 shows the range of the impacts of potential amended energy conservation standards on U.S. production workers in the clothes dryer industry.

TABLE V–23—POTENTIAL CHANGES IN THE TOTAL NUMBER OF DOMESTIC CLOTHES DRYER PRODUCTION WORKERS IN 2014

	Base case	1	2	3	4	5	6
Total Number of Domestic Production Workers in 2014 (without changes in production locations)	3,962	3,962	3,965	4,370	4,420	5,040	6,218
Potential Changes in Domestic Production Workers in 2014 *	....	0–(3,962)	3–(3,962)	408–(3,962)	458–(3,962)	1,078–(3,962)	2,256–(3,962)

* DOE presents a range of potential employment impacts. Numbers in parentheses indicate negative numbers.

All examined TSLs show relatively minor impacts on domestic employment levels at the lower end of the range. In particular, the design options used in the engineering analysis for TSL 1 and TSL 2 almost exclusively involve changes to standby power. These TSLs would not measurably impact domestic employment levels.

At TSL 3 through TSL 5, DOE analyzed design options for the most common product classes that would add labor content to the final product. If manufacturers continue to produce these more complex products in house, it is likely that employment would increase in response to the energy conservation standards. At TSL 3 through 5, greater levels of domestic production employment are also likely because, while requiring more labor, the product changes could be made within existing platforms. The ability to make product changes within existing platforms mitigates some of the pressure to find lower labor costs because this decision would add disruptions with suppliers and add capital costs. However, TSL 6 would effectively require heat pump clothes dryers for all electric units. Manufacturers indicated that such a drastic change to existing products could force them to consider moving domestic production to countries with lower labor costs. Besides the large capital conversion costs, the much higher labor content in heat pump clothes dryers would also put pressure on manufacturers to consider a lower-labor-cost country.

Room Air Conditioner Employment Impacts

DOE's research suggests that currently no room air conditioners are made domestically. All manufacturers or their domestic distributors do maintain offices in the United States to handle design, technical support, training, certification, and other requirements. As amended energy conservation standards for room air conditioners are implemented, however, DOE does not anticipate any changes in domestic employment levels.

c. Impacts on Manufacturing Capacity

Clothes Dryers

At TSL 1 through TSL 5, manufacturers could maintain capacity levels and continue to meet market demand under amended energy conservation standards. While the changes required at these TSLs would require changes that could be made within most existing designs, TSL 6, which would effectively require heat pump technology, could result in short-term capacity constraints. Significant changes to production facilities would be required if amended energy conservation standards effectively mandated heat pump clothes dryers at TSL 6. Several manufacturers stated that they could move all or part of their production if they were required to exclusively manufacture heat pump clothes dryers. Because of these drastic changes, a 3-year time period between the announcement of the final rule and the compliance date of the amended energy conservation standard might not be sufficient to design and manufacture products that have yet to be introduced in the United States and which would require new dryer designs from each manufacturer that continued to offer electric clothes dryers for the United States market.

Room Air Conditioners

DOE anticipates that amended energy conservation standards would not significantly affect the production capacity of room air conditioner manufacturers. Manufacturers mentioned two issues that could potentially constrain capacity. One is the availability of high efficiency compressors, which are currently difficult to obtain. Because amended energy conservation standards would cause the demand for high efficiency compressors to increase, manufacturers worried that they would not be able to obtain the quantities they need to maintain desired production levels. DOE understands that compressor availability is a concern at present. DOE does not believe this shortage will continue when amended standards take effect in 2014 because the number of R–410A compressors available for the room air conditioner industry has already greatly expanded since the ban on R–22 took effect. Because there is a 3-year delay between the announcement of the final rule and the compliance date of the amended energy conservation standard, DOE believes suppliers will have sufficient time to anticipate demand and ramp up production of high efficiency compressors for room air conditioners.

The second potential capacity constraint involves changes to existing chassis sizes, which could be required by amended energy conservation standards. Manufacturers stated that increasing chassis volume requires significant product development and capital investments, which could severely disrupt production at their facilities. DOE understands that increasing chassis volume causes substantial conversion costs, which are quantified in the GRIM. DOE does not believe, however, that the proposed standards would significantly affect production capacity. Even though chassis size increases require large capital and product conversion costs, this design option is not required across all analyzed product classes. In addition, manufacturers were more concerned about the capital and product conversion costs to make these changes than having a three year implementation period to do so, and DOE has accounted for these costs in the establishment of the room air conditioner standards. DOE believes that room air conditioner manufacturers will be able to increase chassis volumes by 2014 while maintaining production capacity levels and continuing to meet market demand for all room air conditioner standard levels.

d. Impacts on Sub-Groups of Manufacturers

Using average cost assumptions to develop an industry cash-flow estimate is not adequate for assessing differential impacts among manufacturer subgroups. Small manufacturers, niche equipment manufacturers, and manufacturers exhibiting a cost structure substantially different from the industry average could be affected disproportionately. While DOE analyzed the impacts to small business in section VI.B, DOE did not identify any other subgroups for clothes dryers or room air conditioners for this rulemaking based on the results of the industry characterization.

e. Cumulative Regulatory Burden

While any one regulation may not impose a significant burden on manufacturers, the combined effects of several impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. In addition to energy conservation standards, other regulations can significantly affect manufacturers' financial operations. Multiple regulations affecting the same manufacturer can strain profits and can lead companies to abandon product lines or markets with lower expected future returns than competing products. For these reasons, DOE conducts an analysis of cumulative regulatory burden as part of its rulemakings pertaining to appliance efficiency.

During previous stages of this rulemaking DOE identified a number of requirements, in addition to amended energy conservation standards for clothes dryers and room air conditioners, with which manufacturers of these products will be required to comply. Manufacturers provided comment on some of these regulations during the preliminary analysis period, including UL 2158, which deals with fire containment in electric clothes dryers, and the Montreal Protocol, which banned R–22 refrigerant in new room air conditioners. DOE summarizes and addresses these comments in section IV.I.3.b and provides additional details of the cumulative regulatory burden analysis in chapter 12 of the direct final rule TSD.

3. National Impact Analysis

a. Significance of Energy Savings

To estimate the energy savings through 2043 attributable to potential standards for clothes dryers and room air conditioners, DOE compared the energy consumption of these products under the base case to their anticipated energy consumption under each TSL. As discussed in section IV.E, the results account for a rebound effect of 15 percent for room air conditioners (that is, 15 percent of the total savings from higher product efficiency are "taken back" by consumers through more intensive use of the product).

Table V–24 and Table V–25 present DOE's forecasts of the national energy savings for each TSL for clothes dryers and room air conditioners, respectively. The savings were calculated using the approach described in section IV.G. Chapter 10 of the direct final rule TSD presents tables that also show the magnitude of the energy savings if the savings are discounted at rates of 7 and 3 percent. Discounted energy savings represent a policy perspective in which energy savings realized farther in the future are less significant than energy savings realized in the nearer term.

TABLE V–24—CLOTHES DRYERS: CUMULATIVE NATIONAL ENERGY SAVINGS IN QUADS

Product class	Trial standard level					
	1	2	3	4	5	6
Vented Electric Standard	0.000	0.038	0.347	0.347	1.268	2.923
Vented Electric Compact 120V	0.000	0.000	0.000	0.000	0.002	0.003

TABLE V–24—CLOTHES DRYERS: CUMULATIVE NATIONAL ENERGY SAVINGS IN QUADS—Continued

Product class	Trial standard level					
	1	2	3	4	5	6
Vented Electric Compact 240V	0.000	0.001	0.001	0.001	0.006	0.016
Vented Gas	0.000	0.009	0.009	0.038	0.164	0.164
Ventless Electric Compact 240V	0.000	0.002	0.002	0.000	0.004	0.016
Ventless Electric Combination Washer/Dryer	0.000	0.011	0.011	0.000	0.011	0.023
Total	0.00	0.062	0.37	0.386	1.455	3.145

TABLE V–25—ROOM AIR CONDITIONERS: CUMULATIVE NATIONAL ENERGY SAVINGS IN QUADS

Product class	Trial standard level					
	1	2	3	4	5	6
Group 1—includes PC 1	0.046	0.083	0.046	0.133	0.133	0.171
Group 2—includes PC 2, 3, 4, 11	0.051	0.115	0.161	0.161	0.327	0.445
Group 3—includes PC 5A, 9, 13	0.001	0.001	0.000	0.001	0.000	0.008
Group 4—includes PC 5B, 10	0.000	0.000	0.000	0.000	0.000	0.003
Group 5—includes PC 6, 7, 8A, 12	0.004	0.004	0.006	0.006	0.014	0.021
Group 6—includes PC 8B, 14, 15, 16	0.002	0.002	0.004	0.004	0.004	0.016
Total	0.105	0.205	0.218	0.305	0.477	0.665

DOE also performed a sensitivity to investigate the impact of adding the rebound effect on the NES for the six energy efficiency TSLs for clothes dryers in appendix 10–C of the TSD. As described in more detail in the TSD, at least one study estimated a potential rebound effective of 5 percent for clothes dryers. The NES results for this sensitively show a consistent, small decrease in potential energy savings from a standard. (Refer to section IV.E for a discussion of the rebound effect.)

DOE recognizes that there may be forms of direct consumer rebound that have not been measured in previous studies. For example, if automatic termination of clothes dryer cycles leaves clothes feeling humid or damp, then consumers may change to longer timed drying cycles. DOE is addressing this type of rebound effect in updates of its clothes dryer test procedure which provides for a field use factor that relates tested clothes dryer energy use to in-field energy use. If DOE detects a significant rebound effect from changing characteristics of clothes dryers, DOE will consider such effects in updates of its test procedure regulations and in future amendments to the energy conservation standards, as appropriate.

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV to the nation of the total costs and savings for consumers that would result from particular standard levels for clothes dryers and room air conditioners. In accordance with the OMB's guidelines on regulatory analysis (OMB Circular A–4, section E, September 17, 2003), DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. The 7-percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy, and reflects the returns to real estate and small business capital as well as corporate capital. DOE used this discount rate to approximate the opportunity cost of capital in the private sector, since recent OMB analysis has found the average rate of return to capital to be near this rate. In addition, DOE used the 3-percent rate to capture the potential effects of standards on private consumption (for example, through higher prices for products and the purchase of reduced amounts of energy). This rate represents the rate at which society discounts future consumption flows to their present value. This rate can be approximated by the real rate of return on long-term government debt (that is, yield on Treasury notes minus annual rate of change in the Consumer Price Index), which has averaged about 3 percent on a pre-tax basis for the last 30 years.

Table V–26 through Table V–29 show the consumer NPV results for each TSL DOE considered for clothes dryers and room air conditioners, using both a 7-percent and a 3-percent discount rate. In each case, the impacts cover the lifetime of products purchased in 2014–2043. See chapter 10 of the direct final rule TSD for more detailed NPV results.

TABLE V–26—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR CLOTHES DRYERS, 3-PERCENT DISCOUNT RATE

Product class	Trial standard level					
	1	2	3	4	5	6
	Billion 2009$					
Vented Electric Standard	0.00	0.40	2.779	2.779	2.125	0.563
Vented Electric Compact 120V	0.00	0.005	0.005	0.005	−0.013	−0.029
Vented Electric Compact 240V	0.00	0.014	0.014	0.014	−0.066	−0.12
Vented Gas	0.00	0.094	0.094	0.215	−1.906	−1.906
Ventless Electric Compact 240V	0.00	0.019	0.019	0.00	−0.010	−0.036

TABLE V–26—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR CLOTHES DRYERS, 3-PERCENT DISCOUNT RATE—Continued

Product class	Trial standard level					
	1	2	3	4	5	6
	Billion 2009$					
Ventless Electric Combination Washer/Dryer	0.00	0.086	0.086	0.00	0.086	0.00
Total	0.00	0.619	2.998	3.013	0.216	−1.528

TABLE V–27—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR CLOTHES DRYERS, 7-PERCENT DISCOUNT RATE

Product class	Trial standard level					
	1	2	3	4	5	6
	Billion 2009$					
Vented Electric Standard	0.00	0.168	1.017	1.017	−1.079	−5.025
Vented Electric Compact 120V	0.00	0.002	0.002	0.002	−0.011	−0.024
Vented Electric Compact 240V	0.00	0.006	0.006	0.006	−0.051	−0.101
Vented Gas	0.00	0.039	0.039	0.051	−1.474	−1.474
Ventless Electric Compact 240V	0.00	0.008	0.008	0.00	−0.013	−0.050
Ventless Electric Combination Washer/Dryer	0.00	0.031	0.031	0.00	0.031	−0.043
Total	0.00	0.254	1.104	1.076	−2.596	−6.716

