FEDERAL REGISTER

Vol. 79 Tuesday,
No. 249 December 30, 2014

Part III

Department of Energy

10 CFR Part 431
Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Single Package Vertical Air Conditioners and Single Package Vertical Heat Pumps; Proposed Rule

DEPARTMENT OF ENERGY

10 CFR Part 431

[Docket Number EERE–2012–BT–STD–0041]

RIN 1904–AC85

Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Single Package Vertical Air Conditioners and Single Package Vertical Heat Pumps

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

ACTION: Notice of proposed rulemaking (NOPR) and announcement of public meeting.

SUMMARY: The Energy Policy and Conservation Act of 1975 (EPCA), as amended, prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including single package vertical air conditioners and single package vertical heat pumps. EPCA also requires that each time the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) Standard 90.1 is amended with respect to the standard levels or design requirements applicable to that equipment, the U.S. Department of Energy (DOE) must adopt amended uniform national standards for this equipment equivalent to those in ASHRAE Standard 90.1, unless DOE determines that there is clear and convincing evidence showing that more-stringent, amended standards would be technologically feasible and economically justified, and would save a significant additional amount of energy. DOE has tentatively concluded that there is sufficient record evidence to support more-stringent standards for two classes of this equipment. However, for four equipment classes, DOE is proposing to adopt the revised ASHRAE levels, due to the absence of any models on the market in two classes, and absence of any models above the revised ASHRAE level in the remaining two classes. Accordingly, DOE is proposing amended energy conservation standards for all classes of single package vertical air conditioners and single package vertical heat pumps. DOE also announces a public meeting to receive comment on these proposed standards and associated analyses and results.

DATES: *Comments:* DOE will accept comments, data, and information regarding this notice of proposed rulemaking (NOPR) before and after the public meeting, but no later than March 2, 2015. See section VII, ''Public Participation,'' for details.

Meeting: DOE will hold a public meeting on Friday, February 6, 2014, from 8:30 a.m. to 12:30 p.m., in Washington, DC. The meeting will also be broadcast as a webinar. See section VII, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 8E–089 1000 Independence Avenue SW., Washington, DC 20585. To attend, please notify Ms. Brenda Edwards at (202) 586–2945. Persons may also attend the public meeting via webinar. For more information, refer to section VII, ''Public Participation,'' near the end of the preamble.

Due to the REAL ID Act implemented by the Department of Homeland Security (DHS), there have been recent changes regarding identification (ID) requirements for individuals wishing to enter Federal buildings from specific States and U.S. territories. As a result, driver's licenses from the following States or territory will not be accepted for building entry, and instead, one of the alternate forms of ID listed below will be required.

DHS has determined that regular driver's licenses (and ID cards) from the following jurisdictions are not acceptable for entry into DOE facilities: Alaska, American Samoa, Arizona, Louisiana, Maine, Massachusetts, Minnesota, New York, Oklahoma, and Washington.

Acceptable alternate forms of Photo-ID include: U.S. Passport or Passport Card; an Enhanced Driver's License or Enhanced ID-Card issued by the States of Minnesota, New York or Washington (Enhanced licenses issued by these States are clearly marked Enhanced or Enhanced Driver's License); a military ID or other Federal government-issued Photo-ID card.

Instructions: Any comments submitted must identify the NOPR for Energy Conservation Standards for Single Package Vertical Air Conditioners and Single Package Vertical Heat Pumps, and provide docket number EERE–2012–BT–STD–0041 and/or regulatory information number (RIN) number 1904–AC85. Comments may be submitted using any of the following methods:

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

2. *Email: SPVU2012STD0041@ee.doe.gov.* Include the docket number and/or RIN in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption.

3. *Postal Mail:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Office, Mailstop EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121. If possible, please submit all items on a compact disc (CD), in which case 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, in which case it is not necessary to include printed copies.

Written comments regarding the burden-hour estimates or other aspects of the collection-of-information requirements contained in this proposed rule may be submitted to the Office of Energy Efficiency and Renewable Energy through the methods listed above and by email to *Chad_S._Whiteman@omb.eop.gov.*

No telefacsimilies (faxes) will be accepted. For detailed instructions on submitting comments and additional information on the rulemaking process, see section VII of this document (Public Participation).

Docket: The docket, which includes **Federal Register** notices, public meeting attendee lists and transcripts, comments, and other supporting documents/materials, is available for review at *www.regulations.gov.* All documents in the docket are listed in the *www.regulations.gov* index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

A link to the docket Web page can be found at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx?ruleid=107.* This Web page contains a link to the docket for this NOPR on the *www.regulations.gov* site. The *www.regulations.gov* Web page contains simple instructions on how to access all documents, including public comments, in the docket. See section VII, ''Public Participation,'' for further information on how to submit comments through *www.regulations.gov.*

For further information on how to submit a comment, review other public comments and the docket, or participate in the public meeting, contact Ms. Brenda Edwards at (202) 586–2945 or by email: *Brenda.Edwards@ee.doe.gov.*

FOR FURTHER INFORMATION CONTACT: Mr. Ron Majette, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121. Telephone: (202) 586–7935. Email: *Ronald.Majette@ee.doe.gov.*

Mr. Eric Stas, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW., Washington, DC 20585–0121. Telephone: (202) 586–9507. Email: *Eric.Stas@hq.doe.gov.*

For information on how to submit or review public comments, contact Ms. Brenda Edwards at (202) 586–2945 or by email: *Brenda.Edwards@ee.doe.gov.*

SUPPLEMENTARY INFORMATION:

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I. Summary of the Proposed Rule

Title III, Part C[1] of the Energy Policy and Conservation Act of 1975 (''EPCA'' or ''the Act''), Pub. L. 94–163 (42 U.S.C. 6311–6317, as codified), added by Public Law 95–619, Title IV, § 441(a), established the Energy Conservation Program for Certain Industrial Equipment, which includes the single package vertical air conditioners (SPVACs) and single package vertical heat pumps (SPVHPs) that are the subject of this rulemaking (collectively referred to as single package vertical units or SPVUs). Pursuant to EPCA, not later than 3 years after the date of enactment of the Energy Independence and Security Act of 2007 (EISA 2007), DOE must review the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1 (ASHRAE Standard 90.1), ''*Energy Standard for Buildings Except Low-Rise Residential Buildings,*'' with respect to single package vertical air conditioners and single package vertical heat pumps in accordance with the procedures established in 42 U.S.C. 6313(a)(6). (42 U.S.C. 6313(a)(10)(B))

At the time DOE commenced this rulemaking, the Department had not considered adoption of the then-current ASHRAE Standard 90.1–2010 levels as part of its analytical baseline (as is typically the case under 42 U.S.C. 6313(a)(6)), because the current energy conservation standards for SPVUs were already set at those levels by EPCA. However, on October 9, 2013, ASHRAE adopted ASHRAE Standard 90.1–2013, and this revision did contain amended standard levels for SPVUs, thereby triggering DOE's statutory obligation to promulgate an amended uniform national standard at those levels, unless DOE determines that there is clear and convincing evidence supporting the adoption of more-stringent energy conservation standards than the ASHRAE levels. The test for adoption of more-stringent standards is whether such standards would result in significant additional conservation of energy and would be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)(I) and (II)) Once complete, this rulemaking will satisfy DOE's statutory obligations under both 42 U.S.C. 6313(a)(6) and (10)(B).

In accordance with these and other statutory provisions discussed in this preamble, DOE has tentatively concluded that there is sufficient evidence to support more-stringent standards for two classes of SPVUs. For the remaining four equipment classes,

[1] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A–1.

DOE has tentatively decided to adopt the levels in ASHRAE Standard 90.1–2013. Accordingly, DOE is proposing amended energy conservation standards for all classes of single package vertical air conditioners and single package vertical heat pumps. As shown in Table I.1, the proposed standards are expressed in terms of: (1) Energy efficiency ratio (EER), which is the ratio of the produced cooling effect of an air conditioner or heat pump to its total work input; and (2) coefficient of performance (COP), which is the ratio of produced heating effect to total work input (applicable only to heat pump units).

If adopted, the proposed standards listed in Table I.1 that are more stringent than those contained in ASHRAE Standard 90.1–2013 would apply to such equipment manufactured in, or imported into, the United States, excluding equipment that is manufactured for export, on and after a date four years after publication of an energy conservation standards final rule. If adopted, the proposed standards listed in Table I.1 that are set at the levels contained in ASHRAE Standard 90.1–2013 would apply to such equipment manufactured in, or imported into, the United States, excluding equipment that is manufactured for export, on and after a date two or three years after the effective date of the requirements in ASHRAE Standard 90.1–2013, depending on equipment size (*i.e.,* October 9, 2015 or 2016).

TABLE I.1—PROPOSED ENERGY CONSERVATION STANDARDS FOR SPVUS

Equipment class	Cooling capacity *Btu/h*	Efficiency level	Standard level	Anticipated compliance date
Single Package Vertical Air Conditioner.	<65,000 Btu/h	EER =11.0	More Stringent than ASHRAE.	2019. [4 years after publication of final rule].
Single Package Vertical Air Conditioner.	≥65,000 Btu/h and <135,000 Btu/h.	EER = 10.0	ASHRAE	October 9, 2015.
Single Package Vertical Air Conditioner.	≥135,000 Btu/h and <240,000 Btu/h.	EER = 10.0	ASHRAE	October 9, 2016.
Single Package Vertical Heat Pump	<65,000 Btu/h	EER = 11.0 COP = 3.3	More Stringent than ASHRAE.	2019. [4 years after publication of final rule].
Single Package Vertical Heat Pump	≥65,000 Btu/h and <135,000 Btu/h.	EER = 10.0 COP = 3.0	ASHRAE	October 9, 2015.
Single Package Vertical Heat Pump	≥135,000 Btu/h and <240,000 Btu/h.	EER = 10.0 COP = 3.0	ASHRAE	October 9, 2016.

A. Benefits and Costs to Consumers

Table I.2 presents DOE's evaluation of the economic impacts of the proposed energy conservation standards on consumers of SPVACs and SPVHPs, as measured by the average life-cycle cost (LCC) savings and the median payback period (PBP). In order to adopt levels above the levels specified in ASHRAE Standard 90.1, DOE must determine that such more-stringent standards would result in significant additional conservation of energy (relative to the efficiency levels specified in ASHRAE Standard 90.1) and that it would be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)(II)) In compliance with this statutory requirement, DOE based its determination to adopt more stringent standards on an analysis comparing these proposed standards with ASHRAE 90.1–2013 (Table I.2). Thus, economic impacts of this determination are calculated as compared to the ASHRAE 90.1–2013 level because DOE is required by statute to, at a minimum, adopt that standard.[2]

The Office of Management and Budget's Circular A–4 [3] provides guidance on establishing the baseline for regulatory impact analyses as follows:

> In some cases, substantial portions of a rule may simply restate statutory requirements that would be self-implementing, even in the absence of the regulatory action. In these cases, you should use a pre-statute baseline. If you are able to separate out those areas where the agency has discretion, you may also use a post-statute baseline to evaluate the discretionary elements of the action.

Accordingly, DOE presents consumer, manufacturer, and economic costs and benefits for the proposed SPVU standards as compared to the current Federal (EPCA) minimum that are currently in effect (pre-statute baseline). In addition, as required by Statute in this case when proposing a standard more stringent than ASHRAE 90.1, and recommended by Circular A–4, DOE also provides these same analyses relative to the post-statute (ASHRAE 90.1–2013) baseline. As noted above, it is these latter analyses that DOE has used as the basis for its determination to adopt more stringent standards. The same analytic methodologies are used in both baselines. Key analyses (using both baselines) are summarized in this Executive Summary in Tables I–2: Impacts of Proposed Energy Conservation Standards on Consumers of SPVUs; I–3: Summary of National Economic Benefits and Costs of Proposed SPVU Energy Conservation Standards; and I–4 and I–5: Annualized Benefits and Costs of Proposed Energy Conservation Standards for SPVUs. Additional analyses are presented in section V.C of this preamble, and in the NOPR TSD. Note that not all analyses were conducted using both baselines; rather DOE used the baseline(s) most appropriate to the purpose of the analysis (showing economic impacts relative to the pre-statute status quo and/or determining whether to adopt standards more stringent than ASHRAE 2013). In all cases, the baseline(s) used are indicated in the analyses.

In overview, the average LCC savings are positive for the equipment classes for which standards higher than the levels in ASHRAE 90.1–2013 are being proposed. DOE did not evaluate economic impacts to the consumers of

[2] See 42 U.S.C. 6313(a)(6)(A)(ii)(I): In general.—Except as provided in subclause (II), not later than 18 months after the date of publication of the amendment to the ASHRAE/IES Standard 90.1 for a product described in clause (i), the Secretary shall establish an amended uniform national standard for the product at the minimum level specified in the amended ASHRAE/IES Standard 90.1.

[3] U.S. Office of Management and Budget "Circular A–4: Regulatory Analysis" (Sept. 17, 2003) contains guidelines regarding development of a baseline, including that "This baseline should be the best assessment of the way the world would look absent the proposed action." (Available at: *http://www.whitehouse.gov/omb/circulars_a004_a-4/*).

SPVACs ≥65,000 Btu/h and <135,000 Btu/h for the ASHRAE baseline, as the ASHRAE level is equal to max-tech. However the economic impacts for this equipment class using the EPCA baseline can be found in Table I.2 and in appendix 8B of the NOPR TSD. DOE also presents results for the parallel class of SPVHPs ≥65,000 Btu/h and <135,000 Btu/h using the EPCA baseline.[4] DOE did not evaluate economic impacts for the large equipment classes because there are no models on the market, and, therefore, no consumers.[5]

TABLE I.2—IMPACTS OF PROPOSED ENERGY CONSERVATION STANDARDS ON CONSUMERS OF SPVUS FOR ASHRAE AND EPCA BASELINE

Equipment class	Cooling capacity *Btu/h*	Average LCC savings *2013$*		Median payback period *years*	
		ASHRAE baseline	EPCA baseline	ASHRAE baseline	EPCA baseline
Single Package Vertical Air Conditioner	<65,000 Btu/h	$179	$261	8.4	10.4
Single Package Vertical Air Conditioner	≥65,000 Btu/h and <135,000 Btu/h.	Adopt ASHRAE.	737	Adopt ASHRAE.	7.0
Single Package Vertical Air Conditioner	≥135,000 Btu/h and <240,000 Btu/h.	Adopt ASHRAE.	N/A	Adopt ASHRAE.	N/A
Single Package Vertical Heat Pump	<65,000 Btu/h	$424	382	4.8	9.3
Single Package Vertical Heat Pump	≥65,000 Btu/h and <135,000 Btu/h.	Adopt ASHRAE.	241	Adopt ASHRAE.	10.9
Single Package Vertical Heat Pump	≥135,000 Btu/h and <240,000 Btu/h.	Adopt ASHRAE.	N/A	Adopt ASHRAE.	N/A

Note: Expected life of SPVUs is on average 15 years.

B. 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 (2014 to 2048). Using a real discount rate of 10.4 percent,[6] DOE estimates that the INPV for manufacturers of SPVUs is $36.5 million in 2013$ using ASHRAE 2013 as a baseline. The INPV of SPVUs from the EPCA baseline can be found in chapter 12 of the NOPR TSD. Under the proposed standards, DOE expects that manufacturers may lose up to 9.0 percent of their INPV, which is approximately $3.3 million.

C. National Benefits[7]

DOE's analyses indicate that the proposed energy conservation standards for SPVUs would save a significant amount of energy. The cumulative energy savings for SPVUs purchased in the 30-year period that begins in the year of compliance with amended standards (2019–2048) amount to 0.23 quadrillion Btus (quads) using ASHRAE as a baseline. This is a savings of 6 percent relative to the energy use of this equipment.[8] Energy savings using EPCA as a baseline can be found in chapter 10 of the NOPR TSD.

The cumulative net present value (NPV) of total customer costs and savings of the proposed SPVU standards ranges from $0.11 billion (at a 7-percent discount rate) to $0.44 billion (at a 3-percent discount rate) using ASHRAE as a baseline. NPV results using EPCA as a baseline can be found in chapter 10 of the NOPR TSD. This NPV expresses the estimated total value of future operating-cost savings minus the estimated increased product costs for SPVUs purchased in 2019–2048.

In addition, the proposed standards would have significant environmental benefits. The energy savings described above using the ASHRAE baseline would result in cumulative emission reductions (over the same period as for energy savings) of 20 million metric tons (Mt)[9] of carbon dioxide (CO_2), 59 thousand tons of methane, 53 thousand tons of sulfur dioxide (SO_2), 18 thousand tons of nitrogen oxides (NO_X), and 0.06 tons of mercury (Hg).[10] The cumulative reduction in CO_2 emissions through 2030 amounts to 2.2 Mt. Emissions results using the EPCA baseline can be found in chapter 13 of the NOPR TSD, and cumulative reduction in CO_2 emissions through 2030 amounts to 4.7 Mt relative to the EPCA baseline.

The value of the CO_2 reductions is calculated using a range of values per metric ton of CO_2 (otherwise known as the Social Cost of Carbon, or SCC) developed by a recent Federal interagency process.[11] The derivation of

[4] However, there are no models available on the market for this class, and therefore these results are not carried into the national impact analysis or other downstream analyses.

[5] Equipment classes for these cooling capacities exist in ASHRAE Standard 90.1 and were established in DOE regulation through EISA 2007. Despite the lack of models and consumers, for these equipment classes DOE is proposing to adopt as federal standards the efficiency levels in ASHRAE 90.1–2013 as required under 42 U.S.C. 6313(a)(6)(A)(ii)(I).

[6] DOE estimated draft financial metrics, including the industry discount rate, based on data in Securities and Exchange Commission (SEC) filings and on industry-reviewed values published in prior HVAC final rules. DOE presented the draft financial metrics to manufacturer in MIA interviews. DOE adjusted those values based on feedback from manufacturers. The complete set of financial metrics and more detail about the methodology can be found in section 12.4.3 of TSD chapter 12.

[7] All monetary values in this section are expressed in 2013 dollars and are discounted to 2014. National benefits apply only to DOE's proposed standard levels that are higher than the ASHRAE levels, and impacts are presented as compared to the ASHRAE 90.1–2013 level as baseline. For equipment classes where DOE is proposing the ASHRAE levels, national benefits do not accrue.

[8] The base case assumptions are described in section IV.G.

[9] A metric ton is equivalent to 1.1 short tons. Results for NO_X and Hg are presented in short tons.

[10] DOE calculated emissions reductions relative to the *Annual Energy Outlook 2013* (*AEO 2013*) Reference case, which generally represents current legislation and environmental regulations for which implementing regulations were available as of December 31, 2012. Emissions factors based on the *Annual Energy Outlook 2014* (*AEO 2014*), which became available too late for incorporation into this analysis, indicate that a significant decrease in the cumulative emission reductions of carbon dioxide and most other pollutants can be expected if the projections of power plant utilization assumed in *AEO 2014* are realized. For example, the estimated amount of cumulative emission reductions of CO_2 is expected to decrease by 33% from DOE's current estimate based on the projections in *AEO 2014* relative to *AEO 2013.* The monetized benefits from GHG reductions would likely decrease by a comparable amount. DOE plans to use emissions factors based on the most recent *AEO* available for the next phase of this rulemaking, which may or may not be AEO 2014, depending on the timing of the issuance of the next rulemaking document.

[11] *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866,* Interagency Working Group on Social Cost of Carbon, United States Government (May

Continued

the SCC values is discussed in section IV.K. DOE estimates that the present monetary value of the CO_2 emissions reduction described above is between $0.12 and $1.9 billion using the ASHRAE baseline. DOE also estimates the present monetary value of the NO_X emissions reduction using the ASHRAE baseline is $7.3 million at a 7-percent discount rate and $21 million at a 3-percent discount rate.[12] Results using the EPCA baseline can be found in chapter 14 of the NOPR TSD.

Table I.3 summarizes the national economic costs and benefits expected to result from the proposed standards for SPVUs using both the ASHRAE and EPCA baselines.

TABLE I.3—SUMMARY OF NATIONAL ECONOMIC BENEFITS AND COSTS OF PROPOSED SPVU ENERGY CONSERVATION STANDARDS USING ASHRAE AND EPCA BASELINES*

Category	Present value *Billion 2013$*		Discount rate %
	ASHRAE baseline	EPCA baseline	
Benefits			
Consumer Operating Cost Savings	0.49	1.0	7
	1.2	2.6	3
CO_2 Reduction Monetized Value ($12.0/t case)**	0.12	0.26	5
CO_2 Reduction Monetized Value ($40.5/t case)**	0.60	1.2	3
CO_2 Reduction Monetized Value ($62.4/t case)**	1.0	2.0	2.5
CO_2 Reduction Monetized Value ($119/t case)**	1.9	3.8	3
NO_X Reduction Monetized Value (at $2,684/ton)**	0.0073	0.015	7
	0.021	0.042	3
Total Benefits†	1.1	2.3	7
	1.9	3.8	3
Costs			
Consumer Incremental Installed Costs	0.38	0.77	7
	0.79	1.5	3
Net Benefits			
Including CO_2 and NO_X Reduction Monetized Value	0.72	1.5	7
	1.1	2.3	3

* This table presents the costs and benefits associated with SPVU shipped in 2019–2048. These results include benefits to customers which accrue after 2044 from the equipment purchased in 2019–2048. The results account for the incremental variable and fixed costs incurred by manufacturers due to the amended standard, some of which may be incurred in preparation for this final rule.

** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios of the updated SCC values. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series used by DOE incorporates an escalation factor.[13]

† Total Benefits for both the 3% and 7% cases are derived using the series corresponding to SCC value of $40.5/t in 2015.

The benefits and costs of these proposed standards, for equipment sold in 2019–2048, can also be expressed in terms of annualized values. The annualized monetary values are the sum of: (1) The annualized national economic value of the benefits from customer operation of equipment that meet the proposed standards (consisting primarily of operating cost savings from using less energy, minus increases in equipment purchase and installation costs, which is another way of representing customer NPV); and (2) the annualized monetary value of the benefits of emission reductions, including CO_2 emission reductions.[14]

Although combining the values of operating savings and CO_2 emission reductions provides a useful perspective, two issues should be considered. First, the national operating savings are domestic U.S. customer monetary savings that occur as a result of market transactions, whereas 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 different time frames for analysis. The national operating cost savings is measured for the lifetime of equipment shipped in 2019–2048. Because carbon dioxide emissions have a very long residence time in the

2013; revised November 2013) (Available at: *http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf*).

[12] DOE is currently investigating valuation of avoided Hg and SO_2 emissions.

[13] The CO_2 and NO_X results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant decrease in cumulative emissions reductions for CO_2, estimated at 33%, and an increase in NO_X, estimated at 13%. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

[14] 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 2014, 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 (2019 through 2048) 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 is a steady stream of payments.

atmosphere,[15] the SCC values reflect future climate-related impacts resulting from the emission of one ton of carbon dioxide that continue well beyond 2100.

Estimates of annualized benefits and costs of the proposed standards (over a 30-year period) are shown in Table I.4. The results under the primary estimate using the ASHRAE baseline are as follows. Using a 7-percent discount rate for benefits and costs other than CO_2 reduction, for which DOE used a 3-percent discount rate along with the average SCC series that has a value of $40.5/t in 2015, the cost of the proposed standards is $29 million per year in increased equipment costs, while the benefits are $38 million per year in reduced equipment operating costs, $29 million from CO_2 reductions, and $0.57 million from reduced NO_X emissions. In this case, the annualized net benefit amounts to $38 million per year. Using a 3-percent discount rate for all benefits and costs and the average SCC series that has a value of $40.5/t in 2015, the cost of the standards proposed in today's rule is $37 million per year in increased equipment costs, while the benefits are $58 million per year in reduced operating costs, $29 million from CO_2 reductions, and $0.97 million in reduced NO_X emissions. In this case, the net benefit amounts to $51 million per year.[16] Results using the EPCA baseline are shown in Table I.5.

TABLE I.4—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR SPVUS

[ASHRAE baseline]

	Discount rate	Primary estimate*	Low net benefits estimate*	High net benefits estimate*
		million 2013$/year		
Benefits				
Operating Cost Savings	7%	38	36	39.
	3%	58	55	61.
CO_2 Reduction Monetized Value ($12.0/t case)**	5%	7.7	7.6	7.7.
CO_2 Reduction Monetized Value ($40.5/t case)**	3%	29	28	29.
CO_2 Reduction Monetized Value ($62.4/t case)**	2.5%	43	42	43.
CO_2 Reduction Monetized Value ($119/t case)**	3%	89	88	89.
NO_X Reduction Monetized Value (at $2,684/ton)**	7%	0.57	0.56	0.57.
	3%	0.97	0.97	0.98.
Total Benefits†	7% plus CO_2 range	46 to 127	44 to 125	48 to 129.
	7%	67	65	69.
	3% plus CO_2 range	67 to 148	63 to 144	70 to 151.
	3%	88	84	91.
Costs				
Incremental Equipment Costs	7%	29	40	28.
	3%	37	53	36.
Net Benefits/Costs				
Total†	7% plus CO_2 range	17 to 98	4 to 85	19 to 101.
	7%	38	25	40.
	3% plus CO_2 range	30 to 111	11 to 91	34 to 115.
	3%	51	31	55.

* This table presents the annualized costs and benefits associated with SPVUs shipped in 2019–2048. These results include benefits to customers which accrue after 2048 from the products purchased in 2019–2048. Costs incurred by manufacturers, some of which may be incurred in preparation for the rule, are not directly included, but are indirectly included as part of incremental equipment costs. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices and building growth (leading to higher shipments) from the *AEO 2013* Reference case, Low Estimate, and High Estimate, respectively. In addition, incremental equipment costs reflect constant real prices for the Primary Estimate, an increase in projected equipment price trends for the Low Benefits Estimate, and a decline rate in projected equipment price trends for the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.2.a.

** The CO_2 values represent global monetized SCC values, in 2013$, in 2015 under several scenarios. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporates an escalation factor. The value for NO_X (in 2013$) is an average value.[17]

† Total benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with a 3% discount rate ($40.5/t case). In the rows labeled "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.

[15] The atmospheric lifetime of CO_2 is estimated of the order of 30–95 years. Jacobson, MZ (2005). "Correction to "Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming."" *J. Geophys. Res.* 110. pp. D14105.