TABLE V–28—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR ROOM AIR CONDITIONERS, 3-PERCENT DISCOUNT RATE

Product class	Trial standard level					
	1	2	3	4	5	6
	Billion 2009$					
Group 1—includes PC 1	0.276	0.362	0.276	0.245	0.245	−1.838
Group 2—includes PC 2, 3, 4, 11	0.427	0.902	1.162	1.162	1.121	−2.374
Group 3—includes PC 5A, 9, 13	−0.001	−0.003	0.00	−0.003	0.00	−0.481
Group 4—includes PC 5B, 10	−0.002	−0.008	0.00	−0.002	0.00	−0.229
Group 5—includes PC 6, 7, 8A, 12	0.036	0.036	0.049	0.049	0.066	−0.379
Group 6—includes PC 8B, 14, 15, 16	0.011	0.011	0.024	0.024	0.024	−0.314
Total	0.747	1.30	1.511	1.474	1.456	−5.616

TABLE V–29—CUMULATIVE NET PRESENT VALUE OF CONSUMER BENEFITS FOR ROOM AIR CONDITIONERS, 7-PERCENT DISCOUNT RATE

Product class	Trial standard level					
	1	2	3	4	5	6
	Billion 2009$					
Group 1—includes PC 1	0.117	0.12	0.117	−0.02	−0.02	−1.386
Group 2—includes PC 2, 3, 4, 11	0.21	0.438	0.558	0.558	0.307	−2.084
Group 3—includes PC 5A, 9, 13	−0.002	−0.003	0.00	−0.003	0.00	−0.317
Group 4—includes PC 5B, 10	−0.002	−0.006	0.00	−0.002	0.00	−0.169
Group 5—includes PC 6, 7, 8A, 12	0.019	0.019	0.025	0.025	0.029	−0.262
Group 6—includes PC 8B, 14, 15, 16	0.006	0.006	0.012	0.012	0.012	−0.223
Total	0.349	0.575	0.712	0.57	0.328	−4.441

DOE investigated the impact of different learning rates on the NPV for the six energy efficiency TSLs for room air conditioners and clothes dryers. The NPV results presented above in Table V.26 to Table V.29 are based on learning rates of 38.9% for room air conditioners and 41.6% for clothes dryers, both of which are referred to as the "default" learning rates. DOE considered three learning rate sensitivities: (1) A "high learning" rate; (2) a "low learning" rate;

and (3) a "no learning" rate. In addition, for clothes dryers there is a fourth sensitivity: "Clothes Dryers Only". The "high learning" rates are 41.4-percent for room air conditioners and 42.9-percent for clothes dryers. The "low learning' rates are 31.0-percent for room air conditioners and 33.9-percent for clothes dryers. The "no learning" rate sensitivity, which is zero-percent for all products, assumes constant real prices over the entire forecast period. For clothes dryers, "clothes dryers only" is based on limited set of historical price data specifically for clothes dryers and the learning rate is 52.2-percent. Refer to section IV.F.1 for details on the development of the above learning rates.

For room air conditioners, Table V.31 provides the annualized NPV of consumer benefits at a 7-percent discount rate for each of the six energy efficiency TSLs for the "default" learning rate and the three sensitivity cases. Table V.32 provides the same annualized NPVs but at a 3-percent discount rate. For clothes dryers, Table V.33 provides the annualized NPV of consumer benefits at a 7-percent discount rate for each of the six energy efficiency TSLs for the "default" learning rate and the four sensitivity cases. Table V.34 provides the same annualized NPVs but at a 3-percent discount rate. Included as part of the annualized NPV in Table V.31 through Table V.34 is the annualized present value of monetized benefits from CO_2 and NO_X emissions reductions. Section V.B.6 below provides a complete description and summary of the monetized benefits from CO_2 and NO_X emissions reductions. For details on the development of the learning rate sensitivities and the corresponding NPV results, see appendix 10–C of the final rule TSD.

TABLE V–30—ROOM AIR CONDITIONERS: ANNUALIZED NET PRESENT VALUE OF CONSUMER BENEFITS INCLUDING ANNUALIZED PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS FOR ENERGY EFFICIENCY TSLS FOR PRODUCTS SHIPPED IN 2014–2043

[3 Percent discount rate]

Trial standard level	Learning rate (LR)			
	Default: LR_{RoomAC} = 38.9%	Low sensitivity: LR_{RoomAC} = 31.0%	High sensitivity: LR_{RoomAC} = 41.4%	No learning: LR = 0% (constant real prices)
	Billion 2009$			
1	0.079	0.075	0.081	0.059
2	0.080	0.076	0.082	0.061
3	0.092	0.088	0.093	0.072
4	0.096	0.088	0.098	0.061
5	0.106	0.091	0.111	0.037
6	(0.241)	(0.289)	(0.226)	(0.463)

Parentheses indicate negative (−) values.

TABLE V–31—ROOM AIR CONDITIONERS: ANNUALIZED NET PRESENT VALUE OF CONSUMER BENEFITS INCLUDING ANNUALIZED PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS FOR ENERGY EFFICIENCY TSLS FOR PRODUCTS SHIPPED IN 2014–2043

[7 Percent discount rate]

Trial standard level	Learning rate (LR)			
	Default: LR_{RoomAC} = 38.9%	Low sensitivity: LR_{RoomAC} = 31.0%	High sensitivity: LR_{RoomAC} = 41.4%	No learning: LR = 0% (constant real prices)
	Billion 2009$			
1	0.059	0.055	0.060	0.041
2	0.060	0.057	0.061	0.043
3	0.072	0.068	0.073	0.056
4	0.066	0.060	0.069	0.037
5	0.058	0.045	0.062	(0.000)
6	(0.313)	(0.355)	(0.300)	(0.502)

Parentheses indicate negative (−) values.

TABLE V–32—CLOTHES DRYER: ANNUALIZED NET PRESENT VALUE OF CONSUMER BENEFITS INCLUDING ANNUALIZED PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS FOR ENERGY EFFICIENCY TSLS FOR PRODUCTS SHIPPED IN 2014–2043

[3 Percent discount rate]

Trial standard level	Learning rate (LR)				
	Default: LR_{CD} = 41.6%	Low sensitivity: LR_{CD} = 33.9%	High sensitivity: LR_{CD} = 42.9%	No learning: LR = 0% (constant real prices)	Sensitivity (Clothes dryers only): LR = 52.2%
	Billion 2009$				
1	0.001	0.001	0.001	0.001	0.001
2	0.036	0.036	0.036	0.035	0.036
3	0.178	0.173	0.179	0.158	0.183
4	0.180	0.175	0.181	0.156	0.186
5	0.110	0.033	0.121	(0.220)	0.199
6	0.185	0.018	0.209	(0.531)	0.378

Parentheses indicate negative (−) values.

TABLE V–33—CLOTHES DRYER: ANNUALIZED NET PRESENT VALUE OF CONSUMER BENEFITS INCLUDING ANNUALIZED PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS FOR ENERGY EFFICIENCY TSLS FOR PRODUCTS SHIPPED IN 2014–2043

[7 Percent discount rate]

Trial standard level	Learning rate (LR)				
	Default: LR_{CD} = 41.6%	Low Sensitivity: LR_{CD} = 33.9%	High Sensitivity: LR_{CD} = 42.9%	No Learning: LR = 0% (constant real prices)	Sensitivity (Clothes Dryers Only): LR = 52.2%
	Billion 2009$				
1	0.001	0.001	0.001	0.001	0.001
2	0.025	0.024	0.025	0.024	0.025
3	0.114	0.110	0.114	0.098	0.118
4	0.113	0.108	0.113	0.094	0.118
5	(0.111)	(0.176)	(0.103)	(0.375)	(0.041)
6	(0.282)	(0.421)	(0.263)	(0.853)	(0.130)

Parentheses indicate negative (−) values.

c. Impacts on Employment

DOE develops estimates of the indirect employment impacts of potential standards on the economy in general. As discussed above, DOE expects energy conservation standards for clothes dryers and room air conditioners to reduce energy bills for consumers of these products, and the resulting net savings to be redirected to other forms of economic activity. These expected shifts in spending and economic activity could affect the demand for labor. As described in section IV.J, to estimate these effects DOE used an input/output model of the U.S. economy. Table V–34 presents the estimated net indirect employment impacts in 2020 and 2043 for the TSLs that DOE considered in this rulemaking. Chapter 13 of the direct final rule TSD presents more detailed results.

TABLE V–34—NET INCREASE IN JOBS FROM INDIRECT EMPLOYMENT EFFECTS UNDER CLOTHES DRYER AND ROOM AIR CONDITIONER TRIAL STANDARD LEVELS

	Thousands					
	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
Residential Clothes Dryers:						
2020	0.00	0.00	0.41	0.36	−1.37	−3.16
2043	0.01	0.01	1.82	1.75	4.25	9.30
Room Air Conditioners:						
2020	0.90	0.88	0.97	1.34	2.04	3.22
2043	0.74	0.73	0.74	1.16	1.94	3.07

The input/output model suggests that today's proposed standards are likely to increase the net demand for labor in the economy. The projected gains are very small, however, relative to total national employment (currently approximately 120 million). Moreover, neither the BLS data nor the input/output model DOE uses includes the quality or wage level of the jobs.

4. Impact on Utility or Performance of Products

As presented in section III.D.1.d of this notice, DOE concluded that none of the TSLs considered in this notice would reduce the utility or performance of the clothes dryers or room air conditioners under consideration in this rulemaking. DOE also notes that manufacturers of these products currently offer clothes dryers and room air conditioners that meet or exceed today's standards. (42 U.S.C. 6295(o)(2)(B)(i)(IV))

5. Impact of Any Lessening of Competition

DOE has also considered any lessening of competition that is likely to result from amended standards. The Attorney General determines the impact, if any, of any lessening of competition likely to result from a proposed standard, and transmits such determination to DOE, together with an analysis of the nature and extent of such impact. (42 U.S.C. 6295(o)(2)(B)(i)(V) and (B)(ii))

DOE published an NOPR containing energy conservation standards identical to those set forth in today's direct final rule and transmitted a copy of today's direct final rule and the accompanying TSD to the Attorney General, requesting that the DOJ provide its determination on this issue. DOE will consider DOJ's comments on the rule in determining whether to proceed with the direct final rule. DOE will also publish and respond to DOJ's comments in the **Federal Register** in a separate notice.

6. Need of the Nation To Conserve Energy

An improvement in the energy efficiency of the products subject to today's rule is likely to improve the security of the nation's energy system by reducing overall demand for energy. Reduced electricity demand may also improve the reliability of the electricity system. As a measure of this reduced demand, Table V–35 presents the estimated reduction in electricity generating capacity in 2043 for the TSLs that DOE considered in this rulemaking.

TABLE V–35—REDUCTION IN ELECTRIC GENERATING CAPACITY IN 2043 UNDER CLOTHES DRYER AND ROOM AIR CONDITIONER TRIAL STANDARD LEVELS

	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
	Gigawatts					
Clothes Dryers	0.002	0.060	0.358	0.345	1.27	2.27
Room Air Conditioners	0.348	0.429	0.436	0.632	1.01	1.46

Energy savings from amended standards for clothes dryers and room air conditioners are expected to produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production. Table V–36 provides DOE's estimate of cumulative CO_2, NO_X, and Hg emissions reductions that would be expected to result from the TSLs considered in this rulemaking. In the environmental assessment (chapter 15 of the direct final rule TSD), DOE reports annual CO_2, NO_X, and Hg emissions reductions for each TSL.

As discussed in section IV.L, DOE has not reported SO_2 emissions reductions from power plants because there is uncertainty about the effect of energy conservation standards on the overall level of SO_2 emissions in the United States due to SO_2 emissions caps. DOE also did not include NO_X emissions reduction from power plants in States subject to CAIR because an energy conservation standard would not affect the overall level of NO_X emissions in those States due to the emissions caps mandated by CAIR.

TABLE V–36—EMISSIONS REDUCTION ESTIMATED FOR CLOTHES DRYER AND ROOM AIR CONDITIONER TRIAL STANDARD LEVELS

[Cumulative for 2014 through 2043]

	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
Clothes Dryers:						
CO_2 *million metric tons*	0.119	2.99	17.75	18.67	70.47	186.6
NO_X *thousand tons*	0.097	2.41	14.26	15.14	57.26	151.3
Hg *tons*	0.000	0.009	0.053	0.051	0.188	0.569
Room Air Conditioners:						
CO_2 *million metric tons*	9.83	11.88	12.49	17.4	26.89	37.68
NO_X *thousand tons*	8.02	9.69	10.2	14.2	21.91	30.69
Hg *tons*	0.012	0.015	0.017	0.022	0.032	0.044

DOE also estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X that DOE estimated for each of the TSLs considered for clothes dryers and room air conditioners. In order to make this calculation similar to the calculation of the NPV of consumer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in 2014–2043. Thus, the emissions reductions extend past 2043.

As discussed in section IV.M, DOE used values for the SCC developed by an interagency process. The four values for CO_2 emissions reductions resulting from that process (expressed in 2009$) are $4.9/ton (the average value from a distribution that uses a 5-percent discount rate), $22.1/ton (the average value from a distribution that uses a 3-percent discount rate), $36.3/ton (the average value from a distribution that uses a 2.5-percent discount rate), and $67.1/ton (the 95th-percentile value from a distribution that uses a 3-percent discount rate). These values correspond to the value of emission reductions in 2010; the values for later years are higher due to increasing damages as the magnitude of climate change increases. For each of the four cases, DOE calculated a present value of the stream of annual values using the same discount rate as was used in the studies upon which the dollar-per-ton values are based. Table V–37 and Table V–38 present the global values of CO_2 emissions reductions at each TSL. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values, and these results are presented in Table V–39 and Table V–40.