[16] All CO_2 and NO_X results shown in this paragraph are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant decrease in cumulative emissions reductions for CO_2, estimated at 33%, and an increase in NO_X, estimated at 13%. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

[17] The CO_2 and NO_X results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant decrease in cumulative emissions reductions for CO_2, estimated at 33%, and an increase in NO_X, estimated at 13%. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

TABLE I.5—ANNUALIZED BENEFITS AND COSTS OF PROPOSED ENERGY CONSERVATION STANDARDS FOR SPVUS
[EPCA baseline]

	Discount rate	Primary estimate*	Low net benefits estimate*	High net benefits estimate*
		million 2013$/year		
Benefits				
Operating Cost Savings	7%	80	76	83.
	3%	121	114	126.
CO_2 Reduction Monetized Value ($12.0/t case)**	5%	16	16	16.
CO_2 Reduction Monetized Value ($40.5/t case)**	3%	58	58	59.
CO_2 Reduction Monetized Value ($62.4/t case)**	2.5%	87	87	88.
CO_2 Reduction Monetized Value ($119/t case)**	3%	181	181	182.
NO_X Reduction Monetized Value (at $2,684/ton)**	7%	1.2	1.2	1.2.
	3%	2.0	2.0	2.0.
Total Benefits†	7% plus CO_2 range	97 to 262	93 to 257	100 to 266.
	7%	139	135	143.
	3% plus CO_2 range	139 to 305	132 to 297	144 to 311.
	3%	182	174	187.
Costs				
Incremental Equipment Costs	7%	60	79	58.
	3%	70	97	68.
Net Benefits/Costs				
Total†	7% plus CO_2 range	37 to 203	14 to 179	42 to 208.
	7%	80	56	85.
	3% plus CO_2 range	68 to 234	35 to 199	76 to 243.
	3%	111	77	119.

* This table presents the annualized costs and benefits associated with SPVUs shipped in 2019–2048. These results include benefits to customers which accrue after 2048 from the products purchased in 2019–2048. Costs incurred by manufacturers, some of which may be incurred in preparation for the rule, are not directly included, but are indirectly included as part of incremental equipment costs. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices and building growth (leading to higher shipments) from the *AEO 2013* Reference case, Low Estimate, and High Estimate, respectively. In addition, incremental equipment costs reflect constant real prices for the Primary Estimate, an increase in projected equipment price trends for the Low Benefits Estimate, and a decline rate in projected equipment price trends for the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.2.a.

** The CO_2 values represent global monetized SCC values, in 2013$, in 2015 under several scenarios. The first three cases use the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The fourth case represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series incorporates an escalation factor. The value for NO_X (in 2013$) is an average value.[18]

† Total benefits for both the 3% and 7% cases are derived using the series corresponding to the average SCC with a 3% discount rate ($40.5/t case). In the rows labeled "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.

DOE has tentatively concluded that, based upon clear and convincing evidence, the proposed standards for the equipment classes with levels more stringent than those presented in ASHRAE Standard 90.1–2013 represent the maximum improvement in energy efficiency that is technologically feasible and economically justified, and would result in the significant conservation of energy.[19] DOE further notes that products achieving these standard levels are already commercially available for all equipment classes covered by this proposal.[20] Based on the analyses described above, DOE has tentatively concluded that the benefits of the proposed standards to the Nation (energy savings, positive NPV of customer benefits, customer LCC savings, and emission reductions) would outweigh the burdens (loss of INPV for manufacturers). DOE also considered higher energy efficiency levels as trial standard levels, and is still considering them in this rulemaking. However, DOE has tentatively concluded that the potential burdens of the higher energy efficiency levels would outweigh the projected benefits.

For the four equipment classes for which no models are available on the market at all, or for which there are no models with efficiency above those levels presented in ASHRAE 90.1–2013, DOE is proposing to adopt the levels in ASHRAE Standard 90.1–2013, per the statutory directive.

Based on consideration of the public comments DOE receives in response to this NOPR and related information collected and analyzed during the course of this rulemaking effort, DOE may adopt energy efficiency levels presented in this NOPR that are either higher or lower than the proposed standards, or some combination of level(s) that incorporate the proposed standards in part.

[18] The CO_2 and NO_X results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant decrease in cumulative emissions reductions for CO_2, estimated at 33%, and an increase in NO_X, estimated at 13%. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

[19] DOE based this decision to set more stringent levels by using 2013 ASHRAE as the base case.

[20] As shown in section 3.8, chapter 3 of the Technical Support Document, for equipment less than 65,000 Btu/h, there are 42 SPVAC models and 69 SPVHP models available at 11 EER or higher.

As noted previously, in compliance with EPCA, DOE based its determination to adopt more stringent standards on an analysis comparing these proposed standards with ASHRAE 2013 as the base case. DOE presents Table I.5 as requested in OMB Circular A–4.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposal, as well as some of the relevant historical background related to the establishment of standards for single package vertical air conditioners and single package vertical heat pumps.

A. Authority

Title III, Part C [21] of the Energy Policy and Conservation Act of 1975 (''EPCA'' or ''the Act''), Pub. L. 94–163 (42 U.S.C. 6311–6317, as codified), added by Pub. L. 95–619, Title IV, § 441(a), established the Energy Conservation Program for Certain Industrial Equipment, which includes the single package vertical air conditioners and single package vertical heat pumps that are the subjects of this rulemaking.[22] In general, this program addresses the energy efficiency of certain types of commercial and industrial equipment. Relevant provisions of the Act specifically include definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314), labelling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

EPCA contains mandatory energy conservation standards for commercial heating, air-conditioning, and water-heating equipment. (42 U.S.C. 6313(a)) Specifically, the statute sets standards for small, large, and very large commercial package air-conditioning and heating equipment, packaged terminal air conditioners (PTACs) and packaged terminal heat pumps (PTHPs), warm-air furnaces, packaged boilers, storage water heaters, instantaneous water heaters, and unfired hot water storage tanks. *Id.* In doing so, EPCA established Federal energy conservation standards that generally correspond to the levels in ASHRAE Standard 90.1, as in effect on October 24, 1992 (*i.e.,* ASHRAE Standard 90.1–1989), for each type of covered equipment listed in 42 U.S.C. 6313(a). The Energy Independence and Security Act of 2007 (EISA 2007), Pub. L. 110–240, amended EPCA by adding definitions and setting minimum energy conservation standards for single package vertical air conditioners (SPVACs) and single package vertical heat pumps (SPVHPs). (42 U.S.C. 6313(a)(10)(A)) The efficiency standards for SPVACs and SPVHPs established by EISA 2007 correspond to the levels contained in ASHRAE Standard 90.1–2004, which originated as addendum ''d'' to ASHRAE Standard 90.1–2001.

EPCA requires that DOE must conduct a rulemaking to consider amended energy conservation standards for a variety of enumerated types of commercial heating, ventilating, and air-conditioning equipment (of which SPVACs and SPVHPs are a subset) each time ASHRAE Standard 90.1 is updated with respect to such equipment. (42 U.S.C. 6313(a)(6)(A)) Such review is to be conducted in accordance with the procedures established for ASHRAE equipment under 42 U.S.C. 6313(a)(6). According to 42 U.S.C. 6313(a)(6)(A), for each type of equipment, EPCA directs that if ASHRAE Standard 90.1 is amended, DOE must publish in the **Federal Register** an analysis of the energy savings potential of amended energy efficiency standards within 180 days of the amendment of ASHRAE Standard 90.1. (42 U.S.C. 6313(a)(6)(A)(i)) EPCA further directs that DOE must adopt amended standards at the new efficiency level in ASHRAE Standard 90.1, unless clear and convincing evidence supports a determination that adoption of a more-stringent level would produce significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)) In addition, DOE notes that pursuant to the EISA 2007 amendments to EPCA, under 42 U.S.C. 6313(a)(6)(C), the agency must periodically review its already-established energy conservation standards for ASHRAE equipment. In December 2012, this provision was further amended by the American Energy Manufacturing Technical Corrections Act (AEMTCA) to clarify that DOE's periodic review of ASHRAE equipment must occur ''[e]very six years.'' (42 U.S.C. 6313(a)(6)(C)(i))

AEMTCA also modified EPCA to specify that any amendment to the design requirements with respect to the ASHRAE equipment, would trigger DOE review of the potential energy savings under U.S.C. 6313(a)(6)(A)(i). Additionally, AEMTCA amended EPCA to require that if DOE proposes an amended standard for ASHRAE equipment at levels more stringent than those in ASHRAE Standard 90.1, DOE, in deciding whether a standard is economically justified, must determine, after receiving comments on the proposed standard, whether the benefits of the standard exceed its burdens by considering, to the maximum 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 product in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses of the products likely to result from the standard;

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

(4) Any lessening of the utility or the performance of the products likely to result from 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 standard;

(6) The need for national energy conservation; and

(7) Other factors the Secretary considers relevant. (42 U.S.C. 6313(a)(6)(B)(ii))

EISA 2007 amended EPCA to provide an independent basis for a one-time review regarding SPVUs that is not tied to the conditions for initiating review specified by 42 U.S.C. 6313(a)(6)(A) or 42 U.S.C. 6313(a)(6)(C) described previously. Specifically, pursuant to 42 U.S.C. 6313(a)(10)(B), DOE must commence review of the most recently published version of ASHRAE Standard 90.1 with respect to SPVU standards in accordance with the procedures established under 42 U.S.C. 6313(a)(6) no later than 3 years after the enactment of EISA 2007. DOE notes that this provision was not tied to the trigger of ASHRAE publication of an updated version of Standard 90.1 or to a 6-year period from the issuance of the last final rule, which occurred on March 7, 2009 (74 FR 12058). DOE was simply obligated to commence its review by a specified date.

Because ASHRAE did not update its efficiency levels for SPVACs and SPVHPs in ASHRAE Standard 90.1–2010, DOE began this rulemaking by analyzing amended standards consistent with the procedures defined under 42 U.S.C. 6313(a)(6)(C). Specifically, pursuant to 42 U.S.C. 6313(a)(6)(C)(i)(II), DOE, must use the procedures established under subparagraph (B) when issuing a NOPR. The statutory

[21] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A–1.

[22] All references to EPCA in this document refer to the statute as amended through the American Energy Manufacturing Technical Corrections Act, Pub. L. 112–210 (enacted December 18, 2012).

provision at 42 U.S.C. 6313(a)(6)(B)(ii), recently amended by AEMTCA, states that in deciding whether a standard is economically justified, DOE must determine, after receiving comments on the proposed standard, whether the benefits of the standard exceed its burdens by considering, to the maximum extent practicable, the following seven factors, as stated previously.

However, before DOE could finalize this NOPR, ASHRAE acted on October 9, 2013 to adopt ASHRAE Standard 90.1–2013, and this revision did contain amended standard levels for SPVUs, thereby triggering DOE's statutory obligation under 42 U.S.C. 6313(a)(6)(A) to promulgate an amended uniform national standard at those levels unless DOE determines that there is clear and convincing evidence supporting the adoption of more-stringent energy conservation standards than the ASHRAE levels. Consequently, DOE prepared an analysis of the energy savings potential of amended standards at the ASHRAE Standard 90.1 levels (as required by 42 U.S.C. 6313(a)(6)(A)(i)) and updated this NOPR and accompanying analyses to reflect appropriate statutory provision, timelines, and compliance dates.

DOE has tentatively concluded that following this rulemaking process will provide ''clear and convincing evidence'' that for two equipment classes for which the proposed standards are more stringent than those set forth in ASHRAE Standard 90.1–2013 would result in significant additional conservation of energy and would be technologically feasible and economically justified, as mandated by 42 U.S.C. 6313(a)(6). For the other four equipment classes, DOE has tentatively concluded to adopt the levels set forth in ASHRAE Standard 90.1–2013.

EPCA, as codified, also contains what is known as an ''anti-backsliding'' provision, which prevents the Secretary from prescribing 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. 6313(a)(6)(B)(iii)(I)) Also, the Secretary may not prescribe an amended or 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) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States. (42 U.S.C. 6313(a)(6)(B)(iii)(II))

Further, EPCA, as codified, establishes a rebuttable presumption that a standard is economically justified if the Secretary finds that the additional cost to the customer 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 applicable test procedure.

Additionally, when a type or class of covered equipment such as ASHRAE equipment, has two or more subcategories, DOE often specifies more than one standard level. DOE generally will adopt a different standard level than that which applies generally to such 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 which justifies a higher or lower standard. In determining whether a performance-related feature justifies a different standard for a group of products, DOE generally considers such factors as the utility to the customer of the feature and other factors DOE deems appropriate. In a rule prescribing such a standard, DOE includes an explanation of the basis on which such higher or lower level was established. DOE followed a similar process in the context of this rulemaking.

B. Background

Single package vertical units primarily serve modular classroom buildings in educational facilities; telecommonunications and electronics enclosures; and offices and other miscellaneous commercial buildings. In almost all of these commercial building applications, the buildings served are expected to be of modular construction, because SPVUs, as packaged air conditioners installed on external building walls, do not impact site preparation costs for modular buildings, which may be relocated multiple times over the building's life. The vertically-oriented configuration of SPVUs allows the building mounting to be unobtrusive and minimizes impacts on modular building transportation requirements. These advantages do not apply to a significant extent in site-constructed buildings.

1. Current Standards

As noted above, EISA 2007 amended EPCA to establish separate equipment classes and minimum energy conservation standards for SPVACs and SPVHPs. (42 U.S.C. 6313(a)(10)(A)) DOE published a final rule technical amendment in the **Federal Register** on March 23, 2009, which codified into DOE's regulations the new SPVAC and SPVHP pump equipment classes and energy conservation standards for this equipment as prescribed by EISA 2007. 74 FR 12058. These standards apply to all SPVUs manufactured on or after January 1, 2010. The current standards are set forth in Table II.1.

TABLE II.1—CURRENT FEDERAL ENERGY CONSERVATION STANDARDS FOR SINGLE PACKAGE VERTICAL AIR CONDITIONERS AND HEAT PUMPS

Equipment type	Cooling capacity *Btu/h*	Efficiency level
Single Package Vertical Air Conditioner	<65,000 Btu/h	EER = 9.0.
Single Package Vertical Air Conditioner	≥65,000 Btu/h and <135,000 Btu/h	EER = 8.9.
Single Package Vertical Air Conditioner	≥135,000 Btu/h and <240,000 Btu/h*	EER = 8.6.
Single Package Vertical Heat Pump	<65,000 Btu/h	EER = 9.0. COP = 3.0.
Single Package Vertical Heat Pump	≥65,000 Btu/h and <135,000 Btu/h	EER = 8.9. COP = 3.0.
Single Package Vertical Heat Pump	≥135,000 Btu/h and <240,000 Btu/h*	EER = 8.6. COP = 2.9.

* There are no models on the market at these cooling capacities.

2. History of Standards Rulemaking for Single Package Vertical Air Conditioners and Single Package Vertical Heat Pumps

Single package vertical units were established as a separate equipment class in ASHRAE Standard 90.1 by addendum ''d'' to ASHRAE Standard 90.1–2001. DOE subsequently evaluated the possibility of creating separate equipment classes for SPVUs but determined that the Energy Policy Act of 2005 (EPACT 2005) had revised the language in 42 U.S.C. 6313(a)(6)(A)(i) [23] to limit DOE's authority to adopt ASHRAE amendments for small, large, and very large commercial package air-conditioning and heating equipment until after January 1, 2010, and thus, DOE could not adopt equipment classes and standards for SPVUs at that time. As explained in a March 2007 energy conservation standards final rule for various ASHRAE products, DOE determined that SPVUs fall under the definition of ''commercial package air conditioning and heating equipment'' (42 U.S.C. 6311(8)(A)), and that any SPVU with cooling capacities less than 760,000 Btu/h would fit within the commercial package air conditioning and heating equipment categories listed in EPCA and be subjected to their respective energy efficiency standards. 72 FR 10038, 10046–10047 (March 7, 2007).

Subsequently, EISA 2007 amended EPCA to: (1) Create separate equipment classes for SPVACs and SPVHPs; (2) set minimum energy conservation standards for these equipment classes; (3) eliminate the restriction on amendments for small, large, and very large commercial package air-conditioning and heating equipment until after January 1, 2010; and (4) instruct DOE to review the most recently published ASHRAE Standard 90.1 with respect to SPVUs no later than 3 years after the enactment of EISA 2007. As noted previously, DOE published a final rule technical amendment in the **Federal Register** which codified into DOE regulations the standards for SPVUs that were established by EISA 2007. 74 FR 12058 (March 23, 2009).

On October 29, 2010, ASHRAE officially released ASHRAE Standard 90.1–2010 to the public. As an initial step in reviewing SPVUs under EPCA, DOE published a Notice of Data Availability (NODA) on May 5, 2011, which contained potential energy savings estimates for certain industrial and commercial equipment, including SPVUs. 76 FR 25622. Although ASHRAE Standard 90.1–2010 did not update the efficiency levels for SPVUs, DOE was obligated to review the potential energy savings for these equipment classes under 42 U.S.C. 6313(a)(10)(B), as noted above. On January 17, 2012, DOE published a notice of proposed rulemaking (January 2012 NOPR) in which it proposed to incorporate by reference the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 390–2003, ''*Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps,*'' into the DOE test procedure for SPVUs and proposed an optional equipment break-in period of no more than 16 hours. 77 FR 2356. DOE also decided to conduct additional analysis for SPVUs to consider more-stringent standards. *Id.* at 2359. On May 16, 2012, DOE published a final rule which incorporated by reference AHRI Standard 390–2003 into the DOE test procedure for SPVUs and increased the maximum duration of the optional break-in period to 20 hours. 77 FR 28928. That final rule (as with the NOPR) did not contain amended standards for SPVUs, as DOE decided to consider more-stringent standards for such equipment on a separate timeline.

However, as noted before, during the course of the present rulemaking, ASHRAE acted on October 9, 2013, to adopt ASHRAE Standard 90.1–2013, and this revision did contain amended standard levels for SPVUs, thereby triggering DOE's statutory obligation to promulgate an amended uniform national standard at those levels, unless DOE determines that there is clear and convincing evidence supporting the adoption of more-stringent energy conservation standards than the ASHRAE levels. Once triggered by ASHRAE action, DOE became subject to certain new statutory requirements and deadlines. For example, the statute required DOE to publish in the **Federal Register** for comment an analysis of the energy savings potential of amended energy conservation standards at the ASHRAE Standard 90.1–2013 levels, not later than 180 days after amendment of the ASHRAE standard. DOE published this energy savings analysis as a Notice of Data Availability (NODA) in the **Federal Register** on April 11, 2014. 79 FR 20114.

Once triggered by ASHRAE action, the applicable legal deadline for completion of this standards rulemaking also shifted. When DOE first commenced this rulemaking pursuant to 42 U.S.C. 6313(a)(10)(B), that provision directed DOE to follow the procedures established under 42 U.S.C. 6313(a)(6). Because DOE had not been triggered by ASHRAE action at the time (as would necessitate use of the procedures under 42 U.S.C. 6313(a)(6)(A)), DOE proceeded as a 6-year-lookback amendment of the standard under 42 U.S.C. 6313(a)(6)(C), which called for a NOPR followed by a final rule not more than two years later. DOE was close to issuing a NOPR at the time it was triggered by ASHRAE action on Standard 90.1–2013. Once triggered, DOE was then required to either adopt the levels in ASHRAE Standard 90.1–2013 not later than 18 months after the publication of the amended ASHRAE standard (*i.e.,* by April 9, 2015), or to adopt more-stringent standards not later than 30 months after publication of the amended ASHRAE standard (*i.e.,* by April 9, 2016). However, given the advanced stage of the NOPR and DOE's rulemaking process (including analysis of the levels ultimately adopted by ASHRAE in Standard 90.1–2013), the Department plans to move as expeditiously as possible and in advance of the statutory deadlines associated with the ASHRAE trigger. With that said, this NOPR is the next step for DOE's analysis of amended energy conservation standards for SPVUs.

In developing this NOPR, DOE reviewed the 11 comments it received in response to the April 2014 NODA. Commenters included: First Co.; Lennox International Inc.; National Comfort Products (NCP); Earthjustice; Goodman Global, Inc.; California Investor-Owned Utilities (CA IOUs); GE Appliances; Appliance Standards Awareness Project (ASAP), the American Council for an Energy-Efficient Economy (ACEEE), the National Resources Defense Council (NRDC), and the Northwest Energy Efficiency Alliance (jointly referred to as the Advocates); Daikin Applied; Edison Electric Institute (EEI); and Air-Conditioning, Heating & Refrigeration Institute (AHRI). All comments relevant to SPVU (as opposed to the other products discussed in the April 2014 NODA) are discussed in this NOPR.

In general, AHRI, Lennox International, Goodman Global, Daikin Applied, and EEI recommended that DOE should adopt the ASHRAE 90.1–2013 values as minimum standards for all considered equipment, including SPVUs. (AHRI, No. 24 at p. 1, Lennox International Inc., No. 15 at p. 2; Goodman Global, Inc., No. 18 at p. 4; Daikin Applied, No. 22 at p. 1; EEI, No. 23 at p. 2) In contrast, the CA IOUs, as well as the Advocates stated that the DOE should adopt more-stringent levels for certain equipment types, including SPVU, because of the potential energy

[23] The relevant language in 42 U.S.C. 6313(a)(6)(A)(i) was subsequently revised by EISA 2007 to remove the reference to January 1, 2010.

savings. (CA IOUs, No. 19 at pp. 2–3; The Advocates, No. 21 at p. 1)

After careful consideration of the public comments and the available information, DOE has tentatively decided to propose energy conservation standards more stringent than those set forth in ASHRAE Standard 90.1–2013 for two SPVU equipment classes and to propose adoption of the levels set forth in ASHRAE Standard 90.1–2013 for the remaining four SPVU equipment classes. Comments specific to individual issues or analyses are discussed in the relevant sections that follow.

III. General Discussion

A. Compliance Dates

As noted above, this rulemaking was initiated pursuant to an EISA 2007 amendment to EPCA that requires DOE to conduct a one-time review of the standard levels for SPVUs under the procedures established in paragraph (6) of 42 U.S.C. 6313(a). (42 U.S.C. 6313(a)(10)(B)) Paragraph (6) contains a number of possible compliance dates for any resulting amended standards, which vary depending on the type of equipment, the triggering mechanism for DOE review (*i.e.,* whether DOE is triggered by a revision to ASHRAE Standard 90.1 or by the ''6-year look back'' requirement), and the action taken (*i.e.,* whether DOE is adopting ASHRAE Standard 90.1 levels or more-stringent levels). The discussion below explains the potential compliance dates as they pertain to the present rulemaking.

Under the first relevant provision, EPCA requires that when ASHRAE Standard 90.1 is amended with respect to certain commercial equipment, DOE must amend its minimum standards to either adopt levels equivalent to the ASHRAE Standard 90.1 levels, or to adopt more-stringent levels. (42 U.S.C. 6313(a)(6)(A)(ii)) If DOE adopts the ASHRAE Standard 90.1 levels as Federal standard levels, compliance with the amended Federal standards is required either two or three years from the effective date of the ASHRAE Standard 90.1 level, depending on the equipment type. (42 U.S.C. 6313(a)(6)(D)) For small commercial package air-conditioning and heating equipment, PTACs, PTHPs, warm-air furnaces, packaged boilers, storage water heaters, instantaneous water heaters, and unfired hot water storage tanks, compliance is required two years after the effective date of the applicable minimum energy efficiency requirement in the amended ASHRAE Standard 90.1. For large and very large commercial package air-conditioning and heating equipment, compliance is required three years after the effective date of the applicable minimum energy efficiency requirement in the amended ASHRAE Standard 90.1. If DOE adopts more-stringent standard levels than the levels contained in the amended ASHRAE Standard 90.1 for any type of equipment, compliance is required four years after the date such final rule is published in the **Federal Register.** *Id.*

Under the second relevant provision, EPCA requires that at least once every 6 years, DOE must review standards for covered equipment and publish either a notice of determination that standards do not need to be amended or a NOPR proposing new standards. (42 U.S.C 6313(a)(6)(C)) For any NOPR published pursuant to 42 U.S.C. 6313(a)(6)(C), the final rule would apply on the date that is the later of either 3 years after publication of the final rule establishing a new standard, or 6 years after the effective date of the current standard for a covered product. (42 U.S.C. 6313(a)(6)(C)(iv)).

In the context of the current rulemaking, when DOE first commenced the rulemaking process, ASHRAE had not released a full revision of ASHRAE Standard 90.1 that revises the minimum energy efficiency requirements for SPVUs. Thus, DOE initially determined the procedural requirements of 42 U.S.C. 6313(a)(6)(C) to be applicable, and accordingly, DOE anticipated a compliance date of 2017, or 3 years after the expected publication of the final rule in 2014.[24]

However, as DOE expected might happen, ASHRAE released a revision of ASHRAE Standard 90.1 on October 9, 2013, consistent with its recent practice of releasing a full revision of ASHRAE Standard 90.1 every 3 years. Because this revision increased the energy efficiency requirements for SPVUs in ASHRAE Standard 90.1, DOE was triggered to act on the ASHRAE Standard 90.1 levels for SPVUs pursuant to 42 U.S.C. 6313(a)(6)(A), and consequently, this rulemaking will simultaneously satisfy the requirements of 42 U.S.C. 6313(a)(6)(A), 42 U.S.C. 6313(a)(6)(C), and 42 U.S.C. 6313(a)(10)(B). However, in this case, DOE believes that the statutory lead time for compliance under such circumstances must ultimately be dictated by the requirements of 42 U.S.C. 6313(a)(6)(A), given that there is now an ''ASHRAE trigger'' upon which DOE is acting. Thus, DOE will use the compliance dates specified under 42 U.S.C. 6313(a)(6)(D) for analyzing amended standards in the final rule. More specifically, if DOE adopts the ASHRAE Standard 90.1–2013 levels for certain SPVU equipment classes, as proposed, the applicable compliance date would be two or three years after the effective date of the applicable ASHRAE standard, depending on equipment size (*i.e.,* by October 9, 2015 or October 9, 2016).[25] If DOE adopts more-stringent standards for certain other SPVU equipment classes, as proposed, the applicable compliance date would be four years after publication of the final rule in the **Federal Register.**

B. Equipment Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered products into equipment classes by the type of energy used or by capacity or other performance-related features that justifies a different standard. In making a determination whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility to the consumer of the feature and other factors DOE determines are appropriate.

Existing energy conservation standards group SPVUs into the following six equipment classes based on the cooling capacity and whether the equipment is an air conditioner or a heat pump:

TABLE III.1—EQUIPMENT CLASSES FOR SINGLE PACKAGE VERTICAL UNITS

Equipment type	Cooling capacity *Btu/h*
Single Package Vertical Air Conditioners.	<65,000.
	≥65,000 and <135,000.
	≥135,000 and <240,000.

[24] 2017 is the later date compared to the alternative of 6 years after the effective date of the current standard, which would be 2016 (as the current SPVU standards became effective in 2010).

[25] Under 42 U.S.C. 6313(a)(6)(D)(i), the applicable compliance date when DOE adopts the ASHRAE standard levels for small commercial package air conditioning and heating equipment (including SPVACs and SPVHPs under 135,000 Btu/h) is two years after the effective date of the minimum energy efficiency requirements in the amended ASHRAE Standard 90.1. Under 42 U.S.C. 6313(a)(6)(D)(ii), the applicable compliance date when DOE adopts the ASHRAE standard levels for large and very large commercial package air conditioning and heating equipment (including SPVACs and SPVHPs ≥ 135,000 Btu/h and < 240,000 Btu/h) is three years after the effective date of the minimum energy efficiency requirement in the amended ASHRAE Standard 90.1.

TABLE III.1—EQUIPMENT CLASSES FOR SINGLE PACKAGE VERTICAL UNITS—Continued

Equipment type	Cooling capacity *Btu/h*
Single Package Vertical Heat Pumps.	<65,000. ≥65,000 and <135,000. ≥135,000 and <240,000.

10 Code of Federal Regulations (CFR) 431.97(d).

1. Consideration of a Space Constrained SPVU Equipment Class

In the April 2014 NODA, DOE noted that ASHRAE Standard 90.1–2013 created a new equipment class for SPVACs and SPVHPs used in space-constrained applications, with a definition for ''nonweatherized space constrained single-package vertical unit'' and efficiency standards for the associated equipment class. In the NODA, DOE tentatively concluded that there was no need to establish a separate space-constrained class for SPVUs, given that certain models currently listed by manufacturers as SPVUs, most of which would meet the ASHRAE space-constrained definition, are being misclassified and should be classified as central air conditioners (in most cases, space-constrained central air conditioners). 79 FR 20114, 20123 (April 11, 2014).

In response to the April 2014 NODA, AHRI and NCP requested that DOE adopt the new ASHRAE 90.1–2013 space-constrained SPVU product class. (AHRI, No. 24 at pp. 1–2; NCP, No. 16 at p. 3) First Co. disagreed with DOE's conclusion that space-constrained SPVUs should be regulated as consumer products rather than commercial equipment and stated that increasing energy conservation standards for SPVU should be done by changing EER/COP, as ASHRAE has done, not by reclassifying them as consumer products. (First Co. No. 14 at p. 1)

DOE does not agree with these commenters and has provided responses to specific concerns below.

Lennox and NCP stated that multi-family structures above 3 stories are considered commercial buildings by both EPCA and ASHRAE Standard 90.1. (Lennox International, No. 15 at p. 4; NCP, No. 16 at pp. 7–8) AHRI added that hotels, apartments, and dormitories are all commercial applications in building types falling within the scope of ASHRAE Standard 90.1. (AHRI, No. 24 at p. 4) NCP argued that SPVUs are distributed to a significant extent for commercial applications, including commercial lodging such as student housing and dormitories, nursing homes, assisted care facilities, hotels, and high-rise apartment buildings. (NCP, No. 16 at p. 10) GE, Lennox, and AHRI analogized that many SPVU are distributed in the same market segments as PTAC/PTHP, which is a type of commercial equipment. (GE Appliances, No. 20 at p. 2; Lennox International, No. 15 at p. 4; AHRI, No. 24 at p. 4)

GE, Lennox, and AHRI stated that SPVU are sold to commercial entities and that consumers are never involved in those sale transactions. (GE Appliances, No. 20 at p. 2; Lennox International, No. 15 at p. 5; AHRI, No. 24 at p. 5) Lennox added that SPVUs (including space-constrained models) involve a much higher degree of design integration than residential split system central air conditioners. (Lennox International, No. 15 at p. 5) NCP argued that while SPVUs may be used temporarily by individual occupants, over their life, they are owned and maintained by the commercial entities that own the buildings. (NCP, No. 16 at p. 7) NCP also added that characterizing SPVUs used in lodging as consumer products is going overbroad, because it overlooks the energy use constraints of various multi-family building configurations. (NCP, No. 16 at p. 3)

DOE notes that the definitions for ''consumer product'' and ''industrial equipment'' in EPCA are not dependent on the definition of residential or commercial buildings found elsewhere in EPCA or in ASHRAE Standard 90.1. As discussed in the April 2014 ASHRAE NODA, EPCA defines ''industrial equipment'' as any article of equipment of certain specified types that consumes, or is designed to consume, energy, which is distributed to any significant extent for industrial and commercial use, and which is not a covered product as defined in 42 U.S.C. 6291(2),[26] without regard to whether such article is in fact distributed in commerce for industrial or commercial use. (42 U.S.C. 6311(2)(A)) EPCA defines ''consumer product'' as any article: (1) Of a type that consumes or is designed to consume energy, and, to any significant extent, is distributed in commerce for personal use or consumption by individuals, (2) without regard to whether such article of such type is in fact distributed in commerce for personal use or consumption by an individual. (42 U.S.C. 6291(1))

Consistent with the NODA and these relevant statutory provisions, DOE maintains that products serving individual rooms in multi-family and lodging applications is for personal use or consumption by individuals, regardless of who designed the system, was involved in the sale transaction, or maintains the equipment. In addition, DOE found similarities between units designed for multi-family applications and those intended for commercial lodging applications, indicating that those products should be treated the same under DOE's regulatory scheme.

Furthermore, the definitions of ''industrial equipment'' and ''consumer product'' are mutually exclusive. A product can only be considered commercial/industrial equipment under EPCA if it does not fit the definition of consumer product. PTACs, referenced by stakeholders as commercial equipment with applications similar to space-constrained SPVUs, are not relevant to this argument because the definition for ''central air conditioner'' explicitly excludes PTACs (*see* 42 U.S.C. 6291(21)). Therefore, DOE differentiates these situations, because while many of the products that would meet the ASHRAE definition for a space-constrained SPVU would also meet the EPCA definition for central air conditioner, PTACs cannot meet the latter definition because they are explicitly excluded.

Lennox and AHRI stated that in the November 4, 2013 proposed rule, ''Energy Conservation Program for Consumer Products and Certain Commercial and Industrial Equipment: Test Procedures for Residential and Commercial Water Heaters,'' (78 FR 66202), DOE recognized that there are commercial water heaters that ''could have residential applications,'' yet DOE specifically chose not to treat that equipment as a consumer covered product because it would be distributed to a (more) significant extent as a commercial product. (Lennox International, No. 15 at p. 5; AHRI, No. 24 at p. 5) NCP agreed that DOE should regulate SPVU in the same manner as DOE recently proposed for light commercial water heaters. (NCP, No. 16 at p. 10) Lennox International, AHRI, and NCP all maintain that SPVUs are used to a significant extent in commercial applications and more rarely in residential applications. (Lennox International, No. 15 at p. 5; AHRI, No. 24 at p. 5; NCP, No. 16 at p. 10)

To clarify this issue, DOE provides the following excerpt from the November 2013 NOPR, along with additional information. The specific

[26] The term ''covered product'' means a consumer product of a type specified in section 6292 of this title. (42 U.S.C. 6291(2)) Central air conditioners and central air conditioning heat pumps are listed as a covered product in section 6292. (42 U.S.C. 6292(a)(3))

reference from the November 2013 NOPR is as follows: ''Although light commercial water heaters could have residential applications, DOE notes that the new 'light commercial water heater' definition represents a type of water heater that, to a significant extent, is distributed in commerce for industrial or commercial use. These water heaters were and continue to be covered industrial equipment, and, if these proposals are finalized, will continue to be subject to the regulations in part 431 and the certification requirements for commercial and industrial equipment in part 429.'' 78 FR 66202, 66207 (Nov. 4, 2013). One must keep in mind that EPCA's definition addressing various types of ''water heater[s]'' contains specific limitations on the input capacities for such models to be considered consumer products. (42 U.S.C. 6291(27); codified at 10 CFR 430.2) DOE further notes that the proposed definition for ''light commercial water heater'' makes the equipment a subtype of commercial water heater. 78 FR 66202, 66207 (Nov. 4, 2013). Commercial storage and instantaneous water heaters are specifically listed in EPCA as a type of industrial equipment at 42 U.S.C. 6313(1)(K) and defined at 42 U.S.C. 6311(12), and there are a number of related definitions in DOE's regulations (*see* 10 CFR 431.102). Therefore, under the statutory scheme, equipment can only be classified as a ''light commercial water heater'' if it does not meet the definition of a ''water heater'' under 10 CFR 430.2. In the same way, space-constrained SPVUs can only be classified as industrial equipment if they do not meet the definition of ''central air conditioner'' or any other covered consumer product.

Lennox, NCP, and AHRI also referred to the history of SPVUs, stating that all SPVUs were previously classified as central air conditioners; the product class was not introduced in ASHRAE Standard 90.1 until the 2004 version and not established in EPCA until EISA 2007, which explicitly separated out SPVUs as type of covered equipment. (NCP, No. 16 at p. 9; Lennox International, No. 15 at p. 3; AHRI, No. 24 at pp. 3–4) NCP and Lennox added that EISA 2007 specified that SPVACs include equipment that is mounted ''through an outside wall,'' expressly contemplating space-constrained units. (NCP, No. 16 at p. 9; Lennox International, No. 15 at pp. 2–3) NCP commented that in an October 2000 NOPR (65 FR 59590, 59610 (Oct. 5, 2000)), DOE proposed creating standards for SPVUs as a niche product, noting that SPVUs ''are not distributed for personal use or consumption by individuals, and therefore believes that at present they are commercial products. . . .'' NCP added that the NOPR (*Id.*) acknowledged that ''the difficult air flow configuration . . . combined with the attempt to minimize the size constrains the ability of these units to attain higher SEERs.'' (NCP, No. 16 at p. 9)

DOE disagrees that all SPVUs were classified as residential central air conditioners prior to EISA 2007. Traditional (non-space constrained) SPVU units and three-phase units would have been classified either as commercial air conditioners or not covered. Furthermore, in the April 2014 NODA, DOE was referring to products classified as through-the-wall (TTW) until January 23, 2010 (when TTW was removed as a product class and TTW products had to meet the regulatory requirements for other central air conditioner product classes). 79 FR 20114, 20121–23 (April 11, 2014). In regards to the intent of EISA 2007 and the October 2000 NOPR, DOE notes that before ASHRAE released Addendum ''i'' to Standard 90.1–2010 in March 2011, there was no such thing as a space-constrained SPVU equipment class. Prior to that time, any references to SPVUs were in regards to traditional units that were not limited in size. Consistent with DOE's position in the October 2000 NOPR, EISA 2007 added SPVUs as a type of commercial equipment, but Congress declined to distinguish a separate equipment class for space-constrained SPVUs. DOE notes that the October 2000 NOPR also considered niche products called ''through-the-wall condensers,'' which were proposed for a separate residential product class.[27] 65 FR 59590, 59610 (Oct. 5, 2000). It is in this product class that DOE expressly contemplated residential space-constrained units, including those models previously classified as TTW that manufacturers are now attempting to classify as SPVUs. DOE does not believe the design, market, and application for these space-constrained units has changed substantially over the past 10 years. In fact, DOE believes the space-constrained products are properly classified, as they were once certified, as central air conditioners, a practice which changed only when the TTW product class was combined with the space-constrained product class and compliance with amended standards for these product classes was required. Based upon the above reasoning, DOE does not see a basis or a need for the space-constrained SPVU equipment class, as these basic models are already covered products as space-constrained central air conditioners. Any product that meets the definition of a ''consumer product'' (42 U.S.C. 6291(1)) is classified as a consumer product and must meet any applicable energy conservation standard, regardless of whether it is used in a commercial application or marketed as commercial equipment.

Lennox and AHRI asserted that the existing base of SPVU products in commercial buildings with fixed physical-dimension requirements limits the ability of manufacturers to increase efficiency; this was the reason for ASHRAE's development of the space-constrained SPVU equipment class. (Lennox International No. 15 at p. 5; AHRI No. 24 at p. 5) NCP stated that lodging and commercial SPVACs are configured for ease of access and maintenance, which impacts efficiency. (NCP, No. 16 at pp. 7–8) NCP added that the presence of multiple units venting to the outside also would affect an individual unit's ultimate performance. (NCP, No. 16 at p. 7) Lennox commented that space-constrained SPVU cannot meet the efficiency levels of residential units. (Lennox International, No. 15 at pp. 5–6)

DOE notes that while equipment meeting the ASHRAE Standard 90.1 definition of a space-constrained SPVU may in fact be constrained in efficiency, the presence of the space-constrained central air conditioner (CAC) equipment class already provides respite for these products. The SEER requirement for space-constrained CAC is 12 SEER, one point below the current standards for CAC and two points below the standard for some CACs (split system CACs in the South and all single package CACs) beginning January 1, 2015. (10 CFR 430.32(c)(1)-(3)) Furthermore, DOE notes that there are currently space-constrained units on the market that meet the 12 SEER requirement.

NCP argued that if DOE excludes equipment used in high-rise multi-family or other commercial lodging applications from the SPVAC class, DOE must establish a new equipment class because such equipment does not qualify as CAC or otherwise fall within any other existing category. (NCP, No. 16 at p. 10) Specifically, NCP stated that their Comfort Pack products cannot be classified as CAC because they always

[27] A TTW product class was created in a May 2002 final rule (67 FR 36368 (May 23, 2002)) and was replaced by the residential space-constrained product class in a June 2011 Direct Final Rule (76 FR 37408, (June 27, 2011)).

include gas or electric resistance heat. (NCP, No. 16 at pp. 5–6)

In response to NCP, EPCA defines ''central air conditioner'' as a product, other than a packaged terminal air conditioner, which: (1) Is powered by single phase electric current; (2) is air-cooled; (3) is rated below 65,000 Btu per hour; (4) is not contained within the same cabinet as a furnace with a rated capacity above 225,000 Btu per hour; and (5) is a heat pump or a cooling only unit. (42 U.S.C. 6291(21); 10 CFR 430.2) DOE notes that criteria number 5 refers to coverage of both a type of air conditioner unit that can only perform cooling (*i.e.,* a ''cooling only unit'') as well as a type of air conditioner unit that can perform both cooling and heating (*i.e.,* a ''heat pump''). Criteria number 5 does not refer to other components such as a furnace or electric heater. The only heating component that excludes equipment from coverage under this definition is a furnace with a rated capacity above 225,000 Btu/hour, as set forth in criteria number 4. DOE notes that for units meeting the definition of ''central air conditioner'' and also containing a furnace in the package (with a rated capacity under 225,000 Btu/hour), the air conditioner is subject to one set of energy conservation standards, while the furnace may be subject to separate standards.

First Co. stated that its commercially-designed SPVHPs cannot be tested under the HSPF test procedure because they cannot be operated at temperatures required for testing Frost Accumulation or Low Temperature. (First Co., No. 14 at p. 2)

In response to First Co., DOE notes that whether a product can be tested in accordance with the test procedure is not typically determinative of whether it meets the product's definition. Instead, the characteristics of the product (as outlined above for central air conditioning) determine whether it meets the definition. If a product that meets the definition cannot be tested in accordance with the test procedure, a manufacturer may apply to DOE for a waiver of the test procedure..

AHRI and GE Appliances stated that all models of SPVUs listed in the AHRI Directory meet the requirement of having components arranged vertically and current models of space-constrained SPVU meet the EPCA definition of ''SPVU.'' (AHRI, No. 24 at pp. 3–4; GE Appliances, No. 20 at pp. 1–2) NCP reasoned that by ''arranged vertically,'' DOE intends to address products that operate in a vertical manner, with a bottom ''return air'' opening and a top ''supply air'' opening. This configuration is commonly referred to within the industry as an ''Upflow'' unit. In addition, for NCP Comfort Pack units, the gas furnace or electrical heating component is positioned vertically above the cooling component and along the vertically moving air flow. Accordingly, NCP's products are vertically arranged as contemplated by the EPCA. (NCP, No. 16 at pp. 4–5)

In response, the EPCA definition for ''SPVU'' requires that the major components be arranged vertically. (42 U.S.C. 6311(22)(A)(i); 10 CFR 431.92) In the April 2014 NODA, when stating that some models do not have their components arranged vertically, DOE was referring to units in which all components were on the same horizontal plane within the cabinet. 79 FR 20114, 20122 (April 11, 2014). DOE acknowledges that most of the products in the AHRI database do have their components arranged vertically. However, even if the units in the AHRI database have their components arranged vertically and otherwise meet the definition of ''SPVU,'' they may also meet the definition of an applicable consumer product, which takes precedence, as discussed previously.

For all of the reasons discussed in this section, DOE is maintaining the position on space-constrained units that it outlined in the April 2014 NODA. Specifically, DOE has not identified a need to establish a separate space-constrained class for SPVUs, given that certain units currently listed by manufacturers as SPVUs, most of which would meet the ASHRAE space-constrained definition, are being misclassified and are appropriately classified as central air conditioners (in most cases, space-constrained central air conditioners).

Lennox and AHRI stated that DOE should expand the applications considered in the analysis; AHRI specified that in addition to office, education, and telecom, DOE should consider lodging, multi-family, and assisted-living applications. (Lennox International No. 15 at p. 7; AHRI No. 24 at p. 6) DOE notes that the applications used in the analysis apply to traditional (non-space constrained) SPVUs. DOE believes that the additional applications suggested by Lennox and AHRI are primarily related to space-constrained applications. Given that DOE is not considering the space-constrained units to be SPVUs, DOE has not included the additional applications in its analysis.

Issue 1: DOE seeks comment on its tentative conclusion that the creation of a space-constrained equipment class for SPVUs is not warranted.

C. Technological Feasibility

1. General

In each energy conservation standards rulemaking, DOE conducts a screening analysis based on information 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 an 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 those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially-available products or in working prototypes to be technologically feasible. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(i).

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) Practicability to manufacture, install, and service; (2) adverse impacts on product utility or availability; and (3) adverse impacts on health or safety. 10 CFR part 430, subpart C, appendix A, section 4(a)(4)(ii)–(iv). Section IV.B of this preamble discusses the results of the screening analysis for SPVUs, 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 NOPR Technical Support Document (TSD).

After screening out or otherwise removing from consideration most of the technologies, the following technologies were identified for consideration in the engineering analysis: (1) Increased frontal coil area; (2) increased depth of coil; (3) improved fan motor efficiency; (4) improved fan blade efficiency; and (5) improved compressor efficiency, and (6) dual condensing heat exchangers. To adopt standards for SPVUs that are more stringent than the efficiency levels in ASHRAE Standard 90.1 as amended, DOE must determine, supported by clear and convincing evidence, that such standards are technologically feasible. (42 U.S.C. 6313(a)(6)(A)(ii)(II)) Since these six design options are commercially available, have been used in SPVU equipment, and are the most common ways by which manufacturers improve the energy efficiency of their

SPVUs, DOE has tentatively determined that clear and convincing evidence supports the conclusion that all of the efficiency levels evaluated in this NOPR are technologically feasible.

Additionally, DOE notes that the four screening criteria do not directly address the propriety status of design options. DOE only considers efficiency levels achieved through the use of proprietary designs in the engineering analysis if they are not part of a unique path to achieve that efficiency level (*i.e.,* if there are other non-proprietary technologies capable of achieving the same efficiency). DOE believes the proposed standards for the equipment covered in this rulemaking would not mandate the use of any proprietary technologies, and that all manufacturers would be able to achieve the proposed levels through the use of non-proprietary designs. DOE seeks comment on this tentative conclusion and requests additional information regarding proprietary designs and patented technologies.

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. Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible (''max-tech'') improvements in energy efficiency for SPVUs, using the design parameters for the most efficient products available on the market or in working prototypes. (See chapter 5 of the NOPR TSD.) The max-tech levels that DOE determined for this rulemaking are described in section IV.C.1 of this proposed rule.

D. Energy Savings

1. Determination of Savings

For each TSL, DOE projected energy savings from the products that are the subject of this rulemaking purchased in the 30-year period that begins in the year of compliance with amended standards (2015–2044 for the ASHRAE level, and 2019–2048 for higher efficiency levels). The savings are measured over the entire lifetime of products purchased in the 30-year analysis period.[28] DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and both base cases. The base case represents a projection of energy consumption in the absence of amended mandatory energy conservation standards, and it considers market forces and policies that affect demand for more-efficient products.

DOE used its national impact analysis (NIA) spreadsheet model to estimate energy savings from amended standards for the products that are the subject of this rulemaking. The NIA spreadsheet model (described in section IV.G of this preamble) calculates energy savings in site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE reports national energy savings in terms of the savings in the energy that is used to generate and transmit the site electricity. To calculate this quantity, DOE derived annual conversion factors from the model used to prepare the Energy Information Administration's (EIA) *Annual Energy Outlook 2013* (*AEO 2013*).[29]

DOE has begun to also estimate full-fuel-cycle energy savings, as discussed in DOE's statement of policy and notice of policy amendment. 76 FR 51281 (August 18, 2011), as amended at 77 FR 49701 (August 17, 2012). The full-fuel-cycle (FFC) metric includes the energy consumed in extracting, processing, and transporting primary fuels, and, thus, presents a more complete picture of the impacts of energy efficiency standards. DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered equipment. See section IV.G.1.a for further discussion.

2. Significance of Savings

Among the criteria that govern DOE's adoption of more-stringent standards for SPVUs than the amended levels in ASHRAE Standard 90.1, clear and convincing evidence must support a determination that the standards would result in ''significant'' additional energy savings. (42 U.S.C. 6313(a)(6)(A)(ii)(II)) Although 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 (D.C. Cir. 1985), indicated that Congress intended ''significant'' energy savings in this context to be savings that were not ''genuinely trivial.'' DOE's estimates of the energy savings for each of the TSLs considered for the proposed rule for SPVUs <65,000 Btu/h (presented in section V.B.3.a) provide evidence that the additional energy savings each would achieve by exceeding the corresponding efficiency levels in ASHRAE Standard 90.1–2013 are nontrivial. Therefore, DOE considers these savings to be ''significant'' as required by 42 U.S.C. 6313(a)(6)(A)(ii)(II).

E. Economic Justification

1. Specific Criteria

As discussed beforehand, EPCA provides seven factors to be evaluated in determining whether a potential energy conservation standard is economically justified. (42 U.S.C. 6313(a)(6)(B)(ii)(I)–(VII)) 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 a potential amended standard on manufacturers, DOE conducts a manufacturer impact analysis (MIA), as discussed in section IV.I. DOE first uses an annual cash-flow approach to determine the quantitative impacts. This step incorporates both a short-term impacts—based on the cost and capital requirements during the period between when a regulation is issued and when entities must comply with the regulation—and a long-term impacts over a 30-year period.[30] The industry-wide impacts analyzed include: (1) Industry net present value (INPV), which values the industry on the basis of expected future cash flows; (2) cash flows by year; (3) changes in revenue and income; and (4) other measures of impact, as appropriate. Second, DOE analyzes and reports the impacts on sub-groups manufacturers, such as 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, as discussed in section IV.M. Finally, DOE takes into account cumulative impacts of various DOE regulations and other regulatory requirements on manufacturers.

[28] In the past, DOE presented energy savings results for only the 30-year period that begins in the year of compliance. In the calculation of economic impacts, however, DOE considered operating cost savings measured over the entire lifetime of products purchased in the 30-year period. DOE has chosen to modify its presentation of national energy savings to be consistent with the approach used for its national economic analysis.

[29] Conversion factors based on the *Annual Energy Outlook 2014* (*AEO 2014*), which became available too late for incorporation into this analysis, show very little change compared to the *AEO 2013*-based factors. DOE plans to use convresion factors based on the most recent *AEO* available for the next phase of this rulemaking, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

[30] DOE also presents a sensitivity analysis that considers impacts for products shipped in a 9-year period.

For individual consumers, measures of economic impact include the changes in life-cycle cost (LCC) and payback period (PBP) associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also calculates the national net present value of the economic impacts applicable to a particular rulemaking. DOE also evaluates the LCC impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a national standard.

b. Savings in Operating Costs Compared to Increase in Price (Life-Cycle Costs)

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product compared to any increase in the price of the covered product that are likely to result from the imposition of the standard. (42 U.S.C. 6313(a)(6)(B)(ii)(II)) DOE conducts this comparison in its LCC and PBP analysis.

The LCC is the sum of the purchase price of a piece of equipment (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the equipment. To account for uncertainty and variability in specific inputs, such as equipment lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value. For its analysis, DOE assumes that consumers will purchase the covered equipment in the first year of compliance with amended standards.

The LCC savings and the PBP for the considered efficiency levels are calculated relative to a base case that reflects projected market trends in the absence of amended standards. DOE identifies 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. DOE's LCC analysis is discussed in further detail in section IV.F.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for adopting an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6313(a)(6)(B)(ii)(III)) As discussed in section IV.G, DOE uses the NIA spreadsheet to project national 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 evaluates potential standards that would not lessen the utility or performance of the considered products. (42 U.S.C. 6313(a)(6)(B)(ii)(IV)) Based on data available to DOE, the proposed standards would not reduce the utility or performance of the products under consideration in this rulemaking.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider any lessening of competition that is likely to result from energy conservation 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. 6313(a)(6)(B)(ii)(V)) DOE will transmit a copy of this proposed rule to the Attorney General with a request that the Department of Justice (DOJ) provide its determination on this issue. DOE will publish and address the Attorney General's determination in the final rule.

f. Need for National Energy Conservation

In evaluating the need for national energy conservation, DOE expects that the energy savings from the proposed standards are likely to provide improvements to the security and reliability of the nation's energy system. (42 U.S.C. 6313(a)(6)(B)(ii)(VII)) Reductions in the demand for electricity also may 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, as discussed in section IV.L.

The proposed standards also are 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 emissions impacts from the proposed standards, and from each TSL it considered, in section IV.J of this preamble. DOE also reports estimates of the economic value of emissions reductions resulting from the considered TSLs, as discussed in section IV.K.

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. 6313(a)(6)(B)(ii)(VII))

2. Rebuttable Presumption

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's 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 effects that proposed energy conservation standards would have on the payback period for customers. These analyses include, but are not limited to, the 3-year payback period contemplated under the rebuttable-presumption test.

In addition, DOE routinely conducts an economic analysis that considers the full range of impacts to customers, manufacturers, the Nation, and the environment, as required under 42 U.S.C. 6313(a)(6)(B)(ii). The results of this analysis serve as the basis for DOE's evaluation of 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 V.B.1.c of this proposed rule.

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this rulemaking with regards to SPVACs and SPVHPs. A separate subsection addresses each component of the analysis.

A. Market and Technology Assessment

To start the rulemaking analysis for SPVACs and SPVHPs, DOE researched information that provided an overall picture of the market for this equipment, including the purpose of the equipment, the industry structure, manufacturers, market characteristics, and technologies used in the equipment. This activity included both quantitative and qualitative assessments based primarily on publically-available information. The topics addressed in this market and technology assessment for the rulemaking include definitions, equipment classes, manufacturers, quantities, and types of equipment sold and offered for sale. The key findings of

DOE's market assessment are summarized below. For additional detail, see chapter 3 of the NOPR TSD.