TABLE V–37—CLOTHES DRYERS: ESTIMATES OF GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION UNDER TRIAL STANDARD LEVELS

TSL	Million 2009$			
	5% discount rate, average *	3% discount rate, average *	2.5% discount rate, average *	3% discount rate, 95th percentile *
1	1	3	5	10
2	15	79	134	239
3	88	465	793	1417
4	93	489	834	1490
5	351	1848	3148	5626
6	929	4894	8339	14902

* Columns are labeled by the discount rate used to calculate the SCC and whether it is an average value or drawn from a different part of the distribution. Values presented in the table incorporate the escalation of the SCC over time.

TABLE V–38—ROOM AIR CONDITIONERS: ESTIMATES OF GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION UNDER TRIAL STANDARD LEVELS

TSL	Million 2009$			
	5% discount rate, average *	3% discount rate, average *	2.5% discount rate, average *	3% discount rate, 95th percentile *
1	43	212	357	648
2	52	259	436	790
3	55	271	455	826
4	77	382	642	1164
5	118	591	996	1803
6	166	833	1404	2541

* Columns are labeled by the discount rate used to calculate the SCC and whether it is an average value or drawn from a different part of the distribution. Values presented in the table incorporate the escalation of the SCC over time.

TABLE V–39—CLOTHES DRYERS: ESTIMATES OF DOMESTIC PRESENT VALUE OF CO_2 EMISSIONS REDUCTION UNDER TRIAL STANDARD LEVELS

TSL	Million 2009$ *			
	5% discount rate, average **	3% discount rate, average **	2.5% discount rate, average **	3% discount rate, 95th percentile **
1	0.042 to 0.14	0.22 to 0.72	0.37 to 1.22	0.67 to 2.19.
2	1.04 to 3.43	5.50 to 18.1	9.37 to 30.8	16.7 to 55.0.
3	6.19 to 20.3	32.6 to 107	55.5 to 182	99.2 to 326.
4	6.51 to 21.4	34.3 to 113	58.4 to 192	104 to 343.
5	24.6 to 80.7	129 to 425	220 to 724	394 to 1294.
6	65.1 to 214	343 to 1126	584 to 1918	1043 to 3428.

* Domestic values are presented as a range between 7 percent and 23 percent of the global values.
** Columns are labeled by the discount rate used to calculate the SCC and whether it is an average value or drawn from a different part of the distribution. Values presented in the table incorporate the escalation of the SCC over time.

TABLE V–40—ROOM AIR CONDITIONERS: ESTIMATES OF DOMESTIC PRESENT VALUE OF CO_2 EMISSIONS REDUCTION UNDER TRIAL STANDARD LEVELS

TSL	Million 2009$*			
	5% discount rate, average **	3% discount rate, average **	2.5% discount rate, average **	3% discount rate, 95th percentile **
1	3.00 to 9.85	14.9 to 48.8	25.0 to 82.1	45.4 to 149.
2	3.64 to 12.0	18.1 to 59.6	30.5 to 100	55.3 to 182.
3	3.83 to 12.6	18.9 to 62.3	31.9 to 105	57.8 to 190.
4	5.36 to 17.6	26.7 to 87.8	45.0 to 148	81.5 to 268.
5	8.29 to 27.2	41.4 to 136	69.7 to 229	126 to 415.

TABLE V–40—ROOM AIR CONDITIONERS: ESTIMATES OF DOMESTIC PRESENT VALUE OF CO_2 EMISSIONS REDUCTION UNDER TRIAL STANDARD LEVELS—Continued

TSL	Million 2009$*			
	5% discount rate, average **	3% discount rate, average **	2.5% discount rate, average **	3% discount rate, 95th percentile **
6	11.6 to 38.3	58.3 to 192	98.3 to 323	178 to 584.

* Domestic values are presented as a range between 7 percent and 23 percent of the global values.
** Columns are labeled by the discount rate used to calculate the SCC and whether it is an average value or drawn from a different part of the distribution. Values presented in the table incorporate the escalation of the SCC over time.

DOE is well aware that scientific and economic knowledge about the contribution of CO_2 and other GHG emissions to changes in the future global climate and the potential resulting damages to the world economy continues to evolve rapidly. Thus, any value placed in this rulemaking on reducing CO_2 emissions is subject to change. DOE, together with other Federal agencies, will continue to review various methodologies for estimating the monetary value of reductions in CO_2 and other GHG emissions. This ongoing review will consider the comments on this subject that are part of the public record for this and other rulemakings, as well as other methodological assumptions and issues. However, consistent with DOE's legal obligations, and taking into account the uncertainty involved with this particular issue, DOE has included in this final rule the most recent values and analyses resulting from the ongoing interagency review process.

DOE also estimated a range for the cumulative monetary value of the economic benefits associated with NO_X emissions reductions anticipated to result from amended standards for clothes dryers and room air conditioners. The dollar-per-ton values that DOE used are discussed in section IV.M. Table V–41 and Table V–42 present the cumulative present values for each TSL calculated using seven-percent and three-percent discount rates.

TABLE V–41—CLOTHES DRYERS: ESTIMATES OF PRESENT VALUE OF NO_X EMISSIONS REDUCTION UNDER TRIAL STANDARD LEVELS

TSL	3% discount rate *Million 2009$*	7% discount rate *Million 2009$*
1	0.031 to 0.314	0.013 to 0.136.
2	0.759 to 7.8	0.328 to 3.37.
3	4.49 to 46.2	1.94 to 19.98.
4	4.77 to 49.02	2.06 to 21.2.
5	18.0 to 185	7.8 to 80.2.
6	47.6 to 490	20.6 to 212.

TABLE V–42—ROOM AIR CONDITIONERS: ESTIMATES OF PRESENT VALUE OF NO_X EMISSIONS REDUCTION UNDER TRIAL STANDARD LEVELS

TSL	3% discount rate *Million 2009$*	7% discount rate *Million 2009$*
1	2.34 to 24.0	1.25 to 12.9.
2	2.83 to 29.1	1.50 to 15.4.
3	2.99 to 30.7	1.61 to 16.6.
4	4.16 to 42.7	2.2 to 22.6.
5	6.40 to 65.8	3.35 to 34.4.
6	8.96 to 92.1	4.64 to 47.7.

The NPV of the monetized benefits associated with emissions reductions can be viewed as a complement to the NPV of the consumer savings calculated for each TSL considered in this rulemaking. Table V–43 shows an example of the calculation of the combined NPV including benefits from emissions reductions for the case of TSL 4 for clothes dryers. Table V–44 through Table V–47 present the NPV values that result from adding the estimates of the potential economic benefits resulting from reduced CO_2 and NO_X emissions in each of four valuation scenarios to the NPV of consumer savings calculated for each TSL considered in this rulemaking, at both a 7-percent and 3-percent discount rate. The CO_2 values used in the columns of each table correspond to the four scenarios for the valuation of CO_2 emission reductions presented in section IV.M.

TABLE V–43—ADDING NET PRESENT VALUE OF CONSUMER SAVINGS TO PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS AT TSL 4 FOR CLOTHES DRYERS

Category	Present value *billion 2009$*	Discount rate (percent)
Benefits:		
Operating Cost Savings	1.726	7%
	4.099	3%
CO_2 Reduction Monetized Value (at $4.9/metric ton) *	0.093	5
CO_2 Reduction Monetized Value (at $22.1/metric ton) *	0.489	3
CO_2 Reduction Monetized Value (at $36.3/metric ton) *	0.834	2.5
CO_2 Reduction Monetized Value (at $67.1/metric ton) *	1.49	3
NO_X Reduction Monetized Value (at $2,519/ton) *	0.012	7
	0.027	3
Total Monetary Benefits **	2.227	7
	4.615	3
Costs:		
Total Incremental Installed Costs	0.65	7
	1.086	3
Net Benefits/Costs:		
Including CO_2 and NO_X**	1.58	7
	3.53	3

* These values represent global values (in 2009$) of the SCC in 2010 under several scenarios. The values of $4.9, $22.1, and $36.3 per ton are the averages of SCC distributions calculated using 5-percent, 3-percent, and 2.5-percent discount rates, respectively. The value of $67.1 per ton represents the 95th percentile of the SCC distribution calculated using a 3-percent discount rate. *See* section IV.M for details. The value for NO_X (in 2009$) is the average of the low and high values used in DOE's analysis.

** Total Monetary Benefits for both the 3-percent and 7-percent cases utilize the central estimate of social cost of CO_2 emissions calculated at a 3% discount rate, which is equal to $22.1/ton in 2010 (in 2009$).

TABLE V–44—RESULTS OF ADDING NET PRESENT VALUE OF CONSUMER SAVINGS (AT 7-PERCENT DISCOUNT RATE) TO NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS UNDER TRIAL STANDARD LEVELS FOR CLOTHES DRYERS

TSL	Consumer NPV at 7% discount rate added with:			
	SCC Value of $4.9/metric ton CO_2* and Low Value for NO_X** *billion 2009$*	SCC Value of $22.1/metric ton CO_2* and Medium Value for NO_X** *billion 2009$*	SCC Value of $36.3/metric ton CO_2* and Medium Value for NO_X** *billion 2009$*	SCC Value of $67.1/metric ton CO_2* and High Value for NO_X** *billion 2009$*
1	0.00061	0.00320	0.00540	0.00965
2	0.0152	0.0804	0.136	0.243
3	0.0903	0.476	0.804	1.437
4	0.0950	0.501	0.846	1.512
5	0.359	1.892	3.192	5.707
6	0.950	5.010	8.455	15.114

* These label values represent the global SCC in 2010, in 2009$. Their present values have been calculated with scenario-consistent discount rates. See section IV.M for a discussion of the derivation of these values.

** Low Value corresponds to $447 per ton of NO_X emissions. Medium Value corresponds to $2,519 per ton of NO_X emissions. High Value corresponds to $4,591 per ton of NO_X emissions.

TABLE V–45—RESULTS OF ADDING NET PRESENT VALUE OF CONSUMER SAVINGS (AT 3-PERCENT DISCOUNT RATE) TO NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS UNDER TRIAL STANDARD LEVELS FOR CLOTHES DRYERS

TSL	Consumer NPV at 3% discount rate added with:			
	SCC Value of $4.9/metric ton CO_2* and Low Value for NO_X** *billion 2009$*	SCC Value of $22.1/metric ton CO_2* and Medium Value for NO_X** *billion 2009$*	SCC Value of $36.3/metric ton CO_2* and Medium Value for NO_X** *billion 2009$*	SCC Value of $67.1/metric ton CO_2* and High Value for NO_X** *billion 2009$*
1	0.00062	0.00330	0.00550	0.00983
2	0.0157	0.0829	0.138	0.247
3	0.0929	0.491	0.818	1.463
4	0.0977	0.516	0.861	1.539
5	0.369	1.949	3.250	5.812
6	0.977	5.163	8.608	15.392

* These label values represent the global SCC in 2010, in 2009$. Their present values have been calculated with scenario-consistent discount rates. See section IV.M for a discussion of the derivation of these values.

** Low Value corresponds to $447 per ton of NO_X emissions. Medium Value corresponds to $2,519 per ton of NO_X emissions. High Value corresponds to $4,591 per ton of NO_X emissions.

TABLE V–46—RESULTS OF ADDING NET PRESENT VALUE OF CONSUMER SAVINGS (AT 7-PERCENT DISCOUNT RATE) TO NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS UNDER TRIAL STANDARD LEVELS FOR ROOM AIR CONDITIONERS

TSL	Consumer NPV at 7% discount rate added with:			
	SCC Value of \$4.9/metric ton CO_2* and Low Value for NO_X** *billion 2009$*	SCC Value of \$22.1/metric ton CO_2* and Medium Value for NO_X** *billion 2009$*	SCC Value of \$36.3/metric ton CO_2* and Medium Value for NO_X** *billion 2009$*	SCC Value of \$67.1/metric ton CO_2* and High Value for NO_X** *billion 2009$*
1	0.044	0.219	0.364	0.661
2	0.054	0.267	0.444	0.805
3	0.0563	0.280	0.464	0.843
4	0.0788	0.394	0.655	1.187
5	0.122	0.610	1.015	1.838
6	0.171	0.859	1.430	2.588

* These label values represent the global SCC in 2010, in 2009$. Their present values have been calculated with scenario-consistent discount rates. See section IV.M for a discussion of the derivation of these values.

** Low Value corresponds to $447 per ton of NO_X emissions. Medium Value corresponds to $2,519 per ton of NO_X emissions. High Value corresponds to $4,591 per ton of NO_X emissions.

TABLE V–47—RESULTS OF ADDING NET PRESENT VALUE OF CONSUMER SAVINGS (AT 3-PERCENT DISCOUNT RATE) TO NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS UNDER TRIAL STANDARD LEVELS FOR ROOM AIR CONDITIONERS

TSL	Consumer NPV at 3% discount rate added with:			
	SCC Value of \$4.9/metric ton CO_2* and Low Value for NO_X** *billion 2009$*	SCC Value of \$22.1/metric ton CO_2*and Medium Value for NO_X** *billion 2009$*	SCC Value of \$36.3/metric ton CO_2* and Medium Value for NO_X** *billion 2009$*	SCC Value of \$67.1/metric ton CO_2* and High Value for NO_X** *billion 2009$*
1	0.045	0.226	0.370	0.672
2	0.055	0.275	0.452	0.819
3	0.0576	0.288	0.472	0.857
4	0.0807	0.405	0.666	1.207
5	0.125	0.627	1.032	1.869
6	0.175	0.884	1.454	2.633

* These label values represent the global SCC in 2010, in 2009$. Their present values have been calculated with scenario-consistent discount rates. See section IV.M for a discussion of the derivation of these values.

** Low Value corresponds to $447 per ton of NO_X emissions. Medium Value corresponds to $2,519 per ton of NO_X emissions. High Value corresponds to $4,591 per ton of NO_X emissions.

Although adding the value of consumer savings to the values of emission reductions provides a valuable perspective, two issues should be considered. First, the national operating cost savings are domestic U.S. consumer monetary savings that occur as a result of market transactions, while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and the SCC are performed with different methods that use quite different time frames for analysis. The national operating cost savings is measured for the lifetime of products shipped in 2014–2043. The SCC values, on the other hand, reflect the present value of future climate-related impacts resulting from the emission of one ton of carbon dioxide in each year. These impacts continue well beyond 2100.

7. Other Factors

The Secretary of Energy, in determining whether a standard is economically justified, may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6295(o)(2)(B)(i)(VI))) In developing the direct final rule, DOE has also considered the Joint Petition submitted to DOE. DOE recognizes the value of consensus agreements submitted by parties in accordance with 42 U.S.C. 6295(p)(4) and has weighed the value of such consensus in establishing the standards set forth in today's final rule. DOE has encouraged the submission of consensus agreements as a way to get diverse stakeholders together, to develop an independent and probative analysis useful in DOE standard setting, and to expedite the rulemaking process. DOE also believes that standard levels recommended in the consensus agreement may increase the likelihood for regulatory compliance, while decreasing the risk of litigation.

C. Proposed Standards

When considering proposed standards, the new or amended energy conservation standard that DOE adopts for any type (or class) of covered product shall be designed to achieve the maximum improvement in energy efficiency that DOE determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) In determining whether a standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens to the greatest extent practicable, in light of the seven statutory factors discussed previously. (42 U.S.C. 6295(o)(2)(B)(i)) The new or amended standard must also "result in significant conservation of energy." (42 U.S.C. 6295(o)(3)(B))

The Department considered the impacts of standards at each trial standard level, beginning with maximum technologically feasible level, to determine whether that level was economically justified. Where the max-tech level was not economically justified, DOE then considered the next most efficient level and undertook the same evaluation until it reached the highest efficiency level that is both technologically feasible and economically justified and saves a significant amount of energy.

To aid the reader as DOE discusses the benefits and burdens of each trial standard level, DOE has included tables that present a summary of the results of DOE's quantitative analysis for each TSL. In addition to the quantitative results presented in the tables, DOE also considers other burdens and benefits that affect economic justification. These include the impacts on identifiable subgroups of consumers, such as low-income households and seniors, who may be disproportionately affected by a national standard. Section V.B.1 presents the estimated impacts of each TSL for these subgroups.

DOE also notes that the economics literature provides a wide-ranging discussion of how consumers trade off upfront costs and energy savings in the absence of government intervention. Much of this literature attempts to explain why consumers appear to undervalue energy efficiency improvements. This undervaluation suggests that regulation that promotes energy efficiency can produce significant net private gains (as well as producing social gains by, for example, reducing pollution). There is evidence that consumers undervalue future energy savings as a result of (1) a lack of information; (2) a lack of sufficient salience of the long-term or aggregate benefits; (3) a lack of sufficient savings to warrant delaying or altering purchases (for example, an inefficient ventilation fan in a new building or the delayed replacement of a water pump); (4) excessive focus on the short term, in the form of inconsistent weighting of future energy cost savings relative to available returns on other investments; (5) computational or other difficulties associated with the evaluation of relevant tradeoffs; and (6) a divergence in incentives (that is, renter versus owner; builder vs. purchaser). Other literature indicates that with less than perfect foresight and a high degree of uncertainty about the future, consumers may trade off these types of investments at a higher than expected rate between current consumption and uncertain future energy cost savings.

In its current regulatory analysis, potential changes in the benefits and costs of a regulation due to changes in consumer purchase decisions are included in two ways: (1) If consumers forego a purchase of a product in the standards case, this decreases sales for product manufacturers and the cost to manufacturers is included in the MIA, and (2) DOE accounts for energy savings attributable only to products actually used by consumers in the standards case; if a regulatory option decreases the number of products used by consumers, this decreases the potential energy savings from an energy conservation standard. DOE provides detailed estimates of shipments and changes in the volume of product purchases in chapter 9 of the TSD. However, DOE's current analysis does not explicitly control for heterogeneity in consumer preferences, preferences across subcategories of products or specific features, or consumer price sensitivity variation according to household income (Reiss and White 2004).

While DOE is not prepared at present to provide a fuller quantifiable framework for estimating the benefits and costs of changes in consumer purchase decisions due to an energy conservation standard, DOE seeks comments on how to more fully assess the potential impact of energy conservation standards on consumer choice and how to quantify this impact in its regulatory analysis in future rulemakings.

1. Benefits and Burdens of TSLs Considered for Clothes Dryers

Table V–48 and Table V–49 present a summary of the quantitative impacts estimated for each TSL for clothes dryers. The efficiency levels contained in each TSL are described in section V.A.

TABLE V–48—SUMMARY OF RESULTS FOR CLOTHES DRYER TRIAL STANDARD LEVELS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
National Energy Savings (*quads*)	0.00	0.062	0.37	0.39	1.45	3.14.
NPV of Consumer Benefits (*2009$ billion*)						
3% discount rate	0.00	0.62	3.00	3.01	0.22	(1.53).
7% discount rate	0.01	0.25	1.10	1.08	(2.60)	(6.72).
Cumulative Emissions Reduction						
CO_2 (*million metric tons*)	0.119	2.99	17.75	18.67	70.47	186.6.
NO_X (*thousand tons*)	0.097	2.41	14.26	15.14	57.26	151.3.
Hg (*ton*)	0.000	0.009	0.053	0.051	0.188	0.569.
Value of Emissions Reduction						
CO_2 (*2009$ million*) *	1 to 10	15 to 239	88 to 1417	93 to 1490	351 to 5626	929 to 14902.
NO_X—3% discount rate (*2009 million*).	0.031 to 0.314	0.759 to 7.8	4.49 to 46.2	4.77 to 49.0	18.0 to 185	47.6 to 490.
NO_X—7% discount rate (*2009$ million*).	0.013 to 0.136	0.328 to 3.37	1.94 to 20.0	2.06 to 21.2	7.8 to 80.2	20.6 to 212.
Generation Capacity Reduction (*GW*)**.	0.002	0.060	0.358	0.345	1.27	2.27.
Employment Impacts						
Total Potential Change in Domestic Production Workers in 2014 (*thousands*).	0.00 to (3.96)	0.00 to (3.96)	0.41 to (3.96)	0.46 to (3.96)	1.08 to (3.96)	2.26 to (3.96).

TABLE V–48—SUMMARY OF RESULTS FOR CLOTHES DRYER TRIAL STANDARD LEVELS: NATIONAL IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
Indirect Domestic Jobs (*thousands*)**	0.01	0.01	1.82	1.75	4.25	9.30.

Parentheses indicate negative (−) values.
* Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.
** Changes in 2043.

TABLE V–49—SUMMARY OF RESULTS FOR CLOTHES DRYER TRIAL STANDARD LEVELS: CONSUMER AND MANUFACTURER IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
Manufacturer Impacts						
Industry NPV (*2009$ million*)	(2.5) to (2.5)	(3.6) to (4.9)	(41.1) to (55.5)	(64.5) to (80.6)	(176.5) to (397.4).	(303.9) to (730.0).
Industry NPV (*% change*)	(0.3) to (0.3)	(0.4) to (0.5)	(4.1) to (5.5)	(6.4) to (8.0)	(17.6) to (39.6)	(30.3) to (72.7).
Consumer Mean LCC Savings* (*2009$*)						
Electric Standard	$0	$2	$14	$14	($30)	($146).
Compact 120V	$0	$14	$14	$14	($99)	($264).
Compact 240V	$0	$8	$8	$8	($99)	($246).
Gas	$0	$2	$2	$2	($100)	($100).
Ventless 240V	$0	$20	$20	$0	($42)	($177).
Ventless Combination Washer/Dryer	$0	$73	$73	$0	$73	($166).
Consumer Median PBP (*years*) **						
Electric Standard	3.9	0.2	5.3	5.3	19.1	22.1.
Compact 120V	n/a	0.9	0.9	0.9	36.1	40.1.
Compact 240V	0.0	0.9	0.9	0.9	45.1	38.2.
Gas	2.2	0.5	0.5	11.7	49.5	49.5.
Ventless 240V	n/a	0.9	0.9	n/a	25.3	26.9.
Ventless Combination Washer/Dryer	n/a	5.3	5.3	n/a	5.3	22.4.
Distribution of Consumer LCC Impacts						
Electric Standard:						
Net Cost (%)	1%	0%	19%	19%	75%	81%.
No Impact (%)	98%	79%	25%	25%	1%	0%.
Net Benefit (%)	2%	21%	56%	56%	24%	19%.
Compact 120V:						
Net Cost (%)	0%	4%	4%	4%	95%	95%.
No Impact (%)	100%	0%	0%	0%	0%	0%.
Net Benefit (%)	0%	96%	96%	96%	5%	5%.
Compact 240V:						
Net Cost (%)	0%	2%	2%	2%	93%	95%.
No Impact (%)	100%	41%	41%	41%	4%	0%.
Net Benefit (%)	0%	56%	56%	56%	3%	5%.
Gas:						
Net Cost (%)	1%	0%	0%	32%	95%	95%.
No Impact (%)	93%	85%	85%	42%	1%	1%.
Net Benefit (%)	7%	15%	15%	26%	4%	4%.
Ventless 240V:						
Net Cost (%)	0%	0%	0%	0%	92%	88%.
No Impact (%)	100%	0%	0%	100%	0%	0%.
Net Benefit (%)	0%	100%	100%	0%	8%	12%.
Ventless Combination Washer/Dryer:						
Net Cost (%)	0%	21%	21%	0%	21%	82%.
No Impact (%)	100%	0%	0%	100%	0%	0%.
Net Benefit (%)	0%	79%	79%	0%	79%	18%.

Parentheses indicate negative (−) values.
* For LCCs, a negative value means an increase in LCC by the amount indicated.
** In some cases the standard level is the same as the baseline efficiency level, so no consumers are impacted and therefore calculation of a payback period is not applicable.

DOE first considered TSL 6, which represents the max-tech efficiency levels. TSL 6 would save 3.14 quads of energy, an amount DOE considers significant. Under TSL 6, the NPV of consumer benefit would be −$6.72 billion, using a discount rate of 7 percent, and −$1.53 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 6 are 186.6 Mt of CO_2, 151.3

thousand tons of NO_X, and 0.569 ton of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 6 ranges from $929 million to $14,902 million. Total generating capacity in 2043 is estimated to decrease by 2.27 GW under TSL 6.

At TSL 6, the average LCC impact is a cost (LCC increase) of $146 for electric standard clothes dryers, a cost of $264 for 120V compact clothes dryers, a cost of $246 for 240V compact clothes dryers, a cost of $100 for gas clothes dryers, a cost of $177 for ventless 240V clothes dryers, and a cost of $166 for combination washer/dryers. The median payback period is 22.1 years for electric standard clothes dryers, 40.1 years for 120Vcompact clothes dryers, 38.2 years for 240V compact clothes dryers, 49.5 years for gas clothes dryers, 26.9 years for ventless 240V clothes dryers, and 22.4 years for combination washer/dryers. The fraction of consumers experiencing an LCC benefit is 19 percent for electric standard clothes dryers, 5 percent for 120V compact clothes dryers, 5 percent for 240V compact clothes dryers, 4 percent for gas clothes dryers, 12 percent for ventless 240V clothes dryers, and 18 percent for combination washer/dryers. The fraction of consumers experiencing an LCC cost is 81 percent for electric standard clothes dryers, 95 percent for 120Vcompact clothes dryers, 95 percent for 240V compact clothes dryers, 95 percent for gas clothes dryers, 88 percent for ventless 240V clothes dryers, and 82 percent for combination washer/dryers.

At TSL 6, the projected change in INPV ranges from a decrease of $303.9 million to a decrease of $730.0 million. TSL 6 would effectively require heat pump clothes dryers for all electric clothes dryer product classes. Changing all electric models to use heat pump technology would be extremely disruptive to current manufacturing facilities and would require substantial product and capital conversion costs. In addition, the large cost increases would greatly harm manufacturer profitability if they were unable to earn additional operating profit on these additional costs. At TSL 6, DOE recognizes the risk of very large negative impacts if manufacturers' expectations concerning reduced profit margins and large conversion costs are realized. If the high end of the range of impacts is reached as DOE expects, TSL 6 could result in a net loss of 72.6 percent in INPV to clothes dryer manufacturers.