1. Definitions of a SPVAC and a SPVHP

EPCA defines ''single package vertical air conditioner'' and ''single package vertical heat pump'' in 42 U.S.C. 6311(23) and (24). In particular, these units can be single or three-phase; must have major components arranged vertically; must be an encased combination of components; and must be intended for exterior mountain on, adjacent interior to, or through an outside wall. DOE codified these definitions into its regulations at 10 CFR 431.92. Certain of these equipment types are sometimes referred to as ''wall-mount'' units and are commonly installed on the exterior wall of classrooms, modular office buildings, and telecom shelters. Certain others of these units are also sometimes found installed in the interior wall of classrooms, such as in a utility closet. These units are beneficial because they provide each room with individual temperature control, and because in the event of a failure of the system, only one room would be affected as opposed to the whole space.

2. Equipment Classes

In evaluating and establishing energy conservation standards, DOE divides covered equipment into equipment classes based on the type of energy used or by capacity or other performance-related feature that justifies having a higher or lower standard from that which applies to other equipment classes.

EPCA currently divides both SPVACs and SPVHPs into 3 size categories and sets a Federal minimum energy efficiency standard for each equipment class. During its research for the market and technology assessment, DOE did not find any performance-related features that would justify creating a new equipment class for SPVUs. Accordingly, for this rulemaking, DOE is proposing to maintain the same equipment classes, as shown in Table IV.1.

TABLE IV.1—CURRENT FEDERAL EQUIPMENT CLASSES FOR SPVUS

Equipment class	Size category (Btu/h)
SPVAC	<65,000.
	≥65,000 and <135,000.
	≥135,000 and <240,000.
SPVHP	<65,000.
	≥65,000 and <135,000.
	≥135,000 and <240,000.

3. Refrigerants

Since January 1st, 2010, all newly manufactured SPVUs in the United States have no longer been allowed to use the previously-prevalent R–22 refrigerant per the Montreal Protocol. As result, the vast majority of SPVUs began using R410A refrigerant instead. DOE is aware of one alternative refrigerant, R407C, which can be used as a replacement for R410A in SPVUs. DOE is aware of some SPVUs which utilize R407C; however, these units are not offered for sale in the United States and therefore are not included among the products potentially regulated by this rule.

4. Review of the Current Market for SPVUs

In order to gather information needed for the market assessment for SPVUs, DOE consulted a variety of sources, including manufacturer literature, manufacturer Web sites, and the AHRI Directory of Certified Product Performance. This information served as resource material throughout the rulemaking. The sections below provide an overview of the SPVU market. For more detail on the SPVU market, see chapter 3 of the NOPR TSD.

a. Trade Association Information

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) is the trade association representing SPVU manufacturers. AHRI develops and publishes technical standards for residential and commercial air-conditioning, heating, and refrigeration equipment using rating criteria and procedures for measuring and certifying equipment performance. The current Federal test procedure for SPVUs incorporates by reference an AHRI standard—AHRI 390–2003, ''Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps.'' AHRI also maintains the Directory of Certified Product Performance, which is a database of equipment ratings for all manufacturers who elect to participate in the program. AHRI has two subsections for SPVUs: (1) Single Package Vertical Systems—AC; and (2) Single Package Vertical Systems—HP. DOE used the data in this certification directory in its market assessment.

b. Manufacturer Information

For SPVUs, DOE identified seven manufacturers: (1) Bard Manufacturing Company; (2) Change'Air; (3) Johnson Controls, Inc.; (4) Marvair; (5) Modine Manufacturing Company; (6) National Coil Company; and (7) Temspec, Inc. DOE also identified certain other companies that list their products in the AHRI Directory, but DOE believes that these models are residential products and not commercial equipment. Therefore, DOE did not include those manufacturers in this list.

Issue 2: DOE seeks comment on whether there are additional companies not named which manufacture this type of equipment.

DOE also takes into consideration the impact of amended energy conservation standards on small businesses. At this time, DOE has identified one small business (Bard Manufacturing Company) in the SPVU market that fall under the Small Business Administration (SBA)'s threshold as having 750 employees or fewer. DOE studies the potential impacts on these small businesses in detail during the manufacturer impact analysis (MIA). A summary of these impacts is contained in section IV.I and VI.B of this NOPR and described in further detail in chapter 12 of the NOPR TSD.

c. Market Data

From the AHRI Directory and manufacturers' Web sites, DOE compiled a database of 319 SPVACs and 270 SPVHPs. Of the 589 total SPVUs, DOE was able to gather efficiency data on 497 units (about 86 percent of DOE's database). DOE was not able to find any units on the market for SPVAC or SPVHP equipment with a cooling capacity greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h and for SPVHP with a cooling capacity greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h. For more information on the SPVU equipment currently available on the market, including a full breakdown of these units into their equipment classes and graphs showing performance data, see chapter 3 of the NOPR TSD.

5. Technology Assessment

In the technology assessment, DOE identifies technology options that appear to be feasible mechanisms for improving equipment efficiency. This assessment provides the technical background and structure on which DOE bases its screening and engineering analyses.

DOE began its technology assessment by examining SPVUs that are currently on the market at both the baselines and higher efficiency levels. This allowed DOE to identify technologies that are commonly incorporated into equipment to achieve higher efficiencies, as well as the impact of certain components and improvements on SPVU efficiency. DOE also researched technology options that are utilized in other air-conditioning and refrigeration equipment to determine their potential applicability to SPVUs. Lastly, DOE explored the market and technical information to identify technologies that have not yet come to market but that are under development and to determine whether those technologies have the potential to improve SPVU efficiency. Although DOE does consider technologies that are proprietary, it does not consider efficiency levels that can only be reached through the use of proprietary technologies, which could allow a single manufacturer to monopolize the market (any such technologies are eliminated during the engineering analysis). Through these methods, DOE identified numerous technologies that could improve the energy efficiency of SPVUs.

Generally, these technologies involve improvements to either the heat exchangers or to the other system components that will improve the overall energy efficiency of the system. First, DOE identified technologies that improve the heat exchanger effectiveness, which included: (1) Increased frontal coil area; (2) increased depth of coil (additional tube rows); (3) increased fin density; (4) improved fin design; (5) improved tube design; (6) hydrophilic film coating on fins; (7) changing to microchannel heat exchangers; and (8) dual condensing heat exchangers. Second, DOE identified technologies that improve the efficiency of other components that make up the rest of the system, including: (1) Improved indoor and outdoor fan motor efficiency; (2) improved fan blade efficiency; (3) improved compressor efficiency (including multi-speed compressors); (4) thermostatic or electronic expansion valves; and (5) thermostatic cyclic controls. All of these technology options are presented in Table IV.2.

TABLE IV.2—POTENTIAL TECHNOLOGY OPTIONS FOR IMPROVED ENERGY EFFICIENCY OF SPVUS

Technology Options	
Heat Exchanger Improvements	Increased frontal coil area.
	Increased depth of coil.
	Increased fin density.
	Improved fin design.
	Improved tube design.
	Hydrophilic film coating on fins.
	Microchannel heat exchangers.
	Dual condensing heat exchangers.
Indoor Blower and Outdoor Fan Improvements	Improved fan motor efficiency.
	Improved fan blades.
Compressor Improvements	Improved compressor efficiency.
	Multi-speed Compressors.
Other Improvements	Thermostatic expansion valves.
	Electronic expansion valves.
	Thermostatic cyclic controls.

Chapter 3 of the NOPR TSD provides additional detail and descriptions of the basic construction and operation of SPVUs, followed by a detailed discussion of each of the technology options discussed in the preceding paragraph. After identifying technology options that will improve the efficiency of SPVUs, DOE passed each of those technology options to the screening analysis for further evaluation.

B. Screening Analysis

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

1. *Technological feasibility.* DOE will consider technologies incorporated in commercial products or in working prototypes to be technologically feasible.

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 a 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))

These four screening criteria do not include the propriety status of design options. As noted previously, DOE will only consider efficiency levels achieved through the use of proprietary designs in the engineering analysis if they are not part of a unique path to achieve that efficiency level. DOE does not believe that any of the technologies identified in the technology assessment are proprietary, and thus, did not eliminate any technologies for that reason. Through a review of each technology, DOE found that the technologies identified met all four screening criteria to be examined further in the analysis.

Typically, technologies that pass the screening analysis are subsequently passed through to the engineering analysis for consideration in DOE's downstream cost-benefit analysis. However, DOE did not analyze some of the technologies identified in the technology assessment because either: (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; or (3) the test procedure and EER or COP metric would not measure the energy impact of these technologies. Accordingly, DOE eliminated the following technologies from further consideration based upon these three additional considerations:

(1) Increased fin density
(2) Improved fin design;
(3) Improved tube design;
(4) Hydrophilic film coating on fins;

(5) Thermostatic or electronic expansion valves;
(6) Thermostatic cyclic controls;
(7) Microchannel heat exchangers; and
(8) Multi-speed compressors.

Of these technologies, numbers 1 through 4 are used in baseline products, so no additional energy savings would be expected. Any potential energy savings of technologies 5, 6, or 8 cannot be measured with the established energy use metrics (EER and COP) because those technologies are associated with part-load performance, which is not captured in the EER or COP metrics used for rating SPVUs. Information indicating efficiency improvement potential in SPVUs is not available for technology number 7.

Issue 3: DOE requests comment on its elimination of these technologies from consideration based upon the criteria discussed above.

After screening out or otherwise removing from consideration most of the technologies, the following technologies were identified for consideration in the engineering analysis: (1) Increased frontal coil area; (2) increased depth of coil; (3) improved fan motor efficiency; (4) improved fan blade efficiency; (5) improved compressor efficiency, and (6) dual condensing heat exchangers.

Chapter 4 of the NOPR TSD contains additional details on the screening analysis.

C. Engineering Analysis

The engineering analysis establishes the relationship between an increase in energy efficiency of the equipment and the increase in manufacturer selling price (MSP) associated with that efficiency level. This relationship serves as the basis for cost-benefit calculations for individual consumers, manufacturers, and the Nation. DOE typically structures its engineering analysis using one of three approaches: (1) Design-option; (2) efficiency-level; or (3) reverse engineering (or cost-assessment). A design-option approach identifies individual technology options (from the market and technology assessment) that can be used alone or in combination with other technology options to increase the energy efficiency of a unit of equipment. Under this approach, cost estimates of the baseline equipment and more-efficient equipment that incorporates design options are based on manufacturer or component supplier data or engineering computer simulation models. Individual design options, or combinations of design options, are added to the baseline model in descending order of cost-effectiveness. An efficiency-level approach establishes the relationship between manufacturer cost and increased efficiency at predetermined efficiency levels above the baseline. Under this approach, DOE typically assesses increases in manufacturer cost for incremental increases in efficiency, without identifying the technology or design options that would be used to achieve such increases. A reverse-engineering, or cost-assessment, approach involves disassembling representative units of SPVACs and SPVHPs, and estimating the manufacturing costs based on a ''bottom-up'' manufacturing cost assessment; such assessments use detailed data to estimate the costs for parts and materials, labor, shipping/packaging, and investment for models that operate at particular efficiency levels.

DOE conducted this engineering analysis for SPVUs using a combination of the efficiency level and cost-assessment approaches for analysis of the EER and COP efficiency levels. More specifically, DOE identified the efficiency levels for the analysis based on market data and then used the cost-assessment approach to determine the manufacturing costs at those levels.

1. Efficiency Levels for Analysis

The engineering analysis first identifies representative baseline equipment, which is the starting point for analyzing potential technologies that provide energy efficiency improvements. ''Baseline equipment'' refers to a model or models having features and technologies typically found in the least-efficient equipment currently available on the market. Based on market data, DOE identified 36,000 Btu/h (3-ton) as the representative cooling capacity for SPVACs and SPVHPs with a cooling capacity less than 65,000 Btu/h, and DOE identified 72,000 (6-ton) as the representative cooling capacity for SPVACs and SPVHPs with a cooling capacity greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h. In the case of SPVUs with a cooling capacity less than 65,000 Btu/h, 3-ton represents the cooling capacity with the most models in the database for SPVACs and SPVHPs. For SPVACs with a cooling capacity greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h, 6-ton represents the most common size for that equipment class. DOE did not find any models of SPVHPs greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h on the market. DOE did not find any SPVUs on the market with cooling capacities greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h.

Next, using the information DOE gathered during the market and technology assessment, DOE selected higher efficiency levels for analysis for these representative cooling capacities based on the most common equipment efficiencies on the market and identified typical technologies and features incorporated into equipment at these higher efficiency levels. DOE also selected the highest efficiency level on the market for each equipment class (*i.e.*, the max-tech level). To determine the appropriate coefficient of performance (COP) levels for SPVHPs, DOE performed an analysis of how COP relates to energy efficiency ratio (EER). DOE reviewed the models in the database it compiled, and for each equipment class, DOE calculated the median COP for each EER efficiency level for analysis. Table IV.3 and Table IV.4 below list the efficiency levels for analysis for SPVUs. Because DOE found no equipment on the market for SPVUs with cooling capacities ≥135,000 Btu/h and <240,000 Btu/h, DOE did not analyze any efficiency levels for those equipment classes.

TABLE IV.3—EFFICIENCY LEVELS FOR ANALYSIS FOR SPVUS <65,000 BTU/H

Efficiency level	SPVAC, 36,000 Btu/h	SPVHP, 36,000 Btu/h
EPCA Baseline [31]	9.0 EER	9.0 EER. 3.0 COP.
ASHRAE Baseline [32].	10.0 EER	10.0 EER. 3.0 COP.
EL1	10.5 EER	10.5 EER. 3.2 COP.
EL2	11.0 EER	11.0 EER. 3.3 COP.
EL3	11.75 EER	11.75 EER. 3.9 COP.
EL4 (max-tech)	12.3 EER	12.3 EER. 3.9 COP.

TABLE IV.4—EFFICIENCY LEVELS FOR ANALYSIS FOR SPVUS ≥65,000 BTU/H AND <135,000 BTU/H

Efficiency level	SPVAC, 72,000 Btu/h	SPVHP, 72,000 Btu/h
EPCA Baseline	8.9 EER	8.9 EER. 3.0 COP.

[31] Refers to the currently-applicable federal minimum efficiency level. See *http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/35.*

[32] Refers to the current minimum efficiency permitted by the latest version of the ASHRAE standard, ASHRAE 90.1–2013.

TABLE IV.4—EFFICIENCY LEVELS FOR ANALYSIS FOR SPVUS ≥65,000 BTU/H AND <135,000 BTU/H—Continued

Efficiency level	SPVAC, 72,000 Btu/h	SPVHP, 72,000 Btu/h
ASHRAE Baseline (max-tech).	10.0 EER	10.0 EER. 3.0 COP.

Issue 3: DOE seeks comment on the EER and COP pairings for SPVHPs and its method of deriving the pairings.

2. Teardown Analysis

After selecting a representative capacity and efficiency level for each equipment class, DOE selected equipment near both the representative cooling capacity and the selected efficiency levels for its teardown analysis. DOE gathered information from these teardowns to create a detailed bill of materials (BOMs) that included all components and processes used to manufacture the equipment. To assemble the BOMs and to calculate the manufacturing product costs (MPCs) of SPVUs, DOE disassembled multiple units into their base components and estimated the materials, processes, and labor required for the manufacture of each individual component, a process known as a ''physical teardown.'' Using the data gathered from the physical teardowns, DOE characterized each component according to its weight, dimensions, material, quantity, and the manufacturing processes used to fabricate and assemble it.

DOE also used a supplementary method called a ''virtual teardown,'' which examines published manufacturer catalogs and supplementary component data to estimate the major differences between a unit of equipment that was physically disassembled and a similar unit of equipment that was not. For virtual teardowns, DOE gathered product data such as dimensions, weight, and design features from publicly-available information, (*e.g.*, manufacturer catalogs and manufacturer Web sites). DOE also obtained information and data not typically found in catalogs, such as fan motor details or assembly details, from physical teardowns of similar equipment or through estimates based on industry knowledge. The teardown analysis included 14 physical and virtual teardowns of SPVUs.

The teardown analysis allowed DOE to identify the technologies that manufacturers typically incorporate into their equipment, along with the efficiency levels associated with each technology or combination of technologies. The end result of each teardown is a structured BOM, which DOE developed for each of the physical and virtual teardowns. The BOMs incorporate all materials, components, and fasteners (classified as either raw materials or purchased parts and assemblies) and characterize the materials and components by weight, manufacturing processes used, dimensions, material, and quantity. The BOMs from the teardown analysis were then used as inputs to the cost model to calculate the MPCs for each type of equipment that was torn down. The MPCs resulting from the teardowns were then used to develop an industry average MPC for each equipment class analyzed. See chapter 5 of the NOPR TSD for more details.

During the development of this engineering analysis, DOE held interviews with manufacturers to gain insight into the SPVU industry and to request feedback on the engineering analysis and assumptions that DOE used. DOE used the information it gathered from those interviews, along with the information obtained through the teardown analysis, to refine the assumptions and data in the cost model. For additional detail on the teardown process, see chapter 5 of the NOPR TSD.

During the teardown process, DOE gained insight into the typical design options manufacturers use to reach specific efficiency levels. DOE can also determine the efficiency levels at which manufacturers tend to make major technological design changes. For this engineering analysis, DOE assumed that manufacturers will switch from a permanent-split capacitor (PSC) indoor motor to a brushless permanent magnet (BPM) motor to achieve the 10 EER level, which was consistent with DOE observations during the physical teardowns. As a result, the engineering results at 10 EER (and higher levels) include the cost of a BPM blower motor. This assumption is further supported by data gathered during the market assessment. In the market assessment, DOE found that at 10 EER, there is a slightly higher number of models with BPM motors than with PSC motors. However, DOE found that most of the models (18 out of 21 models) using a PSC motor at 10 EER are gas-heat units, which DOE estimates make up a small percentage (<4%) of total SPVU shipments. A breakdown of the number of models on the market with BPM and PSC motors, as well as market share estimates of SPVUs with gas-heat, can be found in Chapter 3 of the NOPR TSD (Market and Technology Assessment).

After considering the information gathered during the market assessment and observed during the teardown process, DOE concluded that BPM motors tend to be the dominant blower design option for SPVU manufacturers when reaching the 10 EER level. This assumption is accounted for in the engineering results at the 10 EER level and higher levels, as well as in the energy use characterization and, consequently, in the downstream analyses. For more information on the design options DOE considered at each efficiency level, see chapter 3 of the NOPR TSD.

Issue 4: DOE seeks comment as to whether switching to a BPM motor at 10 EER represents the most probable option of achieving that efficiency level.

3. Cost Model

DOE developed a manufacturing cost model to estimate the manufacturing production cost of SPVUs. The cost model is a spreadsheet model that converts the materials and components in the BOMs into dollar values based on the price of materials, average labor rates associated with fabrication and assembling, and the cost of overhead and depreciation, as determined based on manufacturer interviews and DOE expertise. To convert the information in the BOMs into dollar values, DOE collected information on labor rates, tooling costs, raw material prices, and other factors. For purchased parts, the cost model estimates the purchase price based on volume-variable price quotations and detailed discussions with manufacturers and component suppliers. For fabricated parts, the prices of raw metal materials (*e.g.*, tube, sheet metal) are estimates on the basis of five-year averages (from 2006 to 2011). The cost of transforming the intermediate materials into finished parts is estimated based on current industry pricing. Additional details on the cost model are contained in chapter 5 of the NOPR TSD.

4. Manufacturing Production Costs

Once the cost estimates for all the components in each teardown unit were finalized, DOE totaled the cost of materials, labor, and direct overhead used to manufacture each type of equipment in order to calculate the manufacturing production cost. The total cost of the equipment was broken down into two main costs: (1) The full manufacturing production cost, referred to as MPC; and (2) the non-production cost, which includes selling, general, and administration (SG&A) costs; the cost of research and development; and interest from borrowing for operations or capital expenditures. DOE estimated the MPC at each efficiency level considered for each equipment class, from the baseline through the max-tech level. The incremental increases in MPC over the EPCA baseline efficiency level for each subsequently higher efficiency level are shown in Table IV.5. After incorporating all of the assumptions into the cost model, DOE calculated the percentages attributable to each element of total production costs (*i.e.*, materials, labor, depreciation, and overhead). These percentages are used to validate the assumptions by comparing them to manufacturers' actual financial data published in annual reports, along with feedback obtained from manufacturers during interviews. DOE uses these production cost percentages in the MIA.

The MPCs were initially developed in 2011$. To update the MPCs to 2013$, DOE multiplied the costs by the ratio of the mid-year producer price index (PPI) in 2011 to the mid-year PPI in 2013. For SPVACs, DOE used the PPI for ''unitary air-conditioners, except for air source heat pumps'' (PCU333415333415E),[33] and similarly, the SPVHP costs were updated using the PPI for ''heat pumps'' (PCU333415333415H), which can be found on the Bureau of Labor Statistics Web site.[34]

TABLE IV.5—INCREMENTAL MPC INCREASES

Equipment type	EPCA baseline	ASHRAE baseline	EL1	EL2	EL3	EL4
SPVAC <65,000 Btu/h	....	$274.63	$343.35	$412.06	$616.89	$1,001.24
SPVAC ≥65,000 Btu/h and <135,000 Btu/h	....	381.65	....	....	....	....
SPVHP <65,000 Btu/h	....	315.51	394.45	473.39	708.71	1,150.27
SPVHP ≥65,000 Btu/h and <135,000 Btu/h	....	438.45	....	....	....	....

5. Cost-Efficiency Relationship

The result of the engineering analysis is a cost-efficiency relationship. DOE created a separate cost-efficiency relationship at the representative cooling capacity for each of the four equipment classes analyzed. DOE reported the MPCs in aggregated form to maintain confidentiality of sensitive component data. DOE obtained input from manufacturers during the manufacturer interview process on the MPC estimates and assumptions to confirm their accuracy. For SPVACs with a cooling capacity <65,000 Btu/h, DOE performed physical teardowns and supplemented that with virtual teardowns to develop cost-efficiency relationships for each manufacturer and then created a market-share-weighted relationship based on approximate market share data obtained during the manufacturer interviews. For SPVACs with a cooling capacity ≥65,000 Btu/h and <135,000 Btu/h, DOE performed virtual teardowns of a 6-ton SPVAC and determined the average percentage increase in cost from a 3-ton SPVAC to a 6-ton SPVAC. Then, DOE scaled the 3-ton cost-efficiency curve by that average percentage increase in cost. Likewise for SPVHPs with a cooling capacity <65,000 Btu/h, DOE performed a physical teardown and compared the average percentage increase in cost of a 3-ton SPVHP compared to a 3-ton SPVAC. DOE applied this average percentage increase in cost to the cost-efficiency curve for both SPVACs with a cooling capacity <65,000 Btu/h and SPVACs with a cooling capacity ≥65,000 Btu/h and <135,000 Btu/h to get the respective cost-efficiency curves for the SPVHP equipment class.

In order to develop the cost-efficiency relationships for SPVUs, DOE examined the cost differential to move from one efficiency level to the next for each manufacturer. DOE used the results of the teardowns on a market-share weighted average basis to determine the industry average cost increase to move from one efficiency level to the next. Additional detail on how DOE developed the cost-efficiency relationships and related results are available in chapter 5 of the NOPR TSD. Chapter 5 of the NOPR TSD also presents these cost-efficiency curves in the form of energy efficiency versus MPC.

Issue 5: DOE seeks comment on its derivation of the cost-efficiency curves for SPVHPs and SPVACs with a cooling capacity ≥65,000 Btu/h and <135,000 Btu/h.

6. Manufacturer Markup

To account for manufacturers' non-production costs and profit margin, DOE applies a non-production cost multiplier (the manufacturer markup) to the full MPC. The resulting manufacturer selling price (MSP) is the price at which the manufacturer can recover all production and non-production costs and earn a profit. To meet new or amended energy conservation standards, manufacturers often introduce design changes to their equipment lines that result in increased MPCs. Depending on the competitive pressures, some or all of the increased production costs may be passed from manufacturers to retailers and eventually to customers in the form of higher purchase prices. As production costs increase, manufacturers typically incur additional overhead. The MSP should be high enough to recover the full cost of the equipment (*i.e.*, full production and non-production costs) and yield a profit. The manufacturer markup has an important bearing on profitability. A high markup under a standards scenario suggests manufacturers can readily pass along the increased variable costs and some of the capital and product conversion costs (the one-time expenditure) to customers. A low markup suggests that manufacturers will not be able to recover as much of the necessary investment in plant and equipment.

DOE normally develops the manufacturer markup through an examination of corporate annual reports and Securities and Exchange Commission (SEC) 10–K reports; however, in the case of SPVU manufacturers, DOE did not feel this process would be representative of the majority of the industry, because most SPVU manufacturers are privately-held companies. Therefore, DOE based the manufacturer markup for the SPVU industry on the markup used for the package terminal air conditioner and package terminal heat pump final rule published on in the **Federal Register** on October 7, 2008 (73 FR 58772), and sought manufacturer feedback on this markup number during the interview process. DOE used the PTAC manufacturer markup because it is a comparable industry to the SPVU

[33] From *http://www.bls.gov/news.release/ppi.htm*, ''current price indexes grouped by industry according to the North American Industry Classification System (NAICS) have series identifiers that begin with the prefix ''PCU.'' After the prefix, there are twelve digits (the six-digit industry code is listed twice) followed by up to seven alphanumeric characters identifying product detail.'' The air-conditioning, refrigeration, and forced air heating equipment industry is identified by NAICS with the code 333415.

[34] See *http://www.bls.gov/ppi/*.

industry in terms of the size of the market (*i.e.*, the number of annual shipments) and the types of the equipment on the market (*i.e.*, both are commercial air conditioners of similar capacities). Based on manufacturer feedback during the interviews, DOE determined that the manufacturer markup used in the PTAC and PTHP final rule (1.29) was slightly high for use with SPVU manufacturers. Thus, DOE lowered the estimated average manufacturer markup for the SPVU industry to 1.28 based on the feedback received. See chapter 6 of the NOPR TSD for additional details.

7. Shipping Costs

Manufacturers of heating, ventilation, and air-conditioning (HVAC) equipment typically pay for shipping to the first step in the distribution chain. Freight is not a manufacturing cost, but because it is a substantial cost incurred by the manufacturer, DOE is accounting for shipping costs of SPVUs separately from other non-production costs that comprise the manufacturer markup. To calculate the MSP for SPVUs, DOE multiplied the MPC at each efficiency level (determined from the cost model) by the manufacturer markup and added shipping costs for equipment at the given efficiency level. More specifically, DOE calculated shipping costs at each efficiency level based on the average outer dimensions of equipment at the given efficiency and assuming the use of a typical 53-foot straight-frame trailer with a storage volume of 4,240 cubic feet.

In this rulemaking, shipping costs for SPVUs were determined on an area basis. These products are typically too tall to be double-stacked in a vertical fashion, and they cannot be shipped in any other orientation other than vertical. During interviews, manufacturers agreed with this approach and stated that the compressor and heat exchangers are more likely to be damaged in transit if they are oriented in any direction other than vertical. To calculate these shipping costs, DOE calculated the cost per area of a trailer, based on an estimated cost of $4,000 per shipping load and the standard dimensions of a 53-foot trailer (which would approximate the cost of shipping the equipment across the country). Next, DOE examined the average sizes of equipment in each equipment class at each efficiency level. DOE then estimated the shipping costs by multiplying the equipment area by the respective cost per area on the trailer. DOE updated the shipping costs to 2013$ by using a general gross domestic product (GDP) deflator.[35] Chapter 5 of the NOPR TSD contains additional details about DOE's shipping cost assumptions and DOE's shipping cost estimates.

8. Manufacturer Interviews

As noted in the preceding section, throughout the rulemaking process, DOE has sought and continues to seek feedback and insight from interested parties that would improve the information used in its analysis. DOE interviewed manufacturers as part of the NOPR manufacturer impact analysis. During the interviews, DOE sought feedback on all aspects of its analyses for SPVUs. For the engineering analysis, DOE discussed the analytical assumptions and estimates, cost model, and cost-efficiency curves with SPVU manufacturers. DOE considered all the information manufacturers provided when refining the cost model and assumptions. However, DOE incorporated data and information specific to individual manufacturers into the analysis as averages in order to avoid disclosing sensitive information about individual manufacturers' equipment or manufacturing processes. More detail about the manufacturer interviews are contained in chapter 12 of the NOPR TSD.

D. Markups Analysis

DOE understands that the price of SPVU equipment depends on the distribution channel the customer uses to purchase the equipment. Typical distribution channels for most commercial HVAC equipment include shipments that may pass through manufacturers' national accounts, or through entities including wholesalers, mechanical contractors, and/or general contractors. However, DOE understands that there are multiple branched distribution channels for SPVU equipment for both new construction and replacement equipment. For SPVU equipment, the new equipment distribution channel is one in which SPVU equipment is sold directly or indirectly to manufacturers of wood and non-wood modular buildings, and the rest of the supply chain is essentially the chain of manufacturing, wholesaling, and contractor support for wood and non-wood modular buildings. The distribution channel for replacement equipment goes directly, or through air conditioning wholesalers/distributors, to mechanical contractors who install replacements on behalf of customers, or to wholesalers/distributors of modular buildings, who own leased fleets of modular buildings and who are assumed to perform their own SPVU replacements in their leased fleets.

DOE developed supply chain markups in the form of multipliers that represent increases above equipment purchase costs for air-conditioning equipment wholesalers/distributors, modular building manufacturers and wholesalers/distributors, and mechanical contractors and general contractors working on behalf of customers. DOE applied these markups (or multipliers) to each distribution channel entity's costs that were developed from the engineering analysis. DOE then added sales taxes and installation costs (where appropriate) to arrive at the final installed equipment prices for baseline and higher-efficiency equipment. (See chapter 6 of the NOPR TSD for additional details on markups.) As noted above, DOE identified two separate distribution channels for SPVU equipment to describe how the equipment passes from the equipment manufacturer to the customer, as presented in Table IV.6 below.

TABLE IV.6—DISTRIBUTION CHANNELS FOR SPVU EQUIPMENT

Channel 1 New SPVU Equipment	*Channel 2* Replacement SPVU Equipment
Air-Conditioning Wholesale Distributor or Manufacturer's Representative.	Air-Conditioning Wholesale Distributor or Manufacturer's Representative.

[35] U.S. Department of Commerce, Bureau of Economic Analysis (BEA), Implicit Price Deflators for Gross Domestic Product (Available in Section 1, Table 1.1.9 at *http://www.bea.gov/national/nipaweb/DownSS2.asp*) (Last accessed February 7, 2014).

TABLE IV.6—DISTRIBUTION CHANNELS FOR SPVU EQUIPMENT—Continued

Channel 1 New SPVU Equipment	*Channel 2* Replacement SPVU Equipment
Modular Building Manufacturer	Mechanical Contractor or Modular Building Distributor.
Modular Building Distributor or General Contractor.	
Customer	Customer.

DOE estimated a baseline markup and an incremental markup. DOE defined a ''baseline markup'' as a multiplier that converts the manufacturer selling price of equipment with baseline efficiency into the customer purchase price for the equipment at the same baseline efficiency level. An ''incremental markup'' is defined as the multiplier to convert the incremental increase in manufacturer selling price of higher-efficiency equipment into the customer purchase price for the same (higher-efficiency) equipment.

DOE developed the markups based on available financial data. More specifically, DOE based the air-conditioning wholesaler/distributor markups on data from the Heating, Air Conditioning, and Refrigeration Distributors International (HARDI) 2013 Profit Report.[36] DOE also used financial data from the 2007 U.S. Census Bureau [37] for the wood [38] and non-wood [39] modular building manufacturing industries; concrete product manufacturing sector; [40] the wood [41] and non-wood [42] modular building wholesale industries; brick, stone, and related construction material merchant wholesalers; [43] the plumbing, heating, and air-conditioning contractor industry; [44] and the non-residential general contractor industries [45] to estimate markups for all of these sectors.

The overall markup is the product of all the markups (baseline or incremental) for the different steps within a distribution channel plus sales tax. DOE calculated sales taxes based on 2013 State-by-State sales tax data reported by the Sales Tax Clearinghouse.[46] Because both distribution channel costs and sales tax vary by State, DOE allowed markups due to distribution channel costs and sales taxes within each distribution channel to vary by State. No information was available to develop State-by-State distributions of SPVU equipment by building type or business type, so the distributions of sales by business type are assumed to be the same in all States. The national distribution of the markups varies among business types. Chapter 6 of the NOPR TSD provides additional detail on markups.

Issue 6: Because the identified market channels are complex and their characterization required a number of assumptions, DOE seeks input on its analysis of market channels for the above equipment classes.

E. Energy Use Analysis

Based on information received from manufacturer interviews, DOE believes that approximately 35 percent of SPVAC shipments go to educational facilities, the majority of which are for space conditioning of modular classroom buildings. Another approximately 35 percent of the shipments go to providing cooling for telecommunications and electronics enclosures. The remainder of shipments (30 percent) is used in a wide variety of commercial buildings, including offices, temporary buildings, and some miscellaneous facilities. In almost all of these commercial building applications, the buildings served are expected to be of modular construction, because SPVUs, as packaged air conditioners installed on external building walls, do not impact site preparation costs for modular buildings, which may be relocated multiple times over the building's life. The vertically-oriented configuration of SPVUs allows the building mounting to be unobtrusive and minimizes impacts on modular building transportation requirements. These advantages do not apply to a significant extent in site-constructed buildings. DOE also believes that shipments of SPVHP equipment would primarily be to educational facilities or office-type end uses, but would be infrequently used for telecommunication or electronic enclosures for which the heating requirements are often minimal.

DOE analyzed energy use in three different classes of commercial buildings that utilize SPVU equipment: (1) Modular classrooms; (2) modular offices; and (3) telecommunications shelters. To estimate the energy use of SPVU equipment in these building

[36] Heating, Air-conditioning & Refrigeration Distributors International (HARDI), 2013 Profit Report (2012 Data) (Available at: *http://www.hardinet.org/Profit-Report*).

[37] The U.S. Census Bureau conducts an Economic Census every five years. The 2012 Economic Census is may become available early in 2015; if so, the final rule analysis will be updated with data from the 2012 Economic Census.

[38] U.S. Census Bureau. 2007. Prefabricated Wood Building Manufacturing. Sector 32: 321992. Table EC073111 Manufacturing: Industry Series: Detailed Statistics by Industry for the United States: 2007. (Available at *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=top&refresh=t#none*).

[39] U.S. Census Bureau. 2007. Prefabricated Metal Building and Component Manufacturing. Sector 33: 332311. EC073111 Manufacturing: Industry Series: Detailed Statistics by Industry for the United States: 2007 (Available at *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=top&refresh=t#none*).

[40] U.S. Census Bureau. 2007. Other Concrete Product Manufacturing Sector 32: 327390. EC073111 Manufacturing: Industry Series: Detailed Statistics by Industry for the United States: 2007 (Available at: *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=top&refresh=t#none*).

[41] U.S. Census Bureau. 2007. 423310 Lumber, plywood, millwork, and wood panel merchant wholesalers. EC0742SXSB06. Wholesale Trade: Subject Series—Misc Subjects: Gross Margin and its Components for Merchant Wholesalers for the United States: 2007 (Available at: *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=top&refresh=t#none*).

[42] U.S. Census Bureau. 2007. 423390. Other construction material merchant wholesalers. EC0742SXSB06. Wholesale Trade: Subject Series—Misc Subjects: Gross Margin and its Components for Merchant Wholesalers for the United States: 2007 (Available at: *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=top&refresh=t#none*).

[43] U.S. Census Bureau. 2007. Brick, stone, and related construction material merchant wholesalers: 2007. Sector 42: 423320 Other Construction Material Merchant Wholesalers. Brick, stone, and related construction material merchant wholesalers: Merchant wholesalers, except manufacturers' sales branches and offices. Detailed Statistics by Industry for the United States: 2007 (Available at: *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=top&refresh=t#none*).

[44] U.S. Census Bureau. 2007. Sector 23: 238220. Plumbing, heating, and air-conditioning contractors. EC0723I1: Construction: Industry Series: Preliminary Detailed Statistics for Establishments: 2007 (Available at: *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=top&refresh=t#none*).

[45] U.S. Census Bureau. 2007. Sector 23: 236220. Commercial and institutional building construction. EC0723I1: Construction: Industry Series: Preliminary Detailed Statistics for Establishments: 2007 (Available at: *http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=top&refresh=t#none*).

[46] The Sales Tax Clearing House (2013) (Last accessed Feb. 7, 2014) (Available at: *www.thestc.com/STrates.stm*).

types, DOE developed building simulation models for use with DOE's EnergyPlus software.[47] A prototypical building model was developed for each building type, described by the building footprint, general building size, and design. The building types were represented by a 1,568 ft^2 wood-frame modular classroom, a 1,568 ft^2 wood-frame modular office, and a 240 ft^2 concrete-wall telecommunication shelter. In each case, the building construction (footprint, window-wall ratio, general design) was developed to be representative of typical designs within the general class of building. Operating schedules, internal load profiles, internal electric receptacle (plug) loads, and occupancy for the modular classroom were those from classroom-space-type data found in the DOE Primary School commercial prototype building model.[48] Operating schedules, internal load profiles, internal plug loads, and occupancy for modular office buildings were those from office space in the DOE Small Office commercial prototype building model. *Id.* For the telecommunications shelters, DOE did not identify a source for typical representative internal electronic loads as a function of building size, nor did it find information on representative internal gain profiles. However, based on feedback from shelter manufacturers, DOE used a 36,000 Btu/h (10.55 kW) peak internal load to reflect internal design load in the shelter. DOE determined that on average over the year, this load ran at a scheduled 65 percent of peak value, reflecting estimates for computer server environments.[49] Each of these three building models was used to establish the energy usage of SPVAC and SPVHP equipment in the same building class.

Envelope performance (*e.g.*, wall, window, and roof insulation, and window performance) and lighting power inputs were based on requirements in ASHRAE Standard 90.1–2004.[50] DOE believes that the requirements in ASHRAE Standard 90.1–2004 are sufficiently representative of a mixture of both older and more recent construction[51] and that resulting SPVU equipment loads will be representative of typical SPVU equipment loads in the building stock. Ventilation levels were based on ASHRAE Standard 62.1–2004.[52]

DOE simulated each building prototype in each of 237 U.S. climate locations, taking into account variation in building envelope performance for each climate as required by ASHRAE 90.1–2004. For simulations used to represent the less than 65,000 Btu/h SPVU equipment, no outside air economizers were assumed for the modular office and modular classroom buildings.[53] However, for simulations used to represent greater than or equal to 65,000 Btu/h but less than 135,000 Btu/h equipment, economizer usage was presumed to be climate-dependent in these building types, based on ASHRAE Standard 90.1–2004 requirements for unitary equipment in that capacity range. For the telecommunications shelters, economizers were assumed for 45 percent of buildings, based on manufacturer interviews. In response to the April 2014 NODA and DOE's request for information on the use of economizers in telecommunications shelters, Lennox International stated their belief that economizers would be used in a majority of equipment serving this market. The commenter pointed out that ASHRAE Standard 90.1 now requires the use of economizers in HVAC equipment greater than 54,000 Btu/h in all but two climate zones. Lennox stated that this change in ASHRAE Standard 90.1 has driven this economizer requirement to over 90 percent of units shipped for the telecommunications shelter application (Lennox International Inc., No. 15 at p. 7).

In response, DOE's understanding is that the 54,000 Btu/h limit introduced in ASHRAE Standard 90.1–2010 is for comfort cooling applications and that ASHRAE Standard 90.1 has separate economizer requirements for computer rooms (generally defined as a space where the primary function is to house equipment for processing of electronic data and which has a design electronics power density exceeding 20 W/sf—as would be typical of a telecommunication shelter).[54] These computer room economizer requirements begin to require economizers only for fan cooling units greater than or equal to 65,000 Btu/h and at that threshold only for certain climate zones. The comfort cooling requirements in ASHRAE Standard 90.1, to the extent they are adopted by local jurisdictions, would appear not to apply to telecommunications shelters. And, if such requirements were to apply, they would do so only for a fraction of the products in the less than 65,000 Btu/h SPVU market. Additionally, manufacturers generally agreed during manufacturer interviews that approximately 45 percent of SPVUs that are shipped for telecommunications shelters contain economizers. For these reasons, in this NOPR, DOE still assumed that 45 percent of these buildings used economizers, and requests further information regarding the percentage of SPVUs in telecommunication shelters that use economizers. Users of the SPVU LCC spreadsheet can change the percentage of equipment using economizers to see the impact of different weights. In addition, for the telecommunication shelter, redundant identical air conditioners with alternating usage were assumed when establishing average annual energy consumption per unit.

Simulations were done for the buildings using SPVAC equipment and electric resistance heating, and then a separate set of simulations was done for buildings with SPVHP equipment. For each equipment type and building type combination, DOE simulated each efficiency level identified in the engineering analysis for each equipment class. Fan power at these efficiency levels was based on manufacturer's literature and reported fan power consumption data as developed in the engineering analysis. BPM supply air blower motors were assumed at an EER

[47] EnergyPlus Energy Simulation Software and documentation are available at: *http://apps1.eere.energy.gov/buildings/energyplus/*.

[48] The commercial prototype building models are available on DOE's Web site as Energy Plus input files at: *http://www.energycodes.gov/development/commercial/90.1_models*. Documentation of the initial model development is provided in: Deru, M., *et al., U.S. Department of Energy Commercial Reference Building Models of the National Building Stock*, NREL/TP–5500–46861 (2011).

[49] EnergyConsult Pty Ltd., *Equipment Energy Efficiency Committee Regulatory Impact Statement Consultation Draft: Minimum Energy Performance Standards and Alternative Strategies for Close Control Air Conditioners,* Report No 2008/11 (2008) (Available at: *www.energyrating.gov.au*).

[50] American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), *Energy Standard for Buildings Except Low-Rise Residential Buildings*, ANSI/ASHRAE/IESNA Standard 90.1–2004 (2005).

[51] ASHRAE 90.1–2004 is still one of the prevailing building codes for the design of new commercial buildings. In addition, a large percentage of existing buildings were built in accordance with earlier versions of ASHRAE Standard 90.1.

[52] American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), *Ventilation for Acceptable Indoor Air Quality*, ANSI/ASHRAE/IESNA Standard 62.1–2004 (2004).

[53] An "outside air economizer" is a combination of ventilation and exhaust air dampers and controls that increase the amount of outside air brought in to a building when the outside air conditions (*i.e.*, temperature and humidity) are low, such that increasing the amount of ventilation air reduces the equipment cooling loads.

[54] DOE notes that these requirements introduced in ASHRAE Standard 90.1–2010 continued unchanged in ASHRAE Standard 90.1–2013.

of 10.0 and higher for all classes of equipment based on results from the engineering analysis. The supply air blower motors are assumed to run at constant speed and constant power while operating.

DOE used typical meteorological weather data (TMY3) for each location in the simulations.[55] DOE sized equipment for each building simulation using a design day sizing method incorporating the design data found in the EnergyPlus design-day weather data files for each climate.[56] DOE also incorporated an additional cooling sizing factor of 1.1 for the equipment used in the modular office and modular classroom simulations, reflective of the typical sizing adjustment needed to account for discrete available equipment capacities in SPVAC and SPVHP equipment.

EER and heating COP were converted to corresponding simulation inputs for each efficiency level simulated. These inputs, along with the calculated fan power at each efficiency level, were used in the building simulations. Further details of the building model and the simulation inputs for the SPVAC and SPVHP equipment can be found in chapter 7 of the NOPR TSD.

From the annual simulation results for SPVAC equipment, DOE extracted the condenser energy use for cooling, the supply air blower energy use for both heating and cooling hours, the electric resistance heating energy, and the equipment capacity for each building type, climate, and efficiency level. From these, DOE developed corresponding normalized annual cooling energy per cooling ton and annual blower energy per ton for the efficiency levels simulated. DOE also developed the electrical heating energy per ton for the building. These per-ton cooling and blower energy values were added together and then multiplied by the average cooling capacity estimated for the equipment class simulated to arrive at an initial energy consumption estimate for SPVAC. In a deviation from the SPVU NODA analysis, DOE also noted that where fan power was reduced for higher efficiency levels, there was a corresponding increase in the amount of heating required in each climate to make up for the loss of heat energy imparted into the supply air stream through the use of the more efficient supply air blower during the heating season. This impact was climate dependent, with little heating impact in warm climates, and greater heating impact in cold climates where heating energy requirements dominate during the year. DOE calculated this heating ''take back'' effect for higher efficiency levels as a deviation from the baseline heating energy use for each equipment capacity. The final SPVAC energy consumption estimates were then based on the calculated cooling and supply blower energy uses plus this heating take back, which allowed the resulting energy savings estimates to correctly account for the heating energy increase during the year. In addition, it was estimated that 5 percent of the market for the SPVAC less than 65,000 Btu/h class utilize gas furnace heating. The heating take back for these systems was estimated based on the heating load of the systems with electric resistance heat and assuming an average 81-percent furnace annual fuel utilization efficiency (AFUE).

The analytical method for SPVHP was carried out in a similar fashion; however, for heat pumps, DOE included the heating energy (compressor heating and electric resistance backup) directly from the simulation results and, thus, did not separately calculate a heating take back effect. From these data, DOE developed per-ton energy consumption values for cooling, supply blower, and heating electric loads. These per-ton energy figures were summed and multiplied by the nominal capacity for the equipment class simulated to arrive at the annual per-ton energy consumption for SPVHP for each combination of building type, climate, and efficiency level.

For each combination of equipment class, building type, climate, and efficiency level, DOE developed unit energy consumption (UEC) values for each State using weighting factors to establish the contribution of each climate in each State. Once State-level UEC estimates were established, they were provided as input to the life-cycle cost analysis. National average UEC estimates for each equipment class and efficiency level were also established based on population-based weighting across States and shipment weights to the different building types. With regard to the latter, while DOE established shipment weights for SPVAC equipment related to the three building types (educational, office, and telecommunications), DOE determined that SPVHP equipment was not used to a significant extent in telecommunication facilities and, thus, only allocated shipments of SPVHP equipment to two building types, educational and office.

For details of this energy use analysis, see chapter 7 of the NOPR TSD.

Table IV.7 shows the annual UEC estimates for SPVAC and SPVHP corresponding to the efficiency levels analyzed.

[55] Wilcox S. and W. Marion, *User's Manual for TMY3 Data Sets,* National Renewable Energy Laboratory, Report No. NREL/TP–581–43156 (2008).

[56] EnergyPlus TMY3-based weather data files and design day data files available at: *http://apps1.eere.energy.gov/buildings/energyplus/weatherdata_about.cfm.*

TABLE IV.7—NATIONAL UEC ESTIMATES FOR SPVAC AND SPVHP EQUIPMENT

Efficiency level	Equipment class				
	SPVAC, <65 kBtu/h		SPVHP, <65 kBtu/h	SPVAC, ≥65 and <135 kBtu/h	SPVHP, ≥65 and <135 kBtu/h
	kWh/yr	Gas kBtu/yr *	*kWh/yr*	*kWh/yr*	*kWh/yr*
EPCA Baseline	6,880		20,921	13,743	41,721
ASHRAE Baseline **	6,175	54	20,383	12,251	40,589
EL1	5,923	54	19,921	NA	NA
EL2	5,694	54	19,629	NA	NA
EL3	5,387	54	18,775	NA	NA
EL4 **	5,185	54	18,633	NA	NA

* Calculated average gas heating "take back" based on 5 percent of market with gas heat.
** ASHRAE Baseline represents max-tech levels established for SPVAC and SPVHP greater than or equal to 65,000 Btu/h, but less than 135,000 Btu/h. EL4 represents max-tech levels established for SPVAC and SPVHP less than 65,000 Btu/h.

Issue 7: DOE seeks input on its analysis of UEC for the equipment classes in Table IV.7 and its use in establishing the energy savings potential for higher standards. Of particular interest to DOE is input on shipments of SPVHP equipment to telecommunication shelters and the frequency of use of economizers in equipment serving these shelters.

Issue 8: DOE also recognizes that there may be regional differences between the shipments of heat pumps and air conditioners to warmer or cooler climates, and requests stakeholder input on how or if such differences can be taken into account in the energy use characterization.

F. Life-Cycle Cost and Payback Period Analysis

DOE conducted the life-cycle cost (LCC) and payback period (PBP) analysis to estimate the economic impacts of potential standards on individual consumers of SPVU equipment. DOE first analyzed these impacts for SPVU equipment by calculating the change in consumers' LCCs likely to result from higher efficiency levels compared with the EPCA and ASHRAE baseline efficiency levels for the SPVU classes discussed in the engineering analysis. The LCC calculation considers total installed cost (equipment cost, sales taxes, distribution chain markups, and installation cost), operating expenses (energy, repair, and maintenance costs), equipment lifetime, and discount rate. DOE calculated the LCC for all customers as if each would purchase an SPVU unit in the year the standard takes effect. DOE presumes that the purchase year for all SPVU equipment for purposes of the LCC calculation is 2015, the compliance date for the energy conservation standard equivalent to the levels in ASHRAE 90.1–2013 (for the EPCA baseline), or 2019, the compliance date for the energy conservation standard more stringent than the corresponding levels in ASHRAE 90.1–2013 (for the ASHRAE baseline). To compute LCCs, DOE discounted future operating costs to the time of purchase and summed them over the lifetime of the equipment.

Next, DOE analyzed the effect of changes in installed costs and operating expenses by calculating the PBP of potential standards relative to baseline efficiency levels. The PBP estimates the amount of time it would take the customer to recover the incremental increase in the purchase price of more-efficient equipment through lower operating costs. In other words, the PBP is the change in purchase price divided by the change in annual operating cost that results from the energy conservation standard. DOE expresses this period in years. Similar to the LCC, the PBP is based on the total installed cost and operating expenses. However, unlike the LCC, DOE only considers the first year's operating expenses in the PBP calculation. Because the PBP does not account for changes in operating expense over time or the time value of money, it is also referred to as a simple PBP.

DOE conducted the LCC and PBP analyses using a commercially-available spreadsheet tool and a purpose-built spreadsheet model, available on DOE's Web site.[57] This spreadsheet model developed by DOE accounts for variability in energy use and prices, installation costs, repair and maintenance costs, and energy costs. It uses weighting factors to account for distributions of shipments to different building types and states to generate national LCC savings by efficiency level. The results of DOE's LCC and PBP analysis are summarized in section V.B and described in detail in chapter 8 of the NOPR TSD.

1. Approach

Recognizing that each business that uses SPVU equipment is unique, DOE analyzed variability and uncertainty by performing the LCC and PBP calculations assuming a correspondence between five types of businesses (education, telecommunications, construction and mining firms occupying temporary offices, a variety of service and retail firms occupying conventional office space, and health care firms) for customers located in three types of commercial buildings (telecommunications, education, and office). DOE developed financial data appropriate for the customers in each business and building type. Each type of building has typical customers who have different costs of financing because of the nature of the business. DOE derived the financing costs based on data from the Damodaran Online Web site.[58]

The LCC analysis used the estimated annual energy use for each SPVU equipment unit described in section IV.E. Because energy use of SPVU equipment is sensitive to climate, energy use varies by State. Aside from energy use, other important factors influencing the LCC and PBP analyses are energy prices, installation costs, equipment distribution markups, and sales tax. All of these factors are assumed to vary by State. At the national level, the LCC spreadsheets explicitly model both the uncertainty and the variability in the model's inputs, using probability distributions based on the shipments of SPVU equipment to different States.

[57] See *http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/35.*

[58] Damodaran Online (Last accessed Feb. 14, 2014) (Available at: *http://pages.stern.nyu.edu/~adamodar/New_Home_Page/home.htm*).

As mentioned earlier, DOE generated LCC and PBP results by business type within building type and State and developed weighting factors to generate national average LCC savings and PBPs for each efficiency level. As there is a unique LCC and PBP for each calculated value at the building type and State level, the outcomes of the analysis can also be expressed as probability distributions with a range of LCC and PBP results. A distinct advantage of this type of approach is that DOE can identify the percentage of customers achieving LCC savings or attaining certain PBP values due to an increased efficiency level, in addition to the average LCC savings or average PBP for that efficiency level.

2. Life-Cycle Cost Inputs

For each efficiency level DOE analyzed, the LCC analysis required input data for the total installed cost of the equipment, its operating cost, and the discount rate. Table IV.8 summarizes the inputs and key assumptions DOE used to calculate the consumer economic impacts of all energy efficiency levels analyzed in this rulemaking. A more detailed discussion of the inputs follows.