DOE concludes that at TSL 6 for residential clothes dryers, the benefits of energy savings, generating capacity reductions, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the negative NPV of consumer benefits, the economic burden on a significant fraction of consumers due to the large increases in product cost, and the conversion costs and profit margin impacts that could result in a very large reduction in INPV for the manufacturers. Consequently, the Secretary has concluded that TSL 6 is not economically justified.

DOE next considered TSL 5. TSL 5 would save 1.45 quads of energy, an amount DOE considers significant. Under TSL 5, the NPV of consumer benefit would be −$2.60 billion, using a discount rate of 7 percent, and $0.22 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 5 are 70.47 Mt of CO_2, 57.26 thousand tons of NO_X, and 0.188 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 5 ranges from $351 million to $5,626 million. Total generating capacity in 2043 is estimated to decrease by 1.27 GW under TSL 5.

At TSL 5, the average LCC impact is a cost (LCC increase) of $30 for electric standard clothes dryers, a cost of $99 for 120Vcompact clothes dryers, a cost of $99 for 240V compact clothes dryers, a cost of $100 for gas clothes dryers, a cost of $42 for ventless 240V clothes dryers, and a savings of $73 for combination washer/dryers. The median payback period is 19.1 years for electric standard clothes dryers, 36.1 years for 120Vcompact clothes dryers, 45.1 years for 240V compact clothes dryers, 49.5 years for gas clothes dryers, 25.3 years for ventless 240V clothes dryers, and 5.3 years for combination washer/dryers. The fraction of consumers experiencing an LCC benefit is 24 percent for electric standard clothes dryers, 5 percent for 120Vcompact clothes dryers, 3 percent for 240V compact clothes dryers, 4 percent for gas clothes dryers, 8 percent for ventless 240V clothes dryers, and 79 percent for combination washer/dryers. The fraction of consumers experiencing an LCC cost is 75 percent for electric standard clothes dryers, 95 percent for 120Vcompact clothes dryers, 93 percent for 240V compact clothes dryers, 95 percent for gas clothes dryers, 92 percent for ventless 240V clothes dryers, and 21 percent for combination washer/dryers.

At TSL 5, the projected change in INPV ranges from a decrease of $176.5 million to a decrease of $397.4 million. While most changes at TSL 5 could be made within existing product design, redesigning units to the most efficient technologies on the market today would take considerable capital and product conversion costs. At TSL 5, DOE recognizes the risk of very large negative impacts if manufacturers are not able to earn additional operating profit from the additional production costs to reach TSL 5. If the high end of the range of impacts is reached as DOE expects, TSL 5 could result in a net loss of 39.6 percent in INPV to clothes dryer manufacturers.

The Secretary concludes that at TSL 5 for residential clothes dryers, the benefits of energy savings, generating capacity reductions, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the negative NPV of consumer benefits, the economic burden on a significant fraction of consumers due to the large increases in product cost, and the conversion costs and profit margin impacts that could result in a large reduction in INPV for the manufacturers. Consequently, the Secretary has concluded that TSL 5 is not economically justified.

DOE then considered TSL 4. TSL 4 would save 0.39 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be $1.08 billion, using a discount rate of 7 percent, and $3.01 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 18.67 Mt of CO_2, 15.14 thousand tons of NO_X, and 0.051 ton of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 4 ranges from $93 million to $1,490 million. Total generating capacity in 2043 is estimated to decrease by 0.345 GW under TSL 4.

At TSL 4, DOE projects that the average LCC impact is a savings (LCC decrease) of $14 for electric standard clothes dryers, a savings of $14 for 120V compact clothes dryers, a savings of $8 for 240V compact clothes dryers, a savings of $2 for gas clothes dryers, and no change for ventless 240V clothes dryers and combination washer/dryers. The median payback period is 5.3 years for electric standard clothes dryers, 0.9 years for 120V compact clothes dryers, 0.9 years for 240V compact clothes dryers, 11.7 years for gas clothes dryers, and is not applicable for ventless 240V clothes dryers and combination washer/dryers.[64] The fraction of consumers experiencing an LCC benefit is 56 percent for electric standard clothes dryers, 96 percent for 120V compact

[64] For these product classes, the efficiency level at TSL 4 is the same as the baseline efficiency level, so no consumers are impacted and therefore calculation of a payback period is not applicable.

clothes dryers, 56 percent for 240V compact clothes dryers, 26 percent for gas clothes dryers, zero percent for ventless 240V clothes dryers, and zero percent for combination washer/dryers. The fraction of consumers experiencing an LCC cost is 19 percent for electric standard clothes dryers, 4 percent for 120V compact clothes dryers, 2 percent for 240V compact clothes dryers, 32 percent for gas clothes dryers, zero percent for ventless 240V clothes dryers, and zero percent for combination washer/dryers.

At TSL 4, the projected change in INPV ranges from a decrease of $64.5 million to a decrease of $80.6 million. The design changes required at TSL 4 for the most common standard-size gas and electric products are incremental improvements that are well known in the industry but would still require moderate product and capital conversion costs to implement. At TSL 4, DOE recognizes the risk of negative impacts if manufacturers' expectations concerning reduced profit margins are realized. If the high end of the range of impacts is reached as DOE expects, TSL 4 could result in a net loss of 8.0 percent in INPV to clothes dryer manufacturers.

DOE concludes that at TSL 4 for residential clothes dryers, the benefits of energy savings, generating capacity reductions, emission reductions and the estimated monetary value of the CO_2 emissions reductions, and positive NPV of consumer benefits outweigh the economic burden on some consumers due to the increases in product cost and the profit margin impacts that could result in a reduction in INPV for the manufacturers.

In addition, the efficiency levels in TSL 4 correspond to the recommended levels in the consensus agreement, which DOE believes sets forth a statement by interested persons that are fairly representative of relevant points of view (including representatives of manufacturers of covered products, States, and efficiency advocates) and contains recommendations with respect to an energy conservation standard that are in accordance with 42 U.S.C. 6295(o). Moreover, DOE has encouraged the submission of consensus agreements as a way to get diverse stakeholders together, to develop an independent and probative analysis useful in DOE standard setting, and to expedite the rulemaking process. DOE also believes that standard levels recommended in the consensus agreement may increase the likelihood for regulatory compliance, while decreasing the risk of litigation.

After considering the analysis, comments to the preliminary TSD, and the benefits and burdens of TSL 4, the Secretary concludes that this trial standard level will offer the maximum improvement in efficiency that is technologically feasible and economically justified, and will result in the significant conservation of energy. Therefore, DOE today adopts TSL 4 for residential clothes dryers. The amended energy conservation standards for clothes dryers, expressed as CEF, are shown in Table V–50 .

TABLE V–50—AMENDED ENERGY CONSERVATION STANDARDS FOR CLOTHES DRYERS

Residential clothes dryers	
Product class	Minimum CEF levels *lb/kWh*
1. Vented Electric, Standard (4.4 ft³ or greater capacity)	3.73
2. Vented Electric, Compact (120 V) (less than 4.4 ft³ capacity)	3.61
3. Vented Electric, Compact (240 V) (less than 4.4 ft³ capacity)	3.27
4. Vented Gas	3.30
5. Ventless Electric, Compact (240 V) (less than 4.4 ft³ capacity)	2.55
6. Ventless Electric Combination Washer/Dryer	2.08

2. Benefits and Burdens of TSLs Considered for Room Air Conditioners

Table V–51 and Table V–52 present a summary of the quantitative impacts estimated for each TSL for room air conditioners. The efficiency levels contained in each TSL are described in section V.A.

TABLE V–51—SUMMARY OF RESULTS FOR ROOM AIR CONDITIONER TRIAL STANDARD LEVELS: NATIONAL IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
National Energy Savings (*quads*)	0.105	0.205	0.218	0.305	0.477	0.665.
NPV of Consumer Benefits (*2009$ billion*)						
3% discount rate	0.75	1.30	1.51	1.47	1.46	(5.62).
7% discount rate	0.35	0.57	0.71	0.57	0.33	(4.44).
Cumulative Emissions Reduction						
CO_2 (*million metric tons*)	9.83	11.9	12.5	17.4	26.9	37.7.
NO_X (*thousand tons*)	8.02	9.69	10.2	14.2	21.9	30.7.
Hg (*ton*)	0.012	0.015	0.017	0.022	0.032	0.044.
Value of Emissions Reduction						
CO_2 (*2009$ million*)*	43 to 648	52 to 790	55 to 826	77 to 1164	118 to 1803	166 to 2541.
NO_X—3% discount rate (*2009$ million*).	2.34 to 24.0	2.83 to 29.1	2.99 to 30.7	4.16 to 42.7	6.40 to 65.8	8.96 to 92.1.

TABLE V–51—SUMMARY OF RESULTS FOR ROOM AIR CONDITIONER TRIAL STANDARD LEVELS: NATIONAL IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
NO_X—7% discount rate (*2009$ million*).	1.25 to 12.9	1.50 to 15.4	1.61 to 16.6	2.2 to 22.6	3.35 to 34.4	4.64 to 47.7.
Generation Capacity Reduction (*GW*) **.	0.348	0.429	0.436	0.632	1.01	1.46.
Employment Impacts						
Total Potential Changes in Domestic Production Workers in 2014 (*thousands*).	N/A	N/A	N/A	N/A	N/A	N/A.
Indirect Domestic Jobs (*thousands*) **.	0.74	0.73	0.74	1.16	1.94	3.07.

Parentheses indicate negative (−) values.
* Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.
** Changes in 2043.

TABLE V–52—SUMMARY OF RESULTS FOR ROOM AIR CONDITIONER TRIAL STANDARD LEVELS: CONSUMER AND MANUFACTURER IMPACTS

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
Manufacturer Impacts						
Industry NPV (*2009$ million*).	(44.2) to (84.9)	(65.4) to (112.7) ..	(65.7) to (112.4) ..	(111.3) to (177.6)	(86.6) to (184.4) ..	(80.2) to (344.5).
Industry NPV (*% change*).	(4.6) to (8.9)	(6.8) to (11.8)	(6.9) to (11.8)	(11.6) to (18.6)	(9.1) to (19.3)	(8.4) to (36.0).
Consumer Mean LCC Savings * (*2009$*)						
< 6,000 Btu/h, with Louvers.	$9	$11	$9	$7	$7	($58).
8,000–13,999 Btu/h, with Louvers.	$16	$16	$22	$22	$22	($38).
20,000–24,999 Btu/h, with Louvers.	$6	$6	$0	$6	$0	($214).
> 25,000 Btu/h, with Louvers.	$1	$1	$0	$1	$0	($227).
8,000–10,999 Btu/h, without Louvers.	$4	$4	$13	$13	$20	($66).
> 11,000 Btu/h, without Louvers.	$5	$5	$11	$11	$11	($64).
Consumer Median PBP (*years*) **						
<6,000 Btu/h, with Louvers.	4.1	5.8	4.1	8.6	8.6	20.9.
8,000–13,999 Btu/h, with Louvers.	0.0	0.0	2.8	2.8	7.1	14.7.
20,000–24,999 Btu/h, with Louvers.	4.3	4.3	n/a	4.3	n/a	73.8.
> 25,000 Btu/h, with Louvers.	10.3	10.3	n/a	10.1	n/a	107.7.
8,000–10,999 Btu/h, without Louvers.	1.5	1.5	2.1	2.1	4.9	25.2.
> 11,000 Btu/h, without Louvers.	2.6	2.6	3.7	3.7	3.7	25.9.
Distribution of Consumer LCC Impacts						
< 6,000 Btu/h, with Louvers:						
Net Cost (%)	21%	33%	21%	65%	65%	90%.
No Impact (%) ...	31%	31%	31%	1%	1%	0%.
Net Benefit (%) ..	48%	37%	48%	34%	34%	10%.
8,000–13,999 Btu/h, with Louvers:						
Net Cost (%)	9%	9%	34%	34%	56%	77%.
No Impact (%) ...	60%	60%	2%	2%	1%	0%.
Net Benefit (%) ..	30%	30%	64%	64%	43%	22%.

TABLE V–52—SUMMARY OF RESULTS FOR ROOM AIR CONDITIONER TRIAL STANDARD LEVELS: CONSUMER AND MANUFACTURER IMPACTS—Continued

Category	TSL 1	TSL 2	TSL 3	TSL 4	TSL 5	TSL 6
20,000–24,999 Btu/h, with Louvers:						
Net Cost (%)	5%	5%	0%	5%	0%	98%.
No Impact (%)	85%	85%	0%	85%	0%	2%.
Net Benefit (%)	10%	10%	0%	10%	0%	0%.
> 25,000 Btu/h, with Louvers:						
Net Cost (%)	11%	11%	0%	9%	0%	100%.
No Impact (%)	85%	85%	0%	88%	0%	0%.
Net Benefit (%)	4%	4%	0%	4%	0%	0%.
8,000–10,999 Btu/h, without Louvers:						
Net Cost (%)	1%	1%	12%	12%	38%	92%.
No Impact (%)	90%	90%	25%	25%	6%	2%.
Net Benefit (%)	9%	9%	62%	62%	56%	6%.
> 11,000 Btu/h, without Louvers:						
Net Cost (%)	2%	2%	23%	23%	23%	93%.
No Impact (%)	90%	90%	31%	31%	31%	0%.
Net Benefit (%)	8%	8%	47%	47%	47%	7%.

Parentheses indicate negative (-) values.
* For LCCs, a negative value means an increase in LCC by the amount indicated.
** In some cases the standard level is the same as the baseline efficiency level, so no consumers are impacted and therefore calculation of a payback period is not applicable.

DOE first considered TSL 6, which represents the max-tech efficiency levels. TSL 6 would save 0.665 quads of energy, an amount DOE considers significant. Under TSL 6, the NPV of consumer benefit would be -$4.44 billion, using a discount rate of 7 percent, and −$5.62 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 6 are 37.7 Mt of CO_2, 30.7 thousand tons of NO_X, and 0.044 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 6 ranges from $166 million to $2,541 million. Total generating capacity in 2043 is estimated to decrease by 1.46 GW under TSL 6.

At TSL 6, the average LCC impact is a cost (LCC increase) of $58 for room air conditioners < 6,000 Btu/h, with louvers; a cost of $38 for room air conditioners 8,000–13,999 Btu/h, with louvers; a cost of $214 for room air conditioners 20,000–24,999 Btu/h, with louvers; a cost of $227 for room air conditioners > 25,000 Btu/h, with louvers; a cost of $66 for room air conditioners 8,000–10,999 Btu/h, without louvers; and a cost of $64 for room air conditioners > 11,000 Btu/h, without louvers. The median payback period is 20.9 years for room air conditioners < 6,000 Btu/h, with louvers; 14.7 years for room air conditioners 8,000–13,999 Btu/h, with louvers; 73.8 years for room air conditioners 20,000–24,999 Btu/h, with louvers; 107.7 years for room air conditioners > 25,000 Btu/h, with louvers; 25.2 years for room air conditioners 8,000–10,999 Btu/h, without louvers; and 25.9 years for room air conditioners > 11,000 Btu/h, without louvers. The fraction of consumers experiencing an LCC benefit is 10 percent for room air conditioners < 6,000 Btu/h, with louvers; 22 percent for room air conditioners 8,000–13,999 Btu/h, with louvers; zero percent for room air conditioners 20,000–24,999 Btu/h, with louvers; zero percent for room air conditioners > 25,000 Btu/h, with louvers; 6 percent for room air conditioners 8,000–10,999 Btu/h, without louvers; and 7 percent for room air conditioners > 11,000 Btu/h, without louvers. The fraction of consumers experiencing an LCC cost is 90 percent for room air conditioners < 6,000 Btu/h, with louvers; 77 percent for room air conditioners 8,000–13,999 Btu/h, with louvers; 98 percent for room air conditioners 20,000–24,999 Btu/h, with louvers; 100 percent for room air conditioners > 25,000 Btu/h, with louvers; 92 percent for room air conditioners 8,000–10,999 Btu/h, without louvers; and 93 percent for room air conditioners > 11,000 Btu/h, without louvers.

At TSL 6, the projected change in INPV ranges from a decrease of $80.2 million to a decrease of $344.5 million. At TSL 6, DOE recognizes the risk of large negative impacts if manufacturers' expectations concerning reduced profit margins are realized. If the high end of the range of impacts is reached as DOE expects, TSL 6 could result in a net loss of 36.0 percent in INPV to room air conditioner manufacturers.

The Secretary concludes that at TSL 6 for room air conditioners, the benefits of energy savings, generating capacity reductions, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the negative NPV of consumer benefits, the economic burden on a significant fraction of consumers due to the large increases in product cost, and the capital conversion costs and profit margin impacts that could result in a large reduction in INPV for the manufacturers. Consequently, the Secretary has concluded that TSL 6 is not economically justified.

DOE next considered TSL 5. TSL 5 would save 0.477 quads of energy, an amount DOE considers significant. Under TSL 5, the NPV of consumer benefit would be $0.33 billion, using a discount rate of 7 percent, and $1.46 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 5 are 26.9 Mt of CO_2, 21.9 thousand tons of NO_X, and 0.032 ton of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 5 ranges from $118 million to $1,803 million. Total generating capacity in 2043 is estimated to decrease by 1.01 GW under TSL 5.

At TSL 5, the average LCC impact is a savings (LCC decrease) of $7 for room air conditioners < 6,000 Btu/h, with louvers; a savings of $22 for room air conditioners 8,000–13,999 Btu/h, with louvers; a savings of $0 for room air conditioners 20,000–24,999 Btu/h, with louvers; a savings of $0 for room air conditioners > 25,000 Btu/h, with louvers; a savings of $20 for room air conditioners 8,000–10,999 Btu/h, without louvers; and a savings of $11 for room air conditioners > 11,000 Btu/h, without louvers. The median payback period is 8.6 years for room air conditioners < 6,000 Btu/h, with louvers; 7.1 years for room air conditioners 8,000–13,999 Btu/h, with louvers; not applicable for room air conditioners 20,000–24,999 Btu/h, with louvers or for room air conditioners > 25,000 Btu/h, with louvers;[65] 4.9 years for room air conditioners 8,000–10,999 Btu/h, without louvers; and 3.7 years for room air conditioners > 11,000 Btu/h, without louvers. The fraction of consumers experiencing an LCC benefit is 34 percent for room air conditioners <6,000 Btu/h, with louvers; 43 percent for room air conditioners 8,000–13,999 Btu/h, with louvers; zero percent for room air conditioners 20,000–24,999 Btu/h, with louvers; zero percent for room air conditioners > 25,000 Btu/h, with louvers; 56 percent for room air conditioners 8,000–10,999 Btu/h, without louvers; and 47 percent for room air conditioners > 11,000 Btu/h, without louvers. The fraction of consumers experiencing an LCC cost is 65 percent for room air conditioners <6,000 Btu/h, with louvers; 56 percent for room air conditioners 8,000–13,999 Btu/h, with louvers; zero percent for room air conditioners 20,000–24,999 Btu/h, with louvers; zero percent for room air conditioners > 25,000 Btu/h, with louvers; 38 percent for room air conditioners 8,000–10,999 Btu/h, without louvers; and 23 percent for room air conditioners > 11,000 Btu/h, without louvers.

At TSL 5, the projected change in INPV ranges from a decrease of $86.6 million to a decrease of $184.4 million. At TSL 5, DOE recognizes the risk of moderately negative impacts if manufacturers' expectations concerning reduced profit margins are realized. If the high end of the range of impacts is reached as DOE expects, TSL 5 could result in a net loss of 19.3 percent in INPV to room air conditioner manufacturers.

The Secretary concludes that at TSL 5 for room air conditioners, the benefits of energy savings, positive NPV of consumer benefits, generating capacity reductions, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the economic burden on a significant fraction of consumers in some product classes due to the large increases in product cost, and the capital conversion costs and profit margin impacts that could result in a moderate reduction in INPV for the manufacturers. In particular, the fraction of consumers experiencing an LCC cost is 56 percent for room air conditioners with 8,000–13,999 Btu/h, with louvers, which is the product class with the largest market share. Based on the above findings, the Secretary has concluded that TSL 5 is not economically justified.

DOE then considered TSL 4. TSL 4 would save 0.305 quads of energy, an amount DOE considers significant. Under TSL 4, the NPV of consumer benefit would be $0.57 billion, using a discount rate of 7 percent, and $1.47 billion, using a discount rate of 3 percent.

The cumulative emissions reductions at TSL 4 are 17.4 Mt of CO_2, 14.2 thousand tons of NO_X, and 0.022 ton of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 4 ranges from $77 million to $1,164 million. Total generating capacity in 2043 is estimated to decrease by 0.632 GW under TSL 4.

At TSL 4, DOE projects that the average LCC impact is a savings (LCC decrease) of $7 for room air conditioners < 6,000 Btu/h, with louvers; a savings of $22 for room air conditioners 8,000–13,999 Btu/h, with louvers; a savings of $6 for room air conditioners 20,000–24,999 Btu/h, with louvers; a savings of $1 for room air conditioners > 25,000 Btu/h, with louvers; a savings of $13 for room air conditioners 8,000–10,999 Btu/h, without louvers; and a savings of $11 for room air conditioners > 11,000 Btu/h, without louvers. The median payback period is 8.6 years for room air conditioners < 6,000 Btu/h, with louvers; 2.8 years for room air conditioners 8,000–13,999 Btu/h, with louvers; 4.3 years for room air conditioners 20,000–24,999 Btu/h, with louvers; 10.1 years for room air conditioners > 25,000 Btu/h, with louvers; 2.1 years for room air conditioners 8,000–10,999 Btu/h, without louvers; and 3.7 years for room air conditioners > 11,000 Btu/h, without louvers. The fraction of consumers experiencing an LCC benefit is 34 percent for room air conditioners < 6,000 Btu/h, with louvers; 64 percent for room air conditioners 8,000–13,999 Btu/h, with louvers; 10 percent for room air conditioners 20,000–24,999 Btu/h, with louvers; 4 percent for room air conditioners > 25,000 Btu/h, with louvers; 62 percent for room air conditioners 8,000–10,999 Btu/h, without louvers; and 47 percent for room air conditioners > 11,000 Btu/h, without louvers. The fraction of consumers experiencing an LCC cost is 65 percent for room air conditioners < 6,000 Btu/h, with louvers; 34 percent for room air conditioners 8,000–13,999 Btu/h, with louvers; 5 percent for room air conditioners 20,000–24,999 Btu/h, with louvers; 9 percent for room air conditioners > 25,000 Btu/h, with louvers; 12 percent for room air conditioners 8,000–10,999 Btu/h, without louvers; and 23 percent for room air conditioners > 11,000 Btu/h, without louvers.

At TSL 4, the projected change in INPV ranges from a decrease of $111.3 million to a decrease of $177.6 million. DOE recognizes the risk of moderately negative impacts if manufacturers' expectations concerning reduced profit margins are realized. If the high end of the range of impacts is reached as DOE expects, TSL 4 could result in a net loss of 18.6 percent in INPV to room air conditioner manufacturers.

The Secretary concludes that at TSL 4 for room air conditioners, the benefits of energy savings, generating capacity reductions, emission reductions and the estimated monetary value of the CO_2 emissions reductions, positive NPV of consumer benefits and positive average consumer LCC savings outweigh the economic burden on some consumers (a significant fraction for one product class but small to moderate fractions for the other product classes) due to the increases in product cost, and the capital conversion costs and profit margin impacts that could result in a moderate reduction in INPV for the manufacturers.

In addition, the efficiency levels in TSL 4 correspond to the recommended levels in the consensus agreement, which DOE believes sets forth a statement by interested persons that are fairly representative of relevant points of view (including representatives of manufacturers of covered products, States, and efficiency advocates) and contains recommendations with respect to an energy conservation standard that are in accordance with 42 U.S.C. 6295(o). Moreover, DOE has encouraged the submission of consensus agreements as a way to get diverse stakeholders together, to develop an independent and probative analysis useful in DOE standard setting, and to expedite the rulemaking process. DOE also believes that standard levels recommended in the consensus agreement may increase the likelihood for regulatory

[65] In these cases the standard level is the same as the baseline efficiency level, so no consumers are impacted and therefore calculation of a payback period is not applicable.

compliance, while decreasing the risk of litigation.

After considering the analysis, comments on the preliminary TSD, and the benefits and burdens of TSL 4, DOE concludes that this trial standard level will offer the maximum improvement in efficiency that is technologically feasible and economically justified, and will result in the significant conservation of energy. Therefore, DOE today adopts TSL 4 for room air conditioners. The amended energy conservation standards for room air conditioners, expressed as CEER, are shown in Table V–53.

TABLE V–53—AMENDED ENERGY CONSERVATION STANDARDS FOR ROOM AIR CONDITIONERS

Room air conditioners	
Product class	Minimum CEER levels *Btu/Wh*
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	11.0
2. Without reverse cycle, with louvered sides, and 6,000 to 7,999 Btu/h	11.0
3. Without reverse cycle, with louvered sides, and 8,000 to 13,999 Btu/h	10.9
4. Without reverse cycle, with louvered sides, and 14,000 to 19,999 Btu/h	10.7
5a. Without reverse cycle, with louvered sides, and 20,000 to 24,999 Btu/h	9.4
5b. Without reverse cycle, with louvered sides, and 25,000 Btu/h or more	9.0
6. Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	10.0
7. Without reverse cycle, without louvered sides, and 6,000 to 7,999 Btu/h	10.0
8a. Without reverse cycle, without louvered sides, and 8,000 to 10,999 Btu/h	9.6
8b. Without reverse cycle, without louvered sides, and 11,000 to 13,999 Btu/h	9.5
9. Without reverse cycle, without louvered sides, and 14,000 to 19,999 Btu/h	9.3
10. Without reverse cycle, without louvered sides, and 20,000 Btu/h or more	9.4
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	9.8
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	9.3
13. With reverse cycle, with louvered sides, and 20,000 Btu/h or more	9.3
14. With reverse cycle, without louvered sides, and 14,000 Btu/h or more	8.7
15. Casement-Only	9.5
16. Casement-Slider	10.4

3. Summary of Benefits and Costs (Annualized) of the Standards

The benefits and costs of today's standards can also be expressed in terms of annualized values. The annualized monetary values are the sum of (1) the annualized national economic value, expressed in 2009$, of the benefits from operating products that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase costs, which is another way of representing consumer NPV), and (2) the monetary value of the benefits of emission reductions, including CO_2 emission reductions.[66] The value of the CO_2 reductions, otherwise known as the Social Cost of Carbon (SCC), is calculated using a range of values per metric ton of CO_2 developed by a recent interagency process. The monetary costs and benefits of cumulative emissions reductions are reported in 2009$ to permit comparisons with the other costs and benefits in the same dollar units.