TABLE IV.8—SUMMARY OF INPUTS AND KEY ASSUMPTIONS USED IN THE LCC AND PBP ANALYSES

Inputs	Description
Affecting Installed Costs	
Equipment Price	Equipment price was derived by multiplying manufacturer sales price or MSP (calculated in the engineering analysis) by distribution channel markups, as needed, plus sales tax from the markups analysis.
Installation Cost	Installation cost includes installation labor, installer overhead, and any miscellaneous materials and parts, derived from *RS Means CostWorks 2014* [59] and converted to 2013$.
Affecting Operating Costs	
Annual Energy Use	Annual unit energy consumption for each class of equipment at each efficiency level estimated by state and building type using simulation models and a population-based mapping of climate locations to states.
Electricity Prices, Natural Gas Prices.	DOE developed average electricity prices based on Energy Information Administration (EIA) Form 826 data for 2013.[60] Future electricity prices are projected based on Annual Energy Outlook 2013 (AEO 2013).[61] DOE developed natural gas prices based on EIA state-level commercial prices in EIA data navigator.[62] Future natural gas prices are projected based on AEO 2013.
Maintenance Cost	DOE estimated annual maintenance costs based on RS Means CostWorks 2014 for small, single-zone rooftop commercial air conditioning equipment. Annual maintenance cost did not vary as a function of efficiency.
Repair Cost	DOE estimated the annualized repair cost for baseline-efficiency SPVU equipment based on cost data from RS Means CostWorks 2014 for small, single-zone rooftop commercial air conditioning equipment. DOE assumed that the materials and components portion of the repair costs would vary in direct proportion with the MSP at higher efficiency levels because it generally costs more to replace components that are more efficient.
Affecting Present Value of Annual Operating Cost Savings	
Equipment Lifetime	DOE estimated that SPVU equipment lifetimes range between 10 and 25 years, with an average lifespan of 15 years, based on estimates cited in available packaged air conditioner literature.[63 64 65]
Discount Rate	Mean real discount rates for all buildings range from 2.4 percent for education buildings to almost 11.5 percent for some office building owners.
Analysis Start Year	Start year for LCC is 2019, which is the earliest compliance date that DOE can set for new standards if it adopts any efficiency level for energy conservation standards higher than that shown in ASHRAE Standard 90.1–2013.
Analyzed Efficiency Levels	
Analyzed Efficiency Levels	DOE analyzed the ASHRAE baseline efficiency levels and up to four higher efficiency levels for SPVUs <65,000 Btu/h and only the ASHRAE baseline for SPVUs >65,000 Btu/h. See the engineering analysis for additional details on selections of efficiency levels and cost.

DOE analyzed the EPCA and ASHRAE baseline efficiency levels (reflecting the efficiency levels in ASHRAE Standard 90.1–2013) and up to four higher efficiency levels for SPVUs <65,000 Btu/h. Chapter 5 of the NOPR TSD provides additional details on selections of efficiency levels and cost.

[59] RS Means CostWorks 2014, R.S. Means Company, Inc. (2013) (Last accessed on February 27, 2014).

[60] U.S. Energy Information Administration. Electric Sales, Revenue, and Average Price 2013, Select table Sales and Revenue Data by State, Monthly Back to 1990 (Form EIA–826), (Last accessed on February 19, 2014) (Available at: *http://www.eia.gov/cneaf/electricity/page/sales_revenue.xls*).

[61] U.S. Energy Information Administration. *Annual Energy Outlook 2013* (2013) DOE/EIA–0383(2013). (Last Accessed March 12, 2014) (Available at: *http://www.eia.gov/forecasts/archive/aeo13/).*

[62] U.S. Energy Information Administration. Average Price of Natural Gas Sold to Commercial Consumers—by State. (Last accessed on February 17, 2014) (Available at: *http://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PCS_DMcf_a.htm*).

[63] American Society of Heating, Refrigerating, and Air-Conditioning Engineers, ASHRAE Handbook: 2011 Heating, Ventilating, and Air-Conditioning Applications (2011).

[64] Abramson, Interactive Web-based Owning and Operating Cost Database, Final Report ASHRAE Research Project RP–1237 (2005).

[65] Energy Efficient Strategies Pty Ltd., Equipment Energy Efficiency Committee Regulatory Impact Statement Consultation Draft. Revision to the Energy Labelling Algorithms and Revised MEPS levels and Other Requirements for Air Conditioners, Report No 2008/09 (September 2008) (Last accessed March 22, 2012) (Available at: *http://www.energyrating.gov.au/wp-content/uploads/Energy_Rating_Documents/Library/Cooling/Air_Conditioners/200809-ris-ac.pdf*).

a. Equipment Prices

The price of SPVU equipment reflects the application of distribution channel markups (mechanical contractor markups) and sales tax to the manufacturer sales price (MSP), which is the cost established in the engineering analysis. As described in section IV.D, DOE determined distribution channel costs and markups for air-conditioning equipment. For each equipment class, the engineering analysis provided contractor costs for the ASHRAE baseline equipment and up to four higher equipment efficiencies.

The markup is the percentage increase in price as the SPVU equipment passes through distribution channels. As explained in section IV.D, SPVU equipment is assumed to be delivered by the manufacturer through a variety of distribution channels. If the SPVU equipment is for a new installation, it is assumed to be sold as a component of a new modular building. There are several distribution pathways that involve different combinations of the costs and markups of air-conditioning equipment wholesaler/distributors, manufacturers of modular buildings, and wholesalers/distributors of modular buildings. In some cases, a general contractor is also involved for site preparation and management. Some replacement equipment is assumed to be sold directly to mechanical contractors and to wholesalers/distributors of modular buildings, but some is sold through air-conditioning equipment wholesalers/distributors to these same entities. The overall markups used in LCC analyses are weighted averages of all of the relevant distribution channel markups.

To project an MSP price trend for the NOPR, DOE derived an inflation-adjusted index of the PPI for miscellaneous refrigeration and air-conditioning equipment over the period 1990–2010. These data show a general price index decline from 1990 to 2004, followed by a sharp increase, primarily due to rising prices of copper and steel components that go into this equipment, in turn driven by rapidly rising global demand. Since 2009, there has been no clear trend in the price index. Given the continued slow global economic activity in 2009 through 2013, DOE believes that the extent to which the future trend can be predicted based on the last two decades is very uncertain and that the observed data do not provide a firm basis for projecting future costs trends for SPVU equipment. Therefore, DOE used a constant price assumption as the default price factor index to project future SPVU prices in 2019. Thus, prices projected for the LCC and PBP analysis are equal to the 2013 values for each efficiency level in each equipment class. Appendix 8–D of the NOPR TSD describes the historical data and the derivation of the price projection.

Issue 9: DOE requests comments on the most appropriate trend to use for real (inflation-adjusted) SPVU prices.

b. Installation Costs

DOE derived national average installation costs for SPVU equipment from data provided in RS Means CostWorks 2014 (hereafter referred to as RS Means) specifically for packaged air-conditioning equipment. RS Means provides estimates for installation costs for SPVU units by equipment capacity, as well as cost indices that reflect the variation in installation costs for 295 cities in the United States. The RS Means data identify several cities in all 50 States and the District of Columbia. DOE incorporated location-based cost indices into the analysis to capture variation in installation costs, depending on the location of the consumer.

For more-stringent efficiency levels, DOE recognized that installation costs potentially could be higher with larger units and higher-efficiency SPVU equipment, mainly due to increased size. DOE utilized RS Means installation cost data from RS Means to derive installation cost curves by size of unit for base-efficiency models. DOE did not have data to calibrate the extent to which installation costs might change as efficiency increased. For the NOPR LCC analysis, DOE assumed that installation cost would not increase as a function of increased efficiency.

Issue 10: DOE seeks comments on its assumption that installation costs would not increase for higher-efficiency SPVUs.

c. Annual Energy Use

DOE estimated the annual electricity and natural gas consumed by each class of SPVU equipment, by efficiency level, based on the energy use analysis described in section IV.E and in chapter 7 of the NOPR TSD.

d. Electricity and Natural Gas Prices

Electricity prices and natural gas prices are used to convert changes in the electric and natural gas consumption from higher-efficiency equipment into energy cost savings. Because of the variation in annual electricity and natural gas consumption savings and equipment costs across the country, it is important to consider regional differences in electricity and natural gas prices. DOE used average effective commercial electricity prices [66] and commercial natural gas prices [67] at the State level from Energy Information Administration (EIA) data for 2013. This approach captured a wide range of commercial electricity and natural gas prices across the United States. Furthermore, different kinds of businesses typically use electricity in different amounts at different times of the day, week, and year, and therefore, face different effective prices. To make this adjustment, DOE used EIA's 2003 CBECS data set [68] to identify the average prices that the five business types paid for electricity and natural gas and compared them separately with the corresponding average prices that all commercial customers paid. DOE used the ratios of prices paid by the five types of businesses to the national average commercial prices seen in the 2003 CBECS as multipliers to adjust the average commercial 2013 State price data.

DOE weighted the electricity and natural gas consumption and prices each business type paid in each State by the estimated percentages of SPVU equipment in each business type and by the population in each State to obtain weighted-average national electricity and natural gas costs for 2013. The State/building-type weights reflect the probabilities that a given unit of SPVU equipment shipped will operate with a given fuel price. The original State-by-State average commercial prices range from approximately $0.074 per kWh to approximately $0.341 per kWh for electricity and from approximately $6.81 per MBtu to $43.36 per MBtu for natural gas. See chapter 8 of the NOPR TSD for further details.

The electricity and natural gas price trends provide the relative change in electricity and natural gas costs for future years. DOE used the AEO 2013 reference case to provide the default electricity and natural gas price scenarios. DOE extrapolated the trend in values at the Census Division level from 2025 to 2040 of the projection for all five building types to establish prices

[66] Energy Information Administration, Form EIA–826 Database Monthly Electric Utility Sales and Revenue Data (EIA–826 Sales and Revenue Spreadsheets) (Available at: *http://www.eia.gov/electricity/data/eia826/*> On the right side of the screen under Aggregated, select 1990-current. (Last accessed March 26, 2014).

[67] Energy Information Administration, Natural Gas Prices (Available at: *http://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PCS_DMcf_a.htm*) (Last accessed February 13, 2014).

[68] Energy Information Administration, Commercial Building Energy Consumption Survey 2003, CBECS Public Use Microdata Files (Available at: <*http://www.eia.gov/consumption/commercial/data/2003/index.cfm?view=microdata*>) (Last accessed February 12, 2014).

beyond 2040 (see section IV.F.2.g). DOE provides a sensitivity analysis of the LCC savings and PBP results to different fuel price scenarios using both the *AEO 2013* high-price and low-price projections in appendix 8–C of the NOPR TSD.

e. Maintenance Costs

Maintenance costs are the costs to the consumer of ensuring continued equipment operation. Maintenance costs include services such as cleaning heat-exchanger coils and changing air filters. DOE estimated annual routine maintenance costs for SPVU air conditioners as $311 per year (2013$) for capacities up to 135,000 Btu/h. For heat pumps less than 65,000 Btu/h capacity, maintenance costs reported in the RS Means CostWorks 2013 database were $345 per year; costs were $414 per year for larger capacities. Because data were not available to indicate how maintenance costs vary with equipment efficiency, DOE used preventive maintenance costs that remain constant as equipment efficiency increases.

f. Repair Costs

The repair cost is the cost to the customer of replacing or repairing components that have failed in the SPVU equipment. DOE estimated the one-time repair cost in RS Means as equivalent to those for small packaged rooftop units: $2,594 (2013$) for both air conditioners and heat pumps less than 65,000 Btu/h capacity, and $3,245 for larger units. Based on frequency and type of major repairs in the RS Means database, DOE assumed that the repair would be a one-time event at about year 10 of the equipment life that involved replacing the supply fan motor, compressor, some bearings, and refrigerant. DOE then annualized the present value of the cost over the average equipment life of 15 years to obtain an annualized equivalent repair cost. DOE determined that the materials portion of annualized repair costs would increase in direct proportion with increases in equipment prices, because the replacement parts would be similar to the more expensive original equipment that they replaced. Because the price of SPVU equipment increases with efficiency, the cost for component repair is also expected to increase as the efficiency of equipment increases. See chapter 8 of the NOPR TSD for details on the development of repair cost estimates.

g. Equipment Lifetime

DOE defines ''equipment lifetime'' as the age when a unit of SPVU equipment is retired from service. DOE reviewed available literature to establish typical equipment lifetimes, which showed a wide range of lifetimes from 10 to 25 years. The data did not distinguish between classes of SPVU equipment. Consequently, DOE used a distribution of lifetimes between 10 and 25 years, with an average of 15 years based on a review of a range of packaged cooling equipment lifetime estimates found in published studies and online documents. DOE applied this distribution to all classes of SPVU equipment analyzed. Chapter 8 of the NOPR TSD contains a detailed discussion of equipment lifetimes.

h. Discount Rate

The discount rate is the rate at which future expenditures are discounted to establish their present value. DOE determined the discount rate by estimating the cost of capital for purchasers of SPVU equipment. Most purchasers use both debt and equity capital to fund investments. Therefore, for most purchasers, the discount rate is the weighted-average cost of debt and equity financing, or the weighted-average cost of capital (WACC), less the expected inflation.

To estimate the WACC of SPVU equipment purchasers, DOE used a sample of more than 340 companies grouped to be representative of operators of each of five commercial business types (health care, education, telecommunications, temporary office, and general office,) drawn from a database of 7,766 U.S. companies presented on the Damodaran Online Web site.[69] This database includes most of the publicly-traded companies in the United States. The WACC approach for determining discount rates accounts for the current tax status of individual firms on an overall corporate basis. DOE did not evaluate the marginal effects of increased costs, and, thus, depreciation due to more expensive equipment, on the overall tax status.

DOE used the final sample of companies to represent purchasers of SPVU equipment. For each company in the sample, DOE derived the cost of debt, percentage of debt financing, and systematic company risk from information on the Damodaran Online Web site. Damodaran estimated the cost of debt financing from the nominal long-term Federal government bond rate and the standard deviation of the stock price. DOE then determined the weighted average values for the cost of debt, range of values, and standard deviation of WACC for each category of the sample companies. Deducting expected inflation from the cost of capital provided estimates of the real discount rate by ownership category.

For most educational buildings and a portion of the office buildings occupied by public schools, universities, and State and local government agencies, DOE estimated the cost of capital based on a 40-year geometric mean of an index of long-term tax-exempt municipal bonds (>20 years).[70] Federal office space was assumed to use the Federal bond rate, derived as the 40-year geometric average of long-term (>10 years) U.S. government securities.[71]

Based on this database, DOE calculated the weighted-average, after-tax discount rate for SPVU equipment purchases, adjusted for inflation, in each of the five business types, which were allocated to the three building types used in the analysis based on estimated market shares of modular buildings used by each business type. The allocation percentages came from a combination of manufacturer interviews and industry data published by the Modular Buildings Institute.[72] [73] [74] [75]

Chapter 8 of the NOPR TSD contains the detailed calculations related to discount rates.

3. Payback Period

DOE also determined the economic impact of potential amended energy conservation standards on consumers by calculating the PBP of more-stringent efficiency levels relative to the base-case efficiency levels. The PBP measures the amount of time it takes the commercial customer to recover the assumed higher purchase expense of more-efficient equipment through lower operating costs. Similar to the LCC, the PBP is

[69] Damodaran financial data used for determining cost of capital is available at: *http://pages.stern.nyu.edu/~adamodar/* for commercial businesses (Last accessed February 12, 2014).

[70] Federal Reserve Bank of St. Louis, *State and Local Bonds—Bond Buyer Go 20-Bond Municipal Bond Index* (Last accessed February 12, 2014 (Available at: *http://research.stlouisfed.org/fred2/series/MSLB20/downloaddata?cid=32995*).

[71] Rate calculated with 1973–2013 data. Data source: U.S. Federal Reserve (Last accessed February 12, 2014) (Available at: *http://www.federalreserve.gov/releases/h15/data.htm*).

[72] Modular Building Institute, State of the Industry 2006 (Available at: *http://www.modular.org/HtmlPage.aspx?name=analysis*) (March 6, 2014).

[73] Modular Building Institute, Commercial Modular Construction Report 2008 (Available at: *http://www.modular.org/HtmlPage.aspx?name=analysis*) (March 6, 2014).

[74] Modular Building Institute, Commercial Modular Construction Report 2009 (Available at: *http://www.modular.org/HtmlPage.aspx?name=analysis*) (March 6, 2014).

[75] Modular Building Institute, Relocatable Buildings 2011 Annual Report (Available at: *http://www.modular.org/HtmlPage.aspx?name=analysis*) (March 6, 2014).

based on the total installed cost and the operating expenses for each building type and State, weighted on the probability of shipment to each market. Because the simple PBP does not take into account changes in operating expense over time or the time value of money, DOE considered only the first year's operating expenses to calculate the PBP, unlike the LCC, which is calculated over the lifetime of the equipment. Chapter 8 of the NOPR TSD provides additional details about the PBP.

G. National Impact Analysis

The national impact analysis (NIA) evaluates the effects of a considered energy conservation standard from a national perspective rather than from the customer perspective represented by the LCC. This analysis assesses the net present value (NPV) (future amounts discounted to the present) and the national energy savings (NES) of total commercial consumer costs and savings that are expected to result from amended standards at specific efficiency levels.

The NES refers to cumulative energy savings for the lifetime of units shipped from 2019 through 2048. DOE calculated energy savings in each year relative to a base case, defined as DOE adoption of the efficiency levels specified by ASHRAE Standard 90.1–2013. DOE also calculated energy savings from adopting efficiency levels specified by ASHRAE Standard 90.1–2013 compared to the EPCA base case (*i.e.,* the current Federal standards) for units shipped from 2015 through 2044. The NPV refers to cumulative monetary savings. DOE calculated net monetary savings in each year relative to the base case (ASHRAE Standard 90.1–2013) as the difference between total operating cost savings and increases in total installed cost. DOE accounted for operating cost savings until 2068, when the equipment installed in the 30th year after the compliance date of the amended standards should be retired. Cumulative savings are the sum of the annual NPV over the specified period.

1. Approach

The NES and NPV are a function of the total number of units in use and their efficiencies. Both the NES and NPV depend on annual shipments and equipment lifetime. Both calculations start by using the shipments estimate and the quantity of units in service derived from the shipments model.

To make the analysis more transparent to all interested parties, DOE used a spreadsheet tool, available on DOE's Web site,[76] to calculate the energy savings and the national economic costs and savings from potential amended standards. Interested parties can review DOE's analyses by changing various input quantities within the spreadsheet.

Unlike the LCC analysis, the NES spreadsheet does not use distributions for inputs or outputs, but relies on national average equipment costs and energy costs developed from the LCC spreadsheet. DOE used the NES spreadsheet to perform calculations of energy savings and NPV using the annual energy consumption and total installed cost data from the LCC analysis. For efficiency levels higher than ASHRAE, DOE projected the energy savings, energy cost savings, equipment costs, and NPV of benefits for equipment sold in each SPVU class from 2019 through 2048. For the ASHRAE level, DOE project energy savings for equipment sold from 2015 through 2044. DOE does not calculate economic benefits for the ASHRAE level because it is statutorily required to use the ASHRAE level as the baseline. The projection provided annual and cumulative values for all four output parameters described above.

a. National Energy Savings

DOE calculated the NES associated with the difference between the per-unit energy use under a standards-case scenario and the per-unit energy use in the base case. The average energy per unit used by the SPVUs in service gradually decreases in the standards case relative to the base case because more-efficient SPVUs are expected to gradually replace less-efficient ones.

Unit energy consumption values for each equipment class are taken from the LCC spreadsheet for each efficiency level and weighted based on market efficiency distributions. To estimate the total energy savings for each efficiency level, DOE first calculated the delta unit energy consumption (*i.e.,* the difference between the energy directly consumed by a unit of equipment in operation in the base case and the standards case) for each class of SPVUs for each year of the analysis period. The analysis period begins with the earliest expected compliance date of amended energy conservation standards (*i.e.,* 2015), assuming DOE adoption of the baseline ASHRAE Standard 90.1–2013 efficiency levels. For the analysis of DOE's potential adoption of more-stringent efficiency levels, the analysis period does not begin until the compliance date of 2019, four years after DOE would likely issue a final rule requiring such standards. Second, DOE determined the annual site energy savings by multiplying the stock of each equipment class by vintage (*i.e.,* year of shipment) by the delta unit energy consumption for each vintage (from step one). As mentioned in section IV.E, this includes an increase in gas usage for some SPVAC units sold with gas furnaces (where fan power was reduced to achieve higher efficiency levels). Third, DOE converted the annual site electricity savings into the annual amount of energy saved at the source of electricity generation (the source or primary energy), using a time series of conversion factors derived from the latest version of EIA's National Energy Modeling System (NEMS). Finally, DOE summed the annual primary energy savings for the lifetime of units shipped over a 30-year period to calculate the total NES. DOE performed these calculations for each efficiency level considered for SPVUs in this rulemaking.

DOE has historically presented NES in terms of primary energy savings. In response to the recommendations of a committee on ''Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards'' appointed by the National Academy of Science, DOE announced its intention to use full-fuel-cycle (FFC) measures of energy use and greenhouse gas and other emissions in the national impact analyses and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (August 18, 2011). While DOE stated in that notice that it intended to use the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model to conduct the analysis, it also said it would review alternative methods, including the use of NEMS. After evaluating both models and the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in the **Federal Register** in which DOE explained its determination that NEMS is a more appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (August 17, 2012). DOE received one comment, which was supportive of the use of NEMS for DOE's FFC analysis.[77]

The approach used for the NOPR, and the FFC multipliers that were applied, are described in appendix 10A of the NOPR TSD. NES results are presented in

[76] DOE's Web page on SPVUs can be found at: *http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/35.*

[77] Docket ID: EERE–2010–BT–NOA–0028, comment by Kirk Lundblade.

both primary and FFC savings in section V.B.3.a.

DOE considered whether a rebound effect is applicable in its NES analysis for SPVUs. A rebound effect occurs when an increase in equipment efficiency leads to increased demand for its service. For example, when a consumer realizes that a more-efficient air conditioner will lower the electricity bill, that person may opt for increased comfort in the home by lowering the temperature, thereby returning a portion of the energy cost savings. The NEMS model assumes an efficiency rebound to account for an increased demand for service due to the increase in cooling (or heating) efficiency.[78] For the SPVU market, there are two ways that a rebound effect could occur: (1) Increased use of the air-conditioning equipment within the commercial buildings in which such units are installed; and (2) additional instances of air-conditioning of spaces that were not being cooled before. Because SPVUs are a commercial appliance, the person owning the equipment (*i.e.,* the building owner) is usually not the person operating the equipment (*i.e.,* the renter). Because the operator usually does not own the equipment, that person will not have the operating cost information necessary to influence their operation of the equipment. Therefore, DOE believes that the first instance is unlikely to occur. Similarly, the second instance is unlikely because a small change in efficiency is insignificant among the factors that determine how much floor space will be air-conditioned.

Issue 11: DOE seeks comment on whether a rebound effect should be included in the determination of annual energy savings. If a rebound effect should be included, DOE seeks data to assist in calculation of the rebound effect.

b. Net Present Value

To estimate the NPV, DOE calculated the net impact as the difference between total operating cost savings and increases in total installed costs. DOE calculated the NPV of each considered standard level over the life of the equipment using the following three steps.

First, DOE determined the difference between the equipment costs under the standard-level case and the base case in order to obtain the net equipment cost increase resulting from the higher standard level. As noted in section IV.F.2.a, DOE used a constant price assumption as the default price forecast; the cost to manufacture a given unit of higher efficiency neither increases nor decreases over time. In addition, DOE considered two alternative price trends in order to investigate the sensitivity of the results to different assumptions regarding equipment price trends. One of these used an exponential fit on the deflated Producer Price Index (PPI) for all other miscellaneous refrigeration and air-conditioning equipment, and the other is based on the ''deflator—other durables excluding medical'' that was forecasted for *AEO 2013.* The derivation of these price trends is described in appendix 10B of the NOPR TSD.

Second, DOE determined the difference between the base-case operating costs and the standard-level operating costs in order to obtain the net operating cost savings from each higher efficiency level. Third, DOE determined the difference between the net operating cost savings and the net equipment cost increase in order to obtain the net savings (or expense) for each year. DOE then discounted the annual net savings (or expenses) to 2014 for SPVUs bought on or after 2019 and summed the discounted values to provide the NPV for an efficiency level.

In accordance with the OMB's guidelines on regulatory analysis,[79] 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 on private capital in the U.S. economy. DOE used this discount rate to approximate the opportunity cost of capital in the private sector, because recent OMB analysis has found the average rate of return on capital to be near this rate. DOE used the 3-percent rate to capture the potential effects of standards on private consumption (*e.g.,* through higher prices for products and reduced purchases 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 (*i.e.,* yield on United States 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 past 30 years.

2. Shipments Analysis

In its shipments analysis, DOE developed shipment projections for SPVUs and, in turn, calculated equipment stock over the course of the analysis period. DOE used the shipments projection and the equipment stock to determine the NES. In order to account for the analysis periods of both the ASHRAE level and higher efficiency levels, the shipments portion of the spreadsheet model projects SPVU shipments from 2015 through 2048.

To develop the shipments model, DOE started with 2005 shipment estimates from the Air-Conditioning and Refrigeration Institute (ARI, now AHRI) for units less than 65,000 Btu/h as published in a previous rulemaking,[80] as more recent data are not available. DOE added additional shipments for SPVACs greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h, which make up 3 percent of the market, based on manufacturer interviews. As there are no models on the market for SPVHP greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h, or for any SPVUs greater than or equal to 135,000 Btu/h, DOE did not develop shipment estimates (or generate NES and NPV) for these equipment classes. See chapter 9 of the NOPR TSD for more details on the initial shipment estimates by equipment class that were used as the basis for the shipments projections discussed below.

To project shipments of SPVUs for new construction (starting in 2006), DOE relied primarily on sector-based estimates of saturation and projections of floor space. Based on manufacturer interview information, DOE allocated 35 percent of shipments to the education sector, 35 percent to telecom, and 30 percent to offices. DOE used the 2005 new construction shipments and 2005 new construction floor space for education (from *AEO 2013*) to estimate a saturation rate.[81] DOE applied this

[78] An overview of the NEMS model and documentation is found at: *www.eia.doe.gov/oiaf/aeo/overview/index.html.*

[79] OMB Circular A–4, section E (Sept. 17, 2003) (Available at: *www.whitehouse.gov/omb/circulars_a004_a-4.*)

[80] U.S. Department of Energy—Office of Energy Efficiency and Renewable Energy, Technical Support Document: Energy Efficiency Program for Commercial and Industrial Equipment: Efficiency Standards for Commercial Heating, Air-Conditioning, and Water Heating Equipment Including Packaged Terminal Air-Conditioners and Packaged Terminal Heat Pumps, Small Commercial Packaged Boiler, Three-Phase Air-Conditioners and Heat Pumps <65,000 Btu/h, and Single-Package Vertical Air Conditioners and Single-Package Vertical Heat Pumps <65,000 Btu/h (March 2006) (Available at: *http://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/ashrae_products/ashrae_products_draft_tsd_030206.pdf*). This TSD was prepared for the rulemaking that resulted in the Final Rule: Energy Efficiency Program for Certain Commercial and Industrial Equipment: Efficiency Standards for Commercial Heating, Air-Conditioning, and Water-Heating Equipment. 72 FR 10038 (March 7, 2007).