Although combining the values of operating savings and CO_2 reductions provides a useful perspective, two issues should be considered. First, the national operating savings are domestic U.S. consumer monetary savings that occur as a result of market transactions while the value of CO_2 reductions is based on a global value. Second, the assessments of operating cost savings and CO_2 savings are performed with different methods that use quite different time frames for analysis. The national operating cost savings is measured for the lifetime of products shipped in 2014–2043. The SCC values, on the other hand, reflect the present value of future climate-related impacts resulting from the emission of one ton of carbon dioxide in each year. These impacts go well beyond 2100.

Table V–54 and Table V–55 show the annualized values for clothes dryers and room air conditioners, respectively. Using a 7-percent discount rate and the SCC value of $22.1/ton in 2010 (in 2009$), the cost of the standards for clothes dryers in today's rule is $52.3 million per year in increased equipment costs, while the annualized benefits are $139.1 million per year in reduced equipment operating costs, $25.0 million in CO_2 reductions, and $0.9 million in reduced NO_X emissions. In this case, the net benefit amounts to $112.7 million per year. DOE has calculated that the annualized increased equipment cost can range from $50.5 to $66.6 million per year depending on assumptions and modeling of equipment price trends. The high end of this range corresponds to a constant real equipment price trend. Using the central estimate of energy-related benefits, DOE estimates that calculated net benefits can range from $98.4 to $114.5 million per year. Using a 3-percent discount rate and the SCC value of $22.1/ton in 2010 (in 2009$), the cost of the standards for clothes dryers in today's rule is $55.4 million per year in increased equipment costs, while the benefits are $209.1 million per year in reduced operating costs, $25.0 million in CO_2 reductions, and $1.4 million in reduced NO_X emissions. In this case, the net benefit amounts to $180.1 million per year. DOE has calculated that the range in the annualized increased equipment cost can range from $53.1 to $73.5 million per year depending on assumptions and modeling of equipment price trends. The high end of this range corresponds to a constant real equipment price trend. Using the central estimate of energy-

[66] DOE used a two-step calculation process to convert the time-series of costs and benefits into annualized values. First, DOE calculated a present value in 2011, the year used for discounting the NPV of total consumer costs and savings, for the time-series of costs and benefits using discount rates of three and seven percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates, as shown in Table V.50. From the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in 2011, that yields the same present value. The fixed annual payment is the annualized value. Although DOE calculated annualized values, this does not imply that the time-series of cost and benefits from which the annualized values were determined would be a steady stream of payments.

related benefits, DOE estimates that calculated net benefits can range from $162.0 to $182.4 million per year.

Using a 7-percent discount rate and the SCC value of $22.1/ton in 2010 (in 2009$), the cost of the standards for room air conditioners in today's rule is $107.7 million per year in increased equipment costs, while the annualized benefits are $153.7 million per year in reduced equipment operating costs, $19.5 million in CO_2 reductions, and $0.999 million in reduced NO_X emissions. In this case, the net benefit amounts to $66.4 million per year. DOE has calculated that the annualized increased equipment cost can range from $105.7 to $136.6 million per year depending on assumptions and modeling of equipment price trends. The high end of this range corresponds to a constant real equipment price trend. Using the central estimate of energy-related benefits, DOE estimates that calculated net benefits can range from $37.5 to $68.4 million per year. Using a 3-percent discount rate and the SCC value of $22.1/ton in 2010 (in 2009$), the cost of the standards for room air conditioners in today's rule is $111.0 million per year in increased equipment costs, while the benefits are $186.2 million per year in reduced operating costs, $19.5 million in CO_2 reductions, and $1.20 million in reduced NO_X emissions. In this case, the net benefit amounts to $95.9 million per year. DOE has calculated that the range in the annualized increased equipment cost can range from $108.0 to $146.0 million per year depending on assumptions and modeling of equipment price trends. The high end of this range corresponds to a constant real equipment price trend. Using the central estimate of energy-related benefits, DOE estimates that calculated net benefits can range from $60.9 to $98.9 million per year.

TABLE V–54—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS (TSL 4) FOR CLOTHES DRYERS SOLD IN 2014–2043

	Discount rate	Monetized *(million 2009$/year)*		
		Primary estimate> *	Low estimate> *	High estimate> *
Benefits				
Operating Cost Savings	7%	139.1	120.6	158.3
	3%	209.1	177.4	241.3
CO_2 Reduction at $4.9/t **	5%	6.0	6.0	6.0
CO_2 Reduction at $22.1/t **	3%	25.0	25.0	25.0
CO_2 Reduction at $36.3/t **	2.5%	39.8	39.8	39.8
CO_2 Reduction at $67.1/t **	3%	76.0	76.0	76.0
NO_X Reduction at $2,519/ton **	7%	0.9	0.9	0.9
	3%	1.4	1.4	1.4
Total†	7% plus CO_2 range	146.1 to 216.1	127.6 to 197.6	165.3 to 235.3
	7%	165.0	146.5	184.3
	3%	235.4	203.7	267.6
	3% plus CO_2 range	216.5 to 286.5	184.8 to 254.8	248.7 to 318.7
Costs				
Incremental Product Costs	7%	52.3	66.6	50.5
	3%	55.4	73.5	53.1
Total Net Benefits				
Total †	7% plus CO_2 range	93.7 to 163.7	61.0 to 131.0	114.8 to 184.8
	7%	112.7	79.9	133.8
	3%	180.1	130.2	214.5
	3% plus CO_2 range	161.1 to 231.1	111.3 to 181.3	195.6 to 265.6

* The Primary, Low, and High Estimates utilize forecasts of energy prices and housing starts from the *AEO2010* Reference case, Low Economic Growth case, and High Economic Growth case, respectively. Low estimate corresponds to the low net benefit estimate and uses the zero real price trend sensitivity for equipment prices, and the high estimate corresponds to the high net benefit estimate and utilizes the high technological learning rate sensitivity for the equipment price trend.

** The CO_2 values represent global values (in 2009$) of the social cost of CO_2 emissions in 2010 under several scenarios. The values of $4.9, $22.1, and $36.3 per ton are the averages of SCC distributions calculated using 5-percent, 3-percent, and 2.5-percent discount rates, respectively. The value of $67.1 per ton represents the 95th percentile of the SCC distribution calculated using a 3-percent discount rate. The value for NO_X (in 2009$) is the average of the low and high values used in DOE's analysis.

† Total Benefits for both the 3-percent and 7-percent cases are derived using the SCC value calculated at a 3-percent discount rate, which is $22.1/ton in 2010 (in 2009$). In the rows labeled as "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

TABLE V–55—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS (TSL 4) FOR ROOM AIR CONDITIONERS SOLD IN 2014–2043

	Discount rate	Monetized *(million 2009$/year)*		
		Primary estimate *	Low estimate *	High estimate *
Benefits				
Operating Cost Savings	7%	153.7	145.1	161.9
	3%	186.2	174.2	197.3
CO_2 Reduction at $4.9/t **	5%	5.0	5.0	5.0
CO_2 Reduction at $22.1/t **	3%	19.5	19.5	19.5

TABLE V–55—ANNUALIZED BENEFITS AND COSTS OF AMENDED STANDARDS (TSL 4) FOR ROOM AIR CONDITIONERS SOLD IN 2014–2043—Continued

	Discount rate	Monetized *(million 2009$/year)*		
		Primary estimate *	Low estimate *	High estimate *
CO_2 Reduction at $36.3/t **	2.5%	30.7	30.7	30.7
CO_2 Reduction at $67.1/t **	3%	59.4	59.4	59.4
NO_X Reduction at $2,519/ton **	7%	0.999	0.999	0.999
	3%	1.197	1.197	1.197
Total †	7% plus CO_2 range	159.6 to 214.0	151.1 to 205.5	167.9 to 222.3
	7%	174.1	165.5	182.4
	3%	206.8	194.9	218.0
	3% plus CO_2 range	192.3 to 246.7	180.4 to 234.8	203.5 to 257.9
Costs				
Incremental Product Costs	7%	107.7	136.6	105.7
	3%	111.0	146.0	108.0
Total Net Benefits				
Total †	7% plus CO_2 range	51.9 to 106.3	43.4 to 97.8	62.2 to 116.6
	7%	66.4	28.9	76.7
	3%	95.9	48.9	110.0
	3% plus CO_2 range	81.4 to 135.8	34.4 to 88.8	95.5 to 149.9

* The Primary, Low, and High Estimates utilize forecasts of energy prices and housing starts from the *AEO2010* Reference case, Low Economic Growth case, and Low Economic Growth case, respectively. Low estimate corresponds to the low net benefit estimate and uses the zero real price trend sensitivity for equipment prices, and the high estimate corresponds to the high net benefit estimate and utilizes the high technological learning rate sensitivity for the equipment price trend.

** The CO_2 values represent global values (in 2009$) of the social cost of CO_2 emissions in 2010 under several scenarios. The values of $4.9, $22.1, and $36.3 per ton are the averages of SCC distributions calculated using 5-percent, 3-percent, and 2.5-percent discount rates, respectively. The value of $67.1 per ton represents the 95th percentile of the SCC distribution calculated using a 3-percent discount rate. The value for NO_X (in 2009$) is the average of the low and high values used in DOE's analysis.

† Total Benefits for both the 3-percent and 7-percent cases are derived using the SCC value calculated at a 3-percent discount rate, which is $22.1/ton in 2010 (in 2009$). In the rows labeled as "7% plus CO_2 range" and "3% plus CO_2 range," the operating cost and NO_X benefits are calculated using the labeled discount rate, and those values are added to the full range of CO_2 values.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Section 1(b)(1) of Executive Order 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993), requires each agency to identify the problem that it intends to address, including, where applicable, the failures of private markets or public institutions that warrant new agency action, as well as to assess the significance of that problem. The problems that today's standards address are as follows:

(1) There is a lack of consumer information and/or information processing capability about energy efficiency opportunities in clothes dryer and room air conditioner market.

(2) There is asymmetric information (one party to a transaction has more and better information than the other) and/or high transactions costs (costs of gathering information and effecting exchanges of goods and services).

(3) There are external benefits resulting from improved energy efficiency of clothes dryers and room air conditioners that are not captured by the users of such equipment. These benefits include externalities related to environmental protection and energy security that are not reflected in energy prices, such as reduced emissions of greenhouse gases.

In addition, DOE has determined that today's regulatory action is an "economically significant regulatory action" under section 3(f)(1) of Executive Order 12866. Accordingly, section 6(a)(3) of the Executive Order requires that DOE prepare a regulatory impact analysis (RIA) on today's rule and that the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB) review this rule. DOE presented to OIRA for review the draft rule and other documents prepared for this rulemaking, including the RIA, and has included these documents in the rulemaking record. The assessments prepared pursuant to Executive Order 12866 can be found in the technical support document for this rulemaking. They are available for public review in the Resource Room of DOE's Building Technologies Program, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC 20024, (202) 586–2945, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays.

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011 (76 FR 3281, Jan. 21, 2011). EO 13563 is supplemental to and explicitly reaffirms the principles, structures, and definitions governing regulatory review established in Executive Order 12866. To the extent permitted by law, agencies are required by Executive Order 13563 to: (1) Propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public.

We emphasize as well that Executive Order 13563 requires agencies "to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible." In its guidance, the Office of Information and Regulatory Affairs has emphasized that such techniques may include "identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes." For the reasons stated in the preamble, DOE believes that today's direct final rule is consistent with these principles, including that, to the extent permitted by law, agencies adopt a regulation only upon a reasoned determination that its benefits justify its costs and select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of a final regulatory flexibility analysis (FRFA) for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, "Proper Consideration of Small Entities in Agency Rulemaking" 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's Web site (*http://*www.gc.doe.gov*).*

For the manufacturers of residential clothes dryers and room air conditioners, the Small Business Administration (SBA) has set a size threshold, which defines those entities classified as "small businesses" for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. 65 FR 30836, 30850 (May 15, 2000), as amended at 65 FR 53533, 53545 (Sept. 5, 2000) and codified at 13 CFR part 121. The size standards are listed by NAICS code and industry description and are available at *http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf.* Residential clothes dryer manufacturing is classified under NAICS Code 335224, "Household Laundry Equipment Manufacturing" and room air conditioner manufacturing is classified under NAICS Code 333415, "Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing." The SBA sets a threshold of 1,000 employees or less and 750 employees or less, respectively, for these categories in order for an entity to be considered as a small business, as shown in Table VI–1.

TABLE VI–1—SBA CLASSIFICATION OF SMALL BUSINESSES POTENTIALLY AFFECTED BY THIS RULE

Industry description	Revenue limit	Employee limit	NAICS
Household Laundry Equipment Manufacturing	N/A	1,000	335224
Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.	N/A	750	333415

DOE reviewed the potential standard levels considered in today's notice under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. To estimate the number of small businesses that could be impacted by the amended energy conservation standards, DOE conducted a market survey using all available public information to identify potential small manufacturers. DOE's research included the AHAM membership directory, product databases (the AHRI, AHAM, CEC, and ENERGY STAR databases), individual company Web sites, and the SBA dynamic small business search to find potential small business manufacturers. DOE also asked stakeholders and industry representatives if they were aware of any other small business manufacturers during manufacturer interviews and at previous DOE public meetings. DOE reviewed all publicly available data and contacted various companies, as necessary, to determine whether they met the SBA's definition of a small business manufacturer of covered residential clothes dryers or room air conditioners. DOE screened out companies that did not offer products covered by this rulemaking, did not meet the definition of a "small business," or are foreign owned and operated.

1. Residential Clothes Dryer Industry

The majority of residential clothes dryers are currently manufactured in the United States by one corporation that accounts for over 70 percent of the market. Two additional large manufacturers with foreign and domestic production hold much of the remaining share of the market. The small portion of the remaining residential clothes dryer market is supplied by a combination of international and domestic companies, all of which have small market shares.

Based on its review of the dynamic small business search on the SBA Web site (*http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm*), the Central Contracting Registration (*https://www.bpn.gov/CCRSearch/Search.aspx*), and input from commenters, DOE identified only one manufacturer who could potentially be considered a small business under NAICS Code 335224, "Household Laundry Equipment Manufacturing." DOE does not believe, however, that this company would be directly impacted by the standards established for clothes dryers in today's final rule. DOE notes that while the potential small business manufacturer has developed a highly efficient technology that could be used by other manufacturers to increase the efficiency of clothes dryers, the company does not produce clothes dryers and the technology is not yet commercially available. DOE acknowledges that the technology developed by this small business is a potential design option for clothes dryers, but DOE does not believe this rulemaking would in any way affect the ability of this company to commercialize or sell its technology.

2. Room Air Conditioner Industry

No room air conditioners are manufactured in the United States. Most manufacturing takes place in Asia, primarily China, with limited production in Mexico. In recent years at least two major manufacturers have exited the market. At least three major corporations supply a majority of the market. The remaining market share is held by several large companies. DOE did not identify any small business manufacturers of room air conditioners.

For room air conditioners, DOE initially identified at least 11 distinct manufacturers of room air conditioners sold in the United States. DOE initially determined that 10 of these were large or foreign-owned and operated. DOE determined that the one room air conditioner manufacturer that was previously designated as a small business manufacturer was acquired by another company and now exceeds SBA's employment threshold for consideration as a small business under the appropriate NAICS code. As such, DOE did not identify any small business manufacturers of room air conditioners.

Based on the discussion above, DOE certifies that the standards for clothes dryers and room air conditioners set forth in today's rule would not have a significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared a regulatory flexibility analysis for this rulemaking. DOE will transmit this certification to SBA as required by 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act

Manufacturers of clothes dryers and room air conditioners must certify to DOE that their products comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their products according to the DOE test procedures for clothes dryers and room air conditioners, including any amendments adopted for those test procedures. DOE has proposed regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including clothes dryers and room air conditioners. 75 FR 56796 (Sept. 16, 2010). The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been submitted to OMB for approval. Public reporting burden for the certification is estimated to average 20 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act

DOE has prepared an environmental assessment (EA) of the impacts of the direct final rule pursuant to the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*), the regulations of the Council on Environmental Quality (40 CFR parts 1500–1508), and DOE's regulations for compliance with the National Environmental Policy Act (10 CFR part 1021). This assessment includes an examination of the potential effects of emission reductions likely to result from the rule in the context of global climate change, as well as other types of environmental impacts. The EA has been incorporated into the direct final rule TSD as chapter 15. DOE found that the environmental effects associated with the standards for clothes dryers and room air conditioners were not significant. Therefore, DOE is issuing a Finding of No Significant Impact (FONSI), pursuant to NEPA, the regulations of the Council on Environmental Quality (40 CFR parts 1500–1508), and DOE's regulations for compliance with NEPA (10 CFR part 1021). The FONSI is available in the docket for this rulemaking.

E. Review Under Executive Order 13132

Executive Order 13132, "Federalism," 64 FR 43255 (August 4, 1999), imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of today's direct final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, "Civil Justice Reform" imposes on Federal agencies the general duty to adhere to the following requirements: (1) Eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; and (3) provide a clear legal standard for affected conduct rather than a general standard and promote simplification and burden reduction. 61 FR 4729 (February 7, 1996). Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) Clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this direct final rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law. 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at *http://www.gc.doe.gov.*

Although today's rule does not contain a Federal intergovernmental mandate, it may impose expenditures of $100 million or more on the private sector. Specifically, the final rule could impose expenditures of $100 million or more. Such expenditures may include (1) investment in research and development and in capital expenditures by home appliance manufacturers in the years between the final rule and the compliance date for the new standard, and (2) incremental additional expenditures by consumers to purchase higher efficiency home appliances.

Section 202 of UMRA authorizes an agency to respond to the content requirements of UMRA in any other statement or analysis that accompanies the proposed rule. 2 U.S.C. 1532(c). The content requirements of section 202(b) of UMRA relevant to a private sector mandate substantially overlap the economic analysis requirements that apply under section 325(o) of EPCA and Executive Order 12866. The Supplementary Information section of this notice and the "Regulatory Impact Analysis" section of the direct final rule TSD for this rule respond to those requirements.

Under section 205 of UMRA, the Department is obligated to identify and consider a reasonable number of regulatory alternatives before promulgating a rule for which a written statement under section 202 is required. 2 U.S.C. 1535(a). DOE is required to select from those alternatives the most cost-effective and least burdensome alternative that achieves the objectives of the rule unless DOE publishes an explanation for doing otherwise or the selection of such an alternative is inconsistent with law. As required by 42 U.S.C. 6295(h) and (o), 6313(e), and 6316(a), today's rule would establish energy conservation standards for clothes dryers and room air conditioners that are designed to achieve the maximum improvement in energy efficiency that DOE has determined to be both technologically feasible and economically justified. A full discussion of the alternatives considered by DOE is presented in the "Regulatory Impact Analysis" section of the direct final rule TSD.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 53 FR 8859 (March 18, 1988), that this regulation would not result in any takings which might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516, note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed today's notice under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB, a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy, or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

DOE has concluded that today's regulatory action, which sets forth energy conservation standards for clothes dryers and room air conditioners, is not a significant energy action because the proposed standards are not likely to have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects on the direct final rule.

L. Review Under the Information Quality Bulletin for Peer Review

On December 16, 2004, OMB, in consultation with the Office of Science and Technology (OSTP), issued its Final Information Quality Bulletin for Peer Review (the Bulletin). 70 FR 2664 (Jan. 14, 2005). The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal Government, including influential scientific information related to agency regulatory actions. The purpose of the bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemaking analyses are "influential scientific information," which the Bulletin defines as "scientific information the agency reasonably can determine will have, or does have, a clear and substantial impact on important public policies or private sector decisions." 70 FR 2667.

In response to OMB's Bulletin, DOE conducted formal in-progress peer reviews of the energy conservation standards development process and analyses and has prepared a Peer Review Report pertaining to the energy conservation standards rulemaking analyses. Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. The "Energy Conservation Standards Rulemaking Peer Review Report" dated February 2007 has been disseminated and is available at the following Web site: *http://www1.eere.energy.gov/buildings/appliance_standards/peer_review.html.*

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule prior to its effective date. The report will state that it has been determined that the rule is not a "major rule" as defined by 5 U.S.C. 804(2).

VII. Public Participation

A. Submission of Comments

DOE will accept comments, data, and information regarding this direct final rule no later than the date provided in the **DATES** section at the beginning of this rule. Interested parties may submit comments using any of the methods described in the **ADDRESSES** section at the beginning of this notice.

Submitting comments via regulations.gov. The regulations.gov Web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to regulations.gov information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (CBI)). Comments submitted through regulations.gov cannot be claimed as CBI. Comments received through the Web site will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through regulations.gov before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that regulations.gov provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery, or mail. Comments and documents submitted via email, hand delivery, or mail also will be posted to regulations.gov. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information on a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. Email submissions are preferred. If you submit via mail or hand delivery, please provide all items on a CD, if feasible. It is not necessary to submit printed copies. No facsimiles (faxes) will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, written in English and are free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. According to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery two well-marked copies: one copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked non-confidential with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include: (1) A description of the items; (2) whether and why such items are customarily treated as confidential within the industry; (3) whether the information is generally known by or available from other sources; (4) whether the information has previously been made available to others without obligation concerning its confidentiality; (5) an explanation of the competitive injury to the submitting person which would result from public disclosure; (6) when such information might lose its confidential character due to the passage of time; and (7) why disclosure of the information would be contrary to the public interest.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of today's direct final rule.

List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Reporting and recordkeeping requirements, and Small businesses.

Issued in Washington, DC, on April 8, 2011.

Kathleen Hogan,

Deputy Assistant Secretary for Energy Efficiency, Office of Technology Development, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE amends chapter II, subchapter D, of title 10 of the Code of Federal Regulations, as set forth below:

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

■ 1. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

■ 2. Revise § 430.32 paragraphs (b), and (h) to read as follows:

§ 430.32 Energy and water conservation standards and effective dates.

* * * * *

(b) *Room air conditioners.*

Product class	Energy efficiency ratio, effective from Oct. 1, 2000 to April 20, 2014	Combined energy efficiency ratio, effective as of April 21, 2014
1. Without reverse cycle, with louvered sides, and less than 6,000 Btu/h	9.7	11.0
2. Without reverse cycle, with louvered sides, and 6,000 to 7,999 Btu/h	9.7	11.0
3. Without reverse cycle, with louvered sides, and 8,000 to 13,999 Btu/h	9.8	10.9
4. Without reverse cycle, with louvered sides, and 14,000 to 19,999 Btu/h	9.7	10.7
5a. Without reverse cycle, with louvered sides, and 20,000 to 24,999 Btu/h	8.5	9.4
5b. Without reverse cycle, with louvered sides, and 25,000 Btu/h or more	8.5	9.0
6. Without reverse cycle, without louvered sides, and less than 6,000 Btu/h	9.0	10.0
7. Without reverse cycle, without louvered sides, and 6,000 to 7,999 Btu/h	9.0	10.0
8a. Without reverse cycle, without louvered sides, and 8,000 to 10,999 Btu/h	8.5	9.6
8b. Without reverse cycle, without louvered sides, and 11,000 to 13,999 Btu/h	8.5	9.5
9. Without reverse cycle, without louvered sides, and 14,000 to 19,999 Btu/h	8.5	9.3
10. Without reverse cycle, without louvered sides, and 20,000 Btu/h or more	8.5	9.4
11. With reverse cycle, with louvered sides, and less than 20,000 Btu/h	9.0	9.8
12. With reverse cycle, without louvered sides, and less than 14,000 Btu/h	8.5	9.3
13. With reverse cycle, with louvered sides, and 20,000 Btu/h or more	8.5	9.3
14. With reverse cycle, without louvered sides, and 14,000 Btu/h or more	8.0	8.7
15. Casement-Only	8.7	9.5
16. Casement-Slider	9.5	10.4

* * * * *

(h) *Clothes dryers.* (1) Gas clothes dryers manufactured after January 1, 1988 shall not be equipped with a constant burning pilot.

(2) Clothes dryers manufactured on or after May 14, 1994 and before April 21, 2014, shall have an energy factor no less than:

Product class	Energy factor (lbs/kWh)
i. Electric, Standard (4.4 ft^3 or greater capacity)	3.01
ii. Electric, Compact (120V) (less than 4.4 ft^3 capacity)	3.13
iii. Electric, Compact (240V) (less than 4.4 ft^3 capacity)	2.90
iv. Gas	2.67

(3) Clothes dryers manufactured on or after April 21, 2014, shall have a combined energy factor no less than:

Product class	Combined energy factor (lbs/kWh)
i. Vented Electric, Standard (4.4 ft^3 or greater capacity)	3.73
ii. Vented Electric, Compact (120V) (less than 4.4 ft^3 capacity)	3.61
iii. Vented Electric, Compact (240V) (less than 4.4 ft^3 capacity)	3.27
iv. Vented Gas	3.30
v. Ventless Electric, Compact (240V) (less than 4.4 ft^3 capacity)	2.55
vi. Ventless Electric, Combination Washer-Dryer	2.08

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