[81] Manufacturers reported that in 2012, 50 percent of shipments were for new construction. DOE originally adjusted that split for 2005 until the result from the shipments model was 50/50 in 2012. This resulting 2005 split was 84 percent new construction and 16 percent replacement. However,

saturation rate to *AEO 2013* projections of new construction floor space to project shipments to new construction in the education sector through 2048. In this projection, shipments to education decline through 2026 before rising to levels still lower than those in 2005. DOE originally used this methodology for offices also, as published in the April 2014 NODA. However, in response to the April 2014 NODA, AHRI and Lennox International suggested that the SPVU projected shipment trend was ''optimistic'' and did not reflect the economic downturn. (AHRI, No. 24 at p. 6; Lennox International Inc., No. 15 at p. 7) After reviewing modular building industry literature,[82] DOE agrees with AHRI and Lennox, but for the small office sector only; DOE has determined that the increasing trend in the *AEO* for small offices does not adequately represent the modular building industry. As a result, DOE has tentatively decided to hold SPVU shipments to new office construction constant at 2005 levels. (For more details, see chapter 9 of the NOPR TSD.) For shipments to telecom, DOE developed an index based on County Business Pattern data for establishments[83] and projected this trend forward. This projection increases significantly over the analysis period, which may have led in part to AHRI and Lennox's suggestion that the overall shipment projection was optimistic. However, in response to the April 2014 NODA, the CA IOUs pointed out that the rapid expansion of wireless communications resulted in expanded use of SPVUs. (CA IOUs, No. 19 at p. 5) DOE agrees with the CA IOUs' assessment for telecom and has chosen to maintain the increasing projection for that sector.

To allocate the total projected shipments for office, education, and telecom into the equipment classes applicable to each sector, DOE used the fraction of shipments from 2005 for each equipment class in each sector. This fractions within each sector remained constant over time. The complete discussion of shipment allocation and projected shipments for the different equipment classes can be found in chapter 9 of the NOPR TSD.

In order to model shipments for replacement SPVUs, DOE developed historical shipments for SPVUs back to 1981 based on an index of square footage production data from the Modular Buildings Institute.[84] Shipments prior to 1994 were extrapolated based on a trend from 1994 to 2005. In the stock model, the lifetime of SPVUs follows the distribution discussed in section IV.F.2.g, with a minimum of 10 years and a maximum of 25 years. All retired units are assumed to be replaced with new shipments. The complete discussion of the method for extrapolating historical shipments can be found in chapter 9 of the NOPR TSD.

As equipment purchase price and repair costs increase with efficiency, higher first costs and repair costs can result in a drop in shipments. In manufacturer interviews, manufacturers expressed concern that an increase in first cost could lead customers to switch to split-system or rooftop units. However, manufacturers did not provide any information on the price point at which this switch might occur, and DOE had insufficient data for estimating the elasticity of shipments for SPVUs as a function of first costs, repair costs, or operating costs. In addition, DOE notes that SPVUs serve a specific niche market and that a switch from SPVUs to another type of equipment would require significant changes in the market, such as installation on site rather than at the modular building manufacturer, the use of a mechanical contractor (including their markups), and potential changes to needed ductwork and other infrastructure. Therefore, DOE assumed that the shipments projection would not change under the considered standard levels.

Issue 12: DOE seeks comment on whether amended standards would be likely to affect shipments.

3. Base-Case and Standards-Case Forecasted Distribution of Efficiencies

DOE uses a base-case distribution of efficiency levels to project what the SPVU market would look like in the absence of amended standards. DOE developed a base-case distribution of efficiency levels for SPVU equipment using manufacturer-provided estimates. DOE applied the percentages of models within each efficiency range to the total unit shipments for a given equipment class to estimate the distribution of shipments for the base case. Then, from those market shares and projections of shipments by equipment class, DOE extrapolated future equipment efficiency trends both for a base-case scenario and for standards-case scenarios.

To estimate a base-case efficiency trend, DOE used the trend from 2012 to 2035 found in the Commercial Unitary Air Conditioner Advance Notice of Proposed Rulemaking (ANOPR), which estimated an increase of approximately 1 EER every 35 years.[85] DOE used this same trend in the standards-case scenarios, when seeking to ascertain the impact of amended standards.

For each efficiency level analyzed, DOE used a ''roll-up'' scenario to establish the market shares by efficiency level for the year that compliance would be required with amended standards (*i.e.,* 2015 if DOE adopts the efficiency levels in ASHRAE Standard 90.1–2013, or 2019 if DOE adopts more-stringent efficiency levels than those in ASHRAE Standard 90.1–2013). DOE collected information suggesting that, as the name implies, the efficiencies of equipment in the base case that did not meet the standard level under consideration would roll up to meet the amended standard level. This information also suggests that equipment efficiencies in the base case that were above the standard level under consideration would not be affected. The base-case efficiency distributions for each equipment class are presented in chapter 10 of the NOPR TSD.

H. Consumer Subgroup Analysis

In analyzing the potential impact of new or amended standards on commercial consumers, DOE evaluates the impact on identifiable groups (*i.e.,* subgroups) of consumers, such as different types of businesses that may be disproportionately affected by a national standard level. For this rulemaking, DOE identified mining and construction companies occupying temporary office space as a disproportionately affected subgroup. Because it has generally higher costs of capital and, therefore, higher discount rates than other firms using SPVUs, this consumer subgroup is less likely than average to value the benefits of increased energy savings.

this led to a steep shipments increase in the model from 2005 to 2006. Instead, DOE used the 50/50 split directly in 2005, which resulted in a much steadier shipments trend. Therefore, 2005 new construction shipments are derived using 50 percent of the total 2005 historical shipments.

82 Modular Building Institute, Relocatable Buildings 2012 Annual Report; Relocatable Buildings 2011 Annual Report (Available at: *http://www.modular.org/documents/2012-RB-Annual-Report.pdf* and *http://www.triumphmodular.com/resources/documents/2011relocatable.pdf*).

83 U.S. Census Bureau, County Business Patterns for NAICS 237130 Power and Communication Line and Related Structures Construction (Available at: *http://www.census.gov/econ/cbp/index.html*) (Last accessed April 15, 2014).

84 Available at: *http://www.modular.org/HtmlPage.aspx?name=analysis* (Last accessed May 18, 2012).

85 *See* DOE's technical support document underlying DOE's July 29, 2004 ANOPR. 69 FR 45460 (Available at: *http://www.regulations.gov/#!documentDetail;D=EERE-2006-STD-0103-0078*). SPVUs have only had EER standards since 2002, which was not long enough to establish an efficiency trend.

However, this group also faces relatively high electricity prices compared with some other consumer subgroups. These two conditions tend to offset each other, so a quantitative analysis was required to determine whether this subgroup would experience higher or lower than average LCC savings. Another type of consumer that might be disproportionately affected is public education facilities. Because of their tax-exempt status, public education agencies generally have lower capital costs than other SPVU users and, thus, might disproportionately benefit from increased SPVU energy efficiency; however, they also typically face lower electricity costs than other commercial customers, so a quantitative analysis was required to determine whether they would have lower or higher than average LCC savings.

For the NOPR, DOE also analyzed the potential effects of amended SPVU standards on businesses with high capital costs, which are generally (but not always) small businesses. DOE analyzed the potential impacts of amended standards by conducting the analysis with different discount rates, because small businesses do not have the same access to capital as larger businesses, but they may pay similar prices for electricity. DOE obtained size premium data from Ibbotson Associates' *Stocks, Bonds, Bills, and Inflation 2013 Yearbook.*[86] For the period of 1926–2012, the geometric mean of annual returns for the smallest companies in all industries (13 percent) was 103.1 percent of the average for the total value-weighted index of companies listed on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and National Association of Security Dealers Stock Exchange (NASDAQ) (9.6 percent), implying that on average, historical performance of small companies has been (113.0/109.6)=1.031 or 3.1 percent points higher than the market average, in effect a ''small company size premium'', an extra cost premium that they have to pay to do business. DOE assumed that for businesses purchasing SPVUs and purchasing or renting modular buildings containing SPVUs, the average discount rate for small companies is 3.1 percent higher than the industry average.

DOE determined the impact of consumer subgroup costs and savings using the LCC spreadsheet model. DOE conducted the LCC and PBP analyses separately for consumers represented by the mining and construction firms using temporary office buildings and for public education agencies using portable classrooms, and then compared the results with those for average commercial customers. DOE also conducted an analysis in which only firms with a discount rate 3.1 percent higher than the corresponding industry average were selected. While not all of these firms were small businesses (some had volatile stock prices or other special circumstances), they were the ones that had the highest costs of capital and were the least likely to benefit from increased SPVU standards.

Due to the higher costs of conducting business, benefits of SPVU standards for small and other high-capital-cost businesses are estimated to be slightly lower than for the general population of SPVU owners.

The results of DOE's LCC subgroup analysis are summarized in section V.B.1.b and described in detail in chapter 11 of the NOPR TSD.

I. Manufacturer Impact Analysis

1. Overview

DOE performed a manufacturer impact analysis (MIA) to estimate the financial impact of amended energy conservation standards on manufacturers of SPVUs and to calculate the potential impact of such standards on employment and manufacturing capacity.

The MIA has both quantitative and qualitative aspects. The quantitative portion of the MIA primarily relies on the Government Regulatory Impact Model (GRIM), an industry cash-flow model customized for this rulemaking. The key GRIM inputs are data on the industry cost structure, equipment costs, shipments, and assumptions about markups and conversion expenditures. The key output is the industry net present value (INPV). Different sets of assumptions (markup scenarios) will produce different results. The qualitative portion of the MIA addresses factors such as equipment characteristics, as well as industry and market trends. Chapter 12 of the NOPR TSD describes the complete MIA.

DOE calculated manufacturer impacts relative to a base case, defined as DOE adoption of the efficiency levels specified by ASHRAE Standard 90.1–2013. Consequently, when comparing the INPV impacts of the GRIM model, the baseline technology is at an efficiency of 10 EER/3.0 COP.

DOE conducted the MIA for this rulemaking in three phases. In Phase 1 of the MIA, DOE prepared a profile of the SPVU industry which includes a top-down cost analysis of manufacturers that DOE used to derive preliminary financial inputs for the GRIM (*e.g.,* sales, general, and administration (SG&A) expenses; research and development (R&D) expenses; and tax rates). DOE used public sources of information, including the 2008 Energy Conservation Program for Commercial and Industrial Equipment: Packaged Terminal Air Conditioner and Packaged Terminal Heat Pump Energy Conservation Standards Final Rule (73 FR 58772 (Oct. 7, 2008)), the 2011 Energy Conservation Standards Direct Final Rule for Residential Furnaces, Central Air Conditioners and Heat Pumps (76 FR 37408 (June 27, 2011)); Securities and Exchange Commission (SEC) 10–K filings;[87] corporate annual reports; the U.S. Census Bureau's Annual Survey of Manufacturers;[88] and Hoovers reports.[89]

In phase 2 of the MIA, DOE prepared an industry cash-flow analysis to quantify the potential impacts of an amended energy conservation standard. In general, new or more-stringent energy conservation standards can affect manufacturer cash flow in three distinct ways: (1) Create a need for increased investment; (2) raise production costs per unit; and (3) alter revenue due to higher per-unit prices and possible changes in sales volumes.

In phase 3 of the MIA, DOE conducted structured, detailed interviews with a representative cross-section of manufacturers. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to validate assumptions used in the GRIM and to identify key issues or concerns. See section IV.I.3 for a description of the key issues manufacturers raised during the interviews.

Additionally, in phase 3, DOE evaluates subgroups of manufacturers that may be disproportionately impacted by standards or that may not be accurately represented by the average cost assumptions used to develop the industry cash-flow analysis. For example, small manufacturers, niche players, or manufacturers exhibiting a cost structure that largely differs from the industry average could be more negatively affected. Thus, during Phase

[86] Morningstar, Inc., *Ibbotson SBBI 2013 Classic Yearbook. Market Results for Stocks, Bonds, Bills, and Inflation* 1926–2012 (2013).

[87] Filings & Forms, Securities and Exchange Commission (2013) (Available at: *http://www.sec.gov/edgar.shtml*) (Last accessed April 3, 2013).

[88] U.S. Census Bureau, Annual Survey of Manufacturers: General Statistics: Statistics for Industry Groups and Industries (2010) (Available at: *http://www.census.gov/manufacturing/asm/index.html*>) (Last accessed April 3, 2013).

[89] Hoovers | Company Information | Industry Information | Lists, D&B (2013) (Available at: *http://www.hoovers.com/*) (Last accessed April 3, 2013).

3, DOE analyzed small manufacturers as a subgroup.

The Small Business Administration (SBA) defines a small business for North American Industry Classification System (NAICS) code 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing,'' as having 750 employees or fewer. During its research, DOE identified one domestic company which manufactures equipment covered by this rulemaking and qualifies as a small business under the SBA definition. The small business subgroup is discussed in section VI.B of the preamble, and in chapter 12 of the NOPR TSD.

2. GRIM Analysis

As discussed previously, DOE uses the GRIM to quantify the changes in cash flow that result in a higher or lower industry value due to amended energy conservation standards. The GRIM analysis uses a discounted cash-flow methodology that incorporates manufacturer costs, markups, shipments, and industry financial information as inputs. The GRIM models changes in costs, distribution of shipments, investments, and manufacturer margins that could result from amended energy conservation standards. The GRIM spreadsheet uses the inputs to arrive at a series of annual cash flows, beginning in 2014 (the base year of the analysis) and continuing to 2048. DOE calculated INPVs by summing the stream of annual discounted cash flows during this period. DOE applied a discount rate of 10.4 percent, which was derived from industry financials and then modified according to feedback received during manufacturer interviews.

The GRIM calculates cash flows using standard accounting principles and compares changes in INPV between the base case and each TSL (the standards case). Essentially, the difference in INPV between the base case and a standards case represents the financial impact of the amended energy conservation standard on manufacturers. Additional details about the GRIM, the discount rate, and other financial parameters can be found in chapter 12 of the NOPR TSD.

a. GRIM Key Inputs

i. Manufacturer Production Costs

Manufacturing a higher-efficiency product is typically more expensive than manufacturing a baseline product due to the use of more expensive components and larger quantities of raw materials. The changes in the manufacturer production cost (MPC) 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.

In the MIA, DOE used the MPCs for each considered efficiency level calculated in the engineering analysis, as described in section IV.C and further detailed in chapter 5 of the NOPR TSD. In addition, DOE used information from its teardown analysis, described in section IV.C, to disaggregate the MPCs into material, labor, and overhead costs. To calculate the MPCs for products higher than the baseline, DOE added the incremental material, labor, and overhead costs from the engineering cost-efficiency curves to the baseline MPCs. These cost breakdowns and product mark-ups were revised based on manufacturer comments received during MIA interviews.

ii. Shipments Forecast

The GRIM estimates manufacturer revenues based on total unit shipment forecasts and the distribution of shipments by equipment class. For the base-case analysis, the GRIM uses the NIA base-case shipments forecasts from 2014 (the base year for the MIA analysis) to 2048 (the last year of the analysis period). In the shipments analysis, DOE estimates the distribution of efficiencies in the base case for all equipment classes. See section IV.G.2 for additional details.

For the standards-case shipment forecast, the GRIM uses the NIA standards-case shipment forecasts. The NIA assumes that product efficiencies in the base case that do not meet the energy conservation standard in the standards case ''roll up'' to meet the amended standard in the standard year. See section IV.G.2, above, for additional details.

iii. Product and Capital Conversion Costs

Amended energy conservation standards would cause manufacturers to incur one-time conversion costs to make necessary changes to their production facilities and bring product designs into compliance. DOE evaluated the level of conversion-related expenditures that would be needed to comply with each considered efficiency level in each equipment class. For the purpose of the MIA, DOE classified these conversion costs into two major groups: (1) Product conversion costs; and (2) capital conversion costs. Product conversion costs are one-time investments in research, development, testing, and marketing, focused on making product designs comply with the amended energy conservation standard. Capital conversion costs are one-time investments in property, plant, and equipment to adapt or change existing production facilities so that amended equipment designs can be fabricated and assembled.

To determine the level of capital conversion expenditures manufacturers would incur to comply with amended energy conservation standards, DOE gathered data on the level of capital investment required at each efficiency level during manufacturer interviews. DOE validated manufacturer comments through estimates of capital expenditure requirements derived from the product teardown analysis and engineering model described in section IV.C.

DOE assessed the product conversion costs at each considered efficiency level by integrating data from quantitative and qualitative sources. DOE considered market-share-weighted feedback from multiple manufacturers to determine conversion costs, such as R&D expenditures, at each efficiency level. Manufacturer numbers were aggregated to better reflect the industry as a whole and to protect confidential information.

In general, DOE assumes that all conversion-related investments occur between the year of publication of the final rule and the year by which manufacturers must comply with the standard. The investment figures used in the GRIM can be found in section V.B.2 of the preamble. For additional information on the estimated product conversion and capital conversion costs, see chapter 12 of the NOPR TSD.

b. GRIM Scenarios

i. Markup Scenarios

As discussed previously, manufacturer selling prices (MSPs) include direct manufacturing production costs (*i.e.,* labor, materials, and overhead estimated in DOE's MPCs) and all non-production costs (*i.e.,* SG&A, R&D, and interest), along with profit. To calculate the MSPs in the GRIM, DOE applied non-production cost markups to the MPCs estimated in the engineering analysis for each equipment class and efficiency level. Modifying these markups in the standards case yields different sets of impacts on manufacturers. 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 preservation of gross margin percentage; and (2) a preservation of operating profit. These scenarios lead to different markup values which, when applied to the input MPCs, result in varying revenue and cash flow impacts.

Under the preservation-of-gross-margin-percentage scenario, DOE applied a single uniform ''gross margin percentage'' markup across all efficiency levels. As production costs increase with efficiency, this scenario implies that the absolute dollar markup will increase as well. DOE assumed the non-production cost markup—which includes SG&A expenses, research and development expenses, interest, and profit—to be 1.28 for SPVU equipment. This markup is consistent with the one DOE assumed in the base case for the GRIM. Manufacturers tend to believe it is optimistic to assume that they would be able to maintain the same gross margin percentage markup as their production costs increase. Therefore, DOE assumes that this scenario represents a high bound to industry profitability under an amended energy conservation standard.

In the preservation-of-operating-profit scenario, as the cost of production goes up under a standards case, manufacturers are generally required to reduce their markups to a level that maintains base-case operating profit. DOE implemented this scenario in the GRIM by lowering the manufacturer markups at each TSL to yield approximately the same earnings before interest and taxes in the standards case as in the base case in the year after the compliance date of the amended standards. The implicit assumption behind this markup scenario is that the industry can only maintain its operating profit in absolute dollars after the standard.

3. Manufacturer Interviews

As part of the MIA, DOE discussed potential impacts of standards with three manufacturers of SPVUs. The interviewed manufacturers account for over 90 percent of the domestic SPVU market. In interviews, DOE asked manufacturers to describe their major concerns about this rulemaking. The following section highlights manufacturers' most significant concerns.

a. Size Constraints

Manufacturers noted that higher efficiency standards could force them to increase the size of their SPVU equipment to levels that are not acceptable to their customers. The manufacturers stated that some critical design options, such as increasing the amount of heat exchanger surface area, would necessitate an increase in cabinet size and footprint. For example, in the modular classroom and modular office markets, any additional floor space taken up by a larger SPVU could not be used by students and tenants. In the telecom market, manufacturers noted that telecom operators have standard-sized telecom shelters and current SPVU designs already make use of all available wall space. Any increase in size would force their customers to redesign the layout of the shelters and the complex telecommunications electronics housed therein. These size constraints would affect manufacturers if the amended standards are increased beyond the levels set in ASHRAE Standard 90.1–2013.

According to manufacturers, a change in cabinet size would be particularly problematic in the replacement market. Amended designs may no longer physically fit into existing installation locations. Some examples include units that are too wide to fit through standard-width doorways, that are too tall for the standard ceiling heights, and that protrude too far into classrooms or offices. Aside from the physical space constraints, manufacturers are concerned that air vents and wall plenums would no longer align. The use of sleeves or adaptors to reroute air flow would be unsightly, take up valuable space, and affect air flow in a manner that reduces product efficiency.

b. Alternative Products

Multiple manufacturers stated that a large increase in efficiency could lead to price increases that would cause their customers to consider alternative products, such as unitary systems or commercial roof top units. The manufacturers argued that these systems are often less convenient for end-users due to the need for extensive duct work, the use of long refrigerant lines, and/or the reduced ability to control the flow of fresh air. These manufacturers were concerned that an increase in the energy conservation standard would raise the SPVU prices to the point where end-users would accept the drawbacks of alternative products. DOE did not receive any quantitative comments on the price point at which unitary systems and commercial systems typically become cost-competitive alternatives.

c. Compliance Tolerances

Two manufacturers stated concerns about the tolerances required by compliance testing. They argued that SPVU manufacturers have no control over the variability in the performance of purchased components (such as compressors) or the variability of instrumentation within different test laboratories. As a result, the manufacturers stated that it is unrealistic for DOE to expect their products could test within the narrow confidence limits set forth at 10 CFR 429.43.

d. Constrained Innovation and Customization

Multiple manufacturers noted that complying with more-stringent energy conservation standards would draw time, resources, and focus away from innovation, customization, and customer responsiveness. Manufacturers believe that the design, engineering, and testing resources used to comply with amended standards would be better invested in developing features requested by their customers. Furthermore, multiple manufacturers stated that higher standards push manufacturers toward similar designs. Manufacturers argued that DOE's energy conservation standards constrain their ability to customize products in ways that maximize efficiency based on the end user's specific use-case.

J. Emissions Analysis

In the emissions analysis, DOE estimates the reduction in power sector emissions of carbon dioxide (CO_2), nitrogen oxides (NO_X), sulfur dioxide (SO_2), and mercury (Hg) from amended energy conservation standards for the considered SPVU equipment. In addition, DOE estimates emissions impacts in production activities (extracting, processing, and transporting fuels) that provide the energy inputs to power plants. These are referred to as ''upstream'' emissions. Together, these emissions account for the full-fuel-cycle (FFC). In accordance with DOE's FFC Statement of Policy (76 FR 51281 (August 18, 2011)), this FFC analysis includes impacts on emissions of methane (CH_4) and nitrous oxide (N_2O), both of which are recognized as greenhouse gases.

DOE primarily conducted the emissions analysis using emissions factors for CO_2 and most of the other gases derived from data in *AEO 2013*.[90]

[90] Emissions factors based on the *Annual Energy Outlook 2014* (*AEO 2014*), which became available too late for incorporation into this analysis, indicate that a significant decrease in the cumulative emission reductions of carbon dioxide and most other pollutants can be expected if the projections of power plant utilization assumed in *AEO 2014* are realized. For example, the estimated amount of cumulative emission reductions of CO_2 is expected to decrease by 33% from DOE's current estimate based on the projections in *AEO 2014* relative to *AEO 2013*. The monetized benefits from GHG reductions would likely decrease by a comparable

Combustion emissions of CH_4 and N_2O were estimated using emissions intensity factors published by the Environmental Protection Agency (EPA) through its GHG Emissions Factors Hub.[91] DOE developed separate emissions factors for power sector emissions and upstream emissions. DOE also calculated site and upstream emissions from the additional use of natural gas associated with some of the SPVU efficiency levels. The method that DOE used to derive emissions factors is described in chapter 13 of the NOPR TSD.

For CH_4 and N_2O, DOE calculated emissions reduction in tons and also in terms of units of carbon dioxide equivalent (CO_2eq). Gases are converted to CO_2eq by multiplying the physical units by the gas's global warming potential (GWP) over a 100-year time horizon. Based on the Fifth Assessment Report of the Intergovernmental Panel on Climate Change,[92] DOE used GWP values of 28 for CH_4 and 265 for N_2O.

EIA prepares the *Annual Energy Outlook* using NEMS. Each annual version of NEMS incorporates the projected impacts of existing air quality regulations on emissions. *AEO 2013* generally represents current legislation and environmental regulations, including recent government actions, for which implementing regulations were available as of December 31, 2012.

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap-and-trade programs. Title IV of the Clean Air Act 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 were also limited under the Clean Air Interstate Rule (CAIR; 70 FR 25162 (May 12, 2005)), which created an allowance-based trading program that operates along with the Title IV program. CAIR was remanded to the U.S. Environmental Protection Agency (EPA) by the U.S. Court of Appeals for the District of Columbia Circuit, but it remained in effect. See *North Carolina* v. *EPA,* 550 F.3d 1176 (D.C. Cir. 2008; *North Carolina* v. *EPA,* 531 F.3d 896 (D.C. Cir. 2008). In 2011 EPA issued a replacement for CAIR, the Cross-State Air Pollution Rule (CSAPR). 76 FR 48208 (August 8, 2011). On August 21, 2012, the D.C. Circuit issued a decision to vacate CSAPR.[93] The court ordered EPA to continue administering CAIR. The emissions factors used for this NOPR, which are based on *AEO 2013,* assume that CAIR remains a binding regulation through 2040.[94]

The attainment of emissions caps is typically flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. Under existing EPA regulations, any excess SO_2 emissions allowances resulting from the lower electricity demand caused by the adoption of an efficiency standard could be used to permit offsetting increases in SO_2 emissions by any regulated EGU. In past rulemakings, DOE recognized that there was uncertainty about the effects of efficiency standards on SO_2 emissions covered by the existing cap-and-trade system, but it concluded that negligible reductions in power sector SO_2 emissions would occur as a result of standards.

Beginning around 2016, however, SO_2 emissions will fall as a result of the Mercury and Air Toxics Standards (MATS) for power plants. 77 FR 9304 (Feb. 16, 2012). In the final MATS rule, EPA established a standard for hydrogen chloride as a surrogate for acid gas hazardous air pollutants (HAP), and also established a standard for SO_2 (a non-HAP acid gas) as an alternative equivalent surrogate standard for acid gas HAP. The same controls are used to reduce HAP and non-HAP acid gas; thus, SO_2 emissions will be reduced as a result of the control technologies installed on coal-fired power plants to comply with the MATS requirements for acid gas. *AEO 2013* assumes that, in order to continue operating, coal plants must have either flue gas desulfurization or dry sorbent injection systems installed by 2016. Both technologies, which are used to reduce acid gas emissions, also reduce SO_2 emissions. Under the MATS, emissions will be far below the cap that would be established by CAIR, so it is unlikely that excess SO_2 emissions allowances resulting from the lower electricity demand would be needed or used to permit offsetting increases in SO_2 emissions by any regulated EGU. Therefore, DOE believes that energy efficiency standards will reduce SO_2 emissions in 2016 and beyond.

CAIR established a cap on NO_X emissions in 28 eastern States and the District of Columbia.[95] Energy conservation standards are expected to have little effect on NO_X emissions in those States covered by CAIR because excess NO_X emissions allowances resulting from the lower electricity demand could be used to permit offsetting increases in NO_X emissions. However, standards would be expected to reduce NO_X emissions in the States not affected by the caps, so DOE estimated NO_X emissions reductions from the standards considered in the NOPR for these States.

The MATS limit mercury emissions from power plants, but they do not include emissions caps, and as such, DOE's energy conservation standards would likely reduce Hg emissions. DOE estimated mercury emissions reduction using emissions factors based on *AEO 2013,* which incorporates MATS.

K. Monetizing Carbon Dioxide and Other Emissions Impacts

As part of the development of this NOPR, DOE considered the estimated monetary benefits from the reduced emissions of CO_2 and NO_X that are expected to result from each of the considered efficiency levels. In order to make this calculation similar to the calculation of the NPV of customer benefit, DOE considered the reduced emissions expected to result over the lifetime of products shipped in the forecast period for each efficiency level. This section summarizes the basis for the monetary values used for CO_2 and NO_X emissions and presents the values considered in this rulemaking.

For this NOPR, 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 those values is provided in the

amount. DOE plans to use emissions factors based on the most recent *AEO* available for the next phase of this rulemaking, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

[91] See: *http://www.epa.gov/climateleadership/inventory/ghg-emissions.html.*

[92] IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Chapter 8.

[93] See *EME Homer City Generation, LP* v. *EPA,* 696 F.3d 7, 38 (D.C. Cir. 2012).

[94] On April 29, 2014, the U.S. Supreme Court reversed the judgment of the D.C. Circuit and remanded the case for further proceedings consistent with the Supreme Court's opinion. The Supreme Court held in part that EPA's methodology for quantifying emissions that must be eliminated in certain States due to their impacts in other downwind States was based on a permissible, workable, and equitable interpretation of the Clean Air Act provision that provides statutory authority for CSAPR. See *EPA* v. *EME Homer City Generation,* No 12–1182, slip op. at 32 (U.S. April 29, 2014). Because DOE is using emissions factors based on *AEO 2013* for this NOPR, the analysis assumes that CAIR, not CSAPR, is the regulation in force. The difference between CAIR and CSAPR is not relevant for the purpose of DOE's analysis of SO_2 emissions.

[95] CSAPR also applies to NO_X and it would supersede the regulation of NO_X under CAIR. As stated previously, the current analysis assumes that CAIR, not CSAPR, is the regulation in force. The difference between CAIR and CSAPR with regard to DOE's analysis of NO_X emissions is slight.

following subsection, and a more detailed description of the methodologies used is provided as an appendix to chapter 14 of the NOPR TSD.

1. Social Cost of Carbon

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. 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.

Under section 1(b)(6) of Executive Order 12866, ''Regulatory Planning and Review,'' 58 FR 51735 (Oct. 4, 1993), 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. 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 the 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

When attempting to assess the incremental economic impacts of carbon dioxide emissions, the analyst faces a number of challenges. A recent report from the National Research Council 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 questions of science, economics, and ethics and should be viewed as provisional.

Despite the limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing carbon dioxide emissions. The agency can estimate the benefits from reduced 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 the future benefits by an appropriate discount factor and summing across all affected years.

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. 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. Development of Social Cost of Carbon Values

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$) of $55, $33, $19, $10, and $5 per metric ton of CO_2. These interim values represented 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.

c. Current Approach and Key Assumptions

After the release of the interim values, the interagency group reconvened on a regular basis to generate improved SCC estimates. Specifically, the group considered public comments and further explored the technical literature in relevant fields. The interagency group relied on three integrated assessment models commonly used to estimate the SCC: the FUND, DICE, and PAGE models. 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 sets of SCC values for use in regulatory analyses. Three sets of values are based on the average SCC from three integrated assessment models, at discount rates of 2.5 percent, 3 percent, and 5 percent. The fourth set, 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 climate change further out in the tails of the SCC distribution. The 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, although preference is given to consideration of the global benefits of reducing CO_2 emissions.

Table IV.9 presents the values in the 2010 interagency group report,[96] which is reproduced in appendix 14–A of the NOPR TSD.

TABLE IV.9—ANNUAL SCC VALUES FROM 2010 INTERAGENCY REPORT, 2010–2050

[In 2007 dollars per metric ton CO_2]

Year	Discount rate %			
	5	3	2.5	3
	Average	Average	Average	95th percentile
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

The SCC values used for the NOPR were generated using the most recent versions of the three integrated assessment models that have been published in the peer-reviewed literature.[97] (See appendix 14–B of the NOPR TSD for further information.) Table IV.10 shows the updated sets of SCC estimates in five year increments from 2010 to 2050. Appendix 14–B of the NOPR TSD provides the full set of SCC estimates. The central value that emerges is the average SCC across models at the 3 percent discount rate. However, for purposes of capturing the uncertainties involved in regulatory impact analysis, the interagency group emphasizes the importance of including all four sets of SCC values.

TABLE IV.10—ANNUAL SCC VALUES FROM 2013 INTERAGENCY UPDATE, 2010–2050

[In 2007 dollars per metric ton CO_2]

Year	Discount rate %			
	5	3	2.5	3
	Average	Average	Average	95th percentile
2010	11	32	51	89
2015	11	37	57	109
2020	12	43	64	128
2025	14	47	69	143
2030	16	52	75	159
2035	19	56	80	175
2040	21	61	86	191
2045	24	66	92	206
2050	26	71	97	220

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 analytical challenges that are being addressed by the research community, including research programs housed in many of the Federal agencies participating in the interagency process to estimate the SCC. The interagency group intends to periodically review and reconsider those estimates to reflect increasing knowledge of the science and economics of climate impacts, as well as improvements in modeling.

In summary, in considering the potential global benefits resulting from reduced CO_2 emissions, DOE used the values from the 2013 interagency report, adjusted to 2013$ using the Gross Domestic Product price deflator. For each of the four cases specified, the values used for emissions in 2015 were $12.0, $40.5, $62.4, and $119 per metric ton avoided (values expressed in 2013$). DOE derived values after 2050 using the relevant growth rates for the 2040–2050 period in the interagency update.

DOE multiplied the CO_2 emissions reduction estimated for each year by the SCC value for that year in each of the four cases. To calculate a present value

[96] *Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.* Interagency Working Group on Social Cost of Carbon, United States Government (February 2010) (Available at: *http://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf).*

[97] *Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.* Interagency Working Group on Social Cost of Carbon, United States Government (May 2013; revised November 2013) (Available at: *http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf*).

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

As noted above, DOE has taken into account how amended energy conservation standards would reduce NO_X emissions in those 22 States not affected by emissions caps. DOE estimated the monetized value of NO_X emissions reductions resulting from each of the TSLs considered for the NOPR based on estimates found in the relevant scientific literature. Estimates of monetary value for reducing NO_X from stationary sources range from $476 to $4,893 per ton (2013$).[98] DOE calculated monetary benefits using a medium value for NO_X emissions of $2,684 per short ton (in 2013$), and real discount rates of 3 percent and 7 percent.

DOE is evaluating appropriate monetization of avoided SO_2 and Hg emissions in energy conservation standards rulemakings. It has not included such monetization in the current analysis.

L. Utility Impact Analysis

In the utility impact analysis, DOE analyzes the changes in electric installed capacity and generation that result for each trial standard level. The utility impact analysis uses a variant of NEMS,[99] which is a public domain, multi-sectored, partial equilibrium model of the U.S. energy sector. DOE uses a variant of this model, referred to as NEMS–BT,[100] to account for selected utility impacts of new or amended energy conservation standards. DOE's analysis consists of a comparison between model results for the most recent *AEO* Reference Case and for cases in which energy use is decremented to reflect the impact of potential standards. The energy savings inputs associated with each TSL come from the NIA. Chapter 15 of the NOPR TSD describes the utility impact analysis.

M. Employment Impact Analysis

Employment impacts include direct and indirect impacts. Direct employment impacts are any changes in the number of employees of manufacturers of the products subject to standards; the MIA addresses those impacts. 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. Indirect employment impacts from standards consist of the jobs created or eliminated in the national economy due to: (1) Reduced spending by end users on energy; (2) reduced spending on new energy supply by the utility industry; (3) increased customer spending on the purchase of new products; and (4) the effects of those three factors throughout the economy.

One method for assessing the possible effects on the demand for labor of such shifts in economic activity is to compare sector employment statistics developed by the Labor Department's Bureau of Labor Statistics (BLS). 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.[101] 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. Energy conservation standards have the effect of reducing customer utility bills. Because reduced customer 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 may increase because of shifts in economic activity resulting from amended energy conservation standards for SPVUs.

For the amended standard levels considered in the NOPR, DOE estimated indirect national employment impacts using an input/output model of the U.S. economy called Impact of Sector Energy Technologies version 3.1.1 (ImSET).[102] ImSET is a special-purpose version of the ''U.S. Benchmark National Input-Output'' (I–O) model, which was designed to estimate the national employment and income effects of energy-saving technologies. The ImSET software includes a computer-based I–O model having structural coefficients that 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 most relevant to industrial, commercial, and residential building energy use. DOE notes that ImSET is not a general equilibrium forecasting model, and understands the uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Because ImSET does not incorporate price changes, the employment effects predicted by ImSET may over-estimate actual job impacts over the long run. For the NOPR, DOE used ImSET only to estimate short-term (through 2023) employment impacts.

For more details on the employment impact analysis, see chapter 16 of the NOPR TSD.

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to potential energy conservation standards for SPVUs in this rulemaking. It addresses the TSLs examined by DOE, the projected impacts of each of these levels if adopted as energy conservation standards for SPVUs, and the proposed standard levels that DOE sets forth in the NOPR. Additional details regarding DOE's analyses are contained in the TSD supporting this NOPR.

A. Trial Standard Levels

DOE developed Trial Standard Levels (TSLs) that combine efficiency levels for each equipment class of SPVACs and SPVHPs. Table V.1 presents the efficiency EERs for each equipment class in the EPCA and ASHRAE baseline and each TSL. TSL 1 consists of efficiency level 1 for equipment classes less than 65,000 Btu/h. TSL 2 consists

[98] 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,* Washington, DC. Available at: *www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/2006_cb/2006_cb_final_report.pdf.*

[99] For more information on NEMS, refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 2003,* DOE/EIA–0581(2003), March, 2003.

[100] DOE/EIA approves use of the name ''NEMS'' to describe only an official version of the model without any modification to code or data. Because this analysis entails some minor code modifications and the model is run under various policy scenarios that are variations on DOE/EIA assumptions, DOE refers to it by the name ''NEMS–BT'' (''BT'' is DOE's Building Technologies Program, under whose aegis this work has been performed).

[101] *See* Bureau of Economic Analysis, ''Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II),'' U.S. Department of Commerce (1992).

[102] M. J. Scott, O. V. Livingston, P. J. Balducci, J. M. Roop, and R. W. Schultz, *ImSET 3.1: Impact of Sector Energy Technologies,* PNNL–18412, Pacific Northwest National Laboratory (2009) (Available at: *www.pnl.gov/main/publications/external/technical_reports/PNNL-18412.pdf*).

of efficiency level 2 for equipment classes less than 65,000 Btu/h. TSL 3 consists of efficiency level 3 for equipment classes less than 65,000 Btu/h. TSL 4 consists of efficiency level 4 (max-tech) for equipment classes less than 65,000 Btu/h. For SPVACs between 65,000 and 135,000 Btu/h, there are no models on the market above the ASHRAE level, and for SPVHPs between 65,000 and 135,000 Btu/h and SPVUs greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h, there are no models on the market at all, and, therefore, DOE had no basis with which to develop higher efficiency levels or conduct analyses. As a result, for each TSL, the EER (and COP) for these equipment classes is shown as the ASHRAE standard level of 10.0 EER (and 3.0 COP for heat pumps).

TABLE V.1—EPCA BASELINE, ASHRAE BASELINE, AND TRIAL STANDARD LEVELS FOR SPVUS

Equipment class	EPCA baseline	ASHRAE baseline	Trial standard levels EER(/COP)			
			1	2	3	4
SPVAC <65,000 Btu/h	9.0	10.0	10.5	11.0	11.75	12.3
SPVHP <65,000 Btu/h	9.0/3.0	10.0/3.0	10.5/3.2	11.0/3.3	11.75/3.9	12.3/3.9
SPVAC ≥65,000 Btu/h and <135,000 Btu/h	8.9	10.0	10.0	10.0	10.0	10.0
SPVHP ≥65,000 Btu/h and <135,000 Btu/h	8.9/3.0	10.0/3.0	10.0/3.0	10.0/3.0	10.0/3.0	10.0/3.0
SPVAC ≥135,000 Btu/h and <240,000 Btu/h	8.6	10.0	10.0	10.0	10.0	10.0
SPVHP ≥135,000 Btu/h and <240,000 Btu/h	8.6/2.9	10.0/3.0	10.0/3.0	10.0/3.0	10.0/3.0	10.0/3.0

For clarity, DOE has also summarized the different design options that would be introduced across equipment classes at each TSL in Table V.2 below.

TABLE V.2—DESIGN OPTIONS AT EACH TRIAL STANDARD LEVEL FOR SPVUS

Equipment class	ASHRAE baseline	Trial standard levels			
		1	2	3	4
Design Options for Each TSL (options are cumulative—TSL 4 includes all preceding options)					
SPVAC <65,000 Btu/h	BPM Indoor motor, Increased HX face area.	Addition of HX tube row.	Addition of HX tube row.	Improved Compressor Efficiency, Increased HX face area.	BPM Outdoor motor, High-Efficiency outdoor fan blade, Dual condensing heat exchangers.
SPVHP <65,000 Btu/h	BPM Indoor motor, Increased HX face area.	Addition of HX tube row.	Addition of HX tube row.	Improved Compressor Efficiency, Increased HX face area.	BPM Outdoor motor, High-Efficiency outdoor fan blade, Dual condensing heat exchangers.
*SPVAC ≥65,000 Btu/h and <135,000 Btu/h.	BPM Indoor motor, Increased HX face area.	No change	No change	No change	No change.
*SPVHP ≥65,000 Btu/h and <135,000 Btu/h.	BPM Indoor motor, Increased HX face area.	No change	No change	No change	No change.
SPVAC ≥135,000 Btu/h and <240,000 Btu/h.	No change	No change	No change	No change	No change.
SPVHP ≥135,000 Btu/h and <240,000 Btu/h.	No change	No change	No change	No change	No change.

* TSL1 through TSL4 are marked as "no change" because for these equipment classes, each TSL consists of the ASHRAE efficiency level.

B. Economic Justification and Energy Savings

1. Economic Impacts on Commercial Consumers

a. Life-Cycle Cost and Payback Period

Customers affected by new standards usually incur higher purchase prices and lower operating costs. DOE evaluates these impacts on individual customers by calculating changes in LCC and the PBP associated with the TSLs. The results of the LCC analysis for each TSL were obtained by comparing the installed and operating costs of the equipment in the base-case scenario (EPCA and ASHRAE baselines) against the standards-case scenarios at each TSL. Inputs used for calculating the LCC include total installed costs (*i.e.,* equipment price plus installation costs), operating expenses (*i.e.,* annual energy savings, energy prices, energy price trends, repair costs, and maintenance costs), equipment lifetime, and discount rates.

The LCC analysis is carried out using Monte Carlo simulations. Consequently, the results of the LCC analysis are distributions covering a range of values, as opposed to a single deterministic value. DOE presents the mean or median values, as appropriate, calculated from the distributions of results. The LCC analysis also provides information on the percentage of consumers for whom an increase in the minimum efficiency standard would have a positive impact (net benefit), a negative impact (net cost), or no impact.

DOE also performed a PBP analysis as part of the LCC analysis. The PBP is the number of years it would take for the consumer to recover the increased costs of higher-efficiency equipment as a result of energy savings based on the operating cost savings. The PBP is an economic benefit-cost measure that uses benefits and costs without discounting. Chapter 8 of the NOPR TSD provides detailed information on the LCC and PBP analyses.

As described in section IV.G, DOE used a ''roll-up'' scenario in this rulemaking. Under the roll-up scenario, DOE assumes that the market shares of the efficiency levels (in the ASHRAE base-case) that do not meet the standard level under consideration would be ''rolled up'' into (meaning ''added to'') the market share of the efficiency level at the standard level under consideration, and the market shares of efficiency levels that are above the standard level under consideration would remain unaffected. Customers in the ASHRAE base-case scenario who buy the equipment at or above the TSL under consideration, would be unaffected if the standard were to be set at that TSL. Customers in the ASHRAE base-case scenario who buy equipment below the TSL under consideration would be affected if the standard were to be set at that TSL. Among these affected customers, some may benefit from lower LCCs of the equipment and some may incur net cost due to higher LCCs, depending on the inputs to the LCC analysis such as electricity prices, discount rates, installation costs, and markups.

DOE's LCC and PBP analyses provided key outputs for each efficiency level above the baseline (*i.e.,* efficiency levels more stringent than those in ASHRAE 90.1–2013), as reported in Table V.3 and Table V.4.[103] DOE's results indicate that for SPVAC units, affected customer savings are positive at TSLs 1 and 2, and for SPVHP units, customer savings are positive at TSLs 1, 2, and 3. LCC and PBP results using the EPCA baseline are available in appendix 8B of the NOPR TSD.

TABLE V.3—SUMMARY LCC AND PBP RESULTS FOR SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, <65,000 BTU/H CAPACITY

TSL	Efficiency level	Life-cycle cost 2013$			Life-cycle cost savings				Payback period years
					Average savings 2013$*	% of customers that experience			
		Installed cost	Discounted operating cost	LCC		Net cost	No impact	Net benefit	Median
	ASHRAE Baseline	4,795	12,335	17,130	....	....	....	....	....
1	1	4,939	12,074	17,013	116	25	26	49	7.9
2	2	5,083	11,839	16,922	179	37	1	62	8.4
3	3	5,546	11,578	17,123	(24)	62	0	38	14.4
4	4	6,407	11,516	17,924	(825)	87	0	13	27.3

*Parentheses indicate negative values.

TABLE V.4—SUMMARY LCC AND PBP RESULTS FOR SINGLE-PACKAGE VERTICAL HEAT PUMPS, <65,000 BTU/H CAPACITY

TSL	Efficiency level	Life-cycle cost 2013$			Life-cycle cost savings				Payback period years
					Average savings 2013$*	% of customers that experience			
		Installed cost	Discounted operating cost	LCC		Net cost	No impact	Net benefit	Median
	ASHRAE Baseline	5,363	30,464	35,827	....	....	....	....	....
1	1	5,529	29,939	35,468	358	0	26	74	4.1
2	2	5,695	29,618	35,313	424	1	1	98	4.8
3	3	6,224	28,690	34,914	819	7	0	92	6.2
4	4	7,210	28,698	35,909	(177)	68	0	32	13.6

*Parentheses indicate negative values.

b. Life-Cycle Cost Subgroup Analysis

Using the LCC spreadsheet model, DOE estimated the impacts of the TSLs on the following consumer subgroups: (1) Mining and construction firms using modular temporary office buildings; (2) public education providers using portable classrooms; and (3) small businesses and other businesses with high risk premiums (often due to volatility in their share price and reliance on equity rather than debt financing) and high discount rates (described as ''high rate'' subgroup in this section). DOE analyzed this final subgroup because this group has typically had less access to capital than other businesses, which results in higher financing costs and a higher discount rate than the industry average. Businesses with high discount rates need an earlier return on investment than other businesses and, other things equal, would place a lower value on future energy savings relative to immediate returns than would other businesses. Consequently, the present

[103] Because there are no units above the ASHRAE baseline in the classes greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h, and no units greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h, there are no LCC savings for these classes.

value of future savings is lower for these businesses. DOE estimated the average LCC savings and median PBP using the ASHRAE baseline for the high rate subgroup compared with average SPVU consumers, as shown in Table V.5 and Table V.6 below.

The results of the life-cycle cost subgroup analysis indicate that for SPVAC units, the three subgroups all fare slightly worse than the average consumer, with those subgroups being expected to have lower LCC savings and longer payback periods than average. In the cases of education and mining and construction customers, this occurs mainly because although they pay the same installed cost premium for more-efficient SPVAC units, they use and save less energy than do average customers and so benefit less from the energy savings. In the case of mining and construction customers, LCC savings are also further reduced by the effects of their higher discount rate, which further reduces the value of their already-smaller energy savings. The picture is somewhat more mixed for SPVHPs, with the high-rate subgroup and construction/mining firms generally faring worse, and education generally faring somewhat better than the average consumer. Education SPVHP customers save more energy than the average customer, whereas the opposite is true for education customers for air conditioners. Thus, even though they pay a lower price on average, education customers' energy cost savings are higher than average, and they have a lower discount rate on those savings, making them worth more. In combination, these two factors make their LCC savings higher than those of the average SPVHP customer. The construction and mining SPVHP customers save less energy than the average customer, and their higher discount rate makes these savings worth less to them. Finally, since high discount rate customers save the same amount of energy as the average customer, they only experience the effects of their higher discount rate, which moderately reduces their LCC savings and has no effect on PBP. Chapter 11 of the NOPR TSD provides more detailed discussion on the LCC subgroup analysis and results.

TABLE V.5—COMPARISON OF IMPACTS FOR CONSUMER SUBGROUPS WITH ALL CONSUMERS, SPVAC <65,000 BTU/H

TSL	Energy efficiency level	LCC Savings 2013$*				Median payback period years			
		Construction and mining	Education	High rate	All	Construction and mining	Education	High rate	All
1	1	(27)	98	101	116	13.8	9.6	7.9	7.9
2	2	(60)	148	153	179	14.7	10.1	8.3	8.4
3	3	(429)	(92)	(66)	(24)	26.7	17.5	14.3	14.4
4	4	(1,323)	(944)	(867)	(825)	55.0	33.5	28.1	27.3

*Parentheses indicate negative values.

TABLE V.6—COMPARISON OF IMPACTS FOR CONSUMER SUBGROUPS WITH ALL CONSUMERS, SPVHP <65,000 BTU/H

TSL	Energy efficiency level	LCC savings 2013$*				Median payback period years			
		Construction and mining	Education	High rate	All	Construction and mining	Education	High rate	All
1	1	259	440	342	358	4.2	3.8	4.1	4.1
2	2	274	549	403	424	5.4	4.6	4.8	4.8
3	3	527	1,056	769	819	6.3	6.1	6.2	6.2
4	4	(488)	83	(222)	(177)	14.5	12.7	13.6	13.6

*Parentheses indicate negative values.

c. Rebuttable Presumption Payback

As discussed in section III.E.2, EPCA provides a rebuttable presumption that, in essence, 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. However, DOE routinely conducts a full economic analysis that considers the full range of impacts, including those to the consumer, manufacturer, Nation, and environment, as required under 42 U.S.C. 6295(o)(2)(B)(i) and 6316(e)(1). 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. For comparison with the more detailed analytical results, DOE calculated a rebuttable presumption payback period for each TSL. Table V.7 shows the rebuttable presumption payback periods for the representative equipment classes using the ASHRAE baseline. No equipment class has a rebuttable presumption payback period of less than 3 years.

TABLE V.7—REBUTTABLE PRESUMPTION PAYBACK PERIODS FOR SPVU EQUIPMENT CLASSES

Equipment class	Rebuttable presumption payback years			
	TSL 1	TSL 2	TSL 3	TSL 4
SPVAC <65,000 Btu/h	5.2	5.4	8.6	14.8
SPVHP <65,000 Btu/h	3.2	4.0	4.8	9.5

2. Economic Impact on Manufacturers

As noted in section IV.I, DOE performed a manufacturer impact analysis to estimate the impact of amended energy conservation standards on manufacturers of SPVUs. DOE calculated manufacturer impacts relative to a base case, defined as DOE adoption of the efficiency levels specified by ASHRAE Standard 90.1–2013. Consequently, when comparing the INPV impacts under the GRIM model, the baseline technology is at an efficiency of 10 EER/3.0 COP. The following subsection describes the expected impacts on manufacturers at each considered TSL. Chapter 12 of the NOPR TSD explains the analysis in further detail, and also contains results using the EPCA baseline.

a. Industry Cash-Flow Analysis Results

Table V.8 depicts the estimated financial impacts on manufacturers and the conversion costs that DOE expects manufacturers would incur at each TSL. The financial impacts on manufacturers are represented by changes in industry net present value.

The impact of potential amended energy conservation standards were analyzed under two markup scenarios: (1) The preservation of gross margin percentage; and (2) the preservation of operating profit. As discussed in section IV.I.2.b, DOE considered the preservation of gross margin percentage scenario by applying a uniform ''gross margin percentage'' markup across all efficiency levels. As production cost increases with efficiency, this scenario implies that the absolute dollar markup will increase. DOE assumed the nonproduction cost markup—which includes SG&A expenses, research and development expenses, interest, and profit to be a factor of 1.28. These markups are consistent with the ones DOE assumed in the engineering analysis and in the base case of the GRIM. Manufacturers have indicated that it is optimistic to assume that as their production costs increase in response to an amended energy conservation standard, they would be able to maintain the same gross margin percentage markup. Therefore, DOE assumes that this scenario represents a high bound to industry profitability under an amended energy conservation standard.

The preservation of operating profit scenario reflects manufacturer concerns about their inability to maintain their margins as manufacturing production costs increase to reach more-stringent efficiency levels. In this scenario, while manufacturers make the necessary investments required to convert their facilities to produce new standards-compliant equipment, operating profit does not change in absolute dollars and decreases as a percentage of revenue.

Each of the modeled scenarios results in a unique set of cash flows and corresponding industry values at each TSL. In the following discussion, the INPV results refer to the difference in industry value between the base case and each standards case that result from the sum of discounted cash flows from the base year 2014 through 2048, the end of the analysis period. To provide perspective on the short-run cash flow impact, DOE includes in the discussion of the results a comparison of free cash flow between the base case and the standards case at each TSL in the year before amended standards would take effect. This figure provides an understanding of the magnitude of the required conversion costs relative to the cash flow generated by the industry in the base case.

TABLE V.8—MANUFACTURER IMPACT ANALYSIS RESULTS FOR SPVUS

	Units	Base case	Trial standard level*			
			1	2	3	4
INPV	$M	36.5	32.4 to 34.2	33.2 to 38.0	27.5 to 49.2	3.0 to 47.4
Change in INPV	$M	....	(4.1) to (2.3)	(3.3) to 1.5	(9.0) to 12.7	(33.4) to 10.9
	%	....	(11.3) to (6.3)	(9.0) to 4.1	(24.7) to 34.9	(91.7) to 29.9
Free Cash Flow (FCF) in 2018	$M	2.9	0.6	0.4	(2.1)	(9.5)
Change in FCF in 2018	$M	....	(2.3)	(2.5)	(5.0)	(12.4)
	%	....	(78.2)	(85.0)	(174.0)	(428.2)
Conversion Costs	$M	....	6.5	7.2	16.1	33.9

*Parentheses indicate negative values.

At TSL 1, the standard for all equipment classes with capacity less than 65,000 Btu/h is set at 10.5 EER/3.2 COP. The standard for all equipment classes with capacity greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h and greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h is set at the baseline (*i.e.,* 10.0 EER/3.0 COP). DOE estimates the change in INPV to range from −$4.1 to −$2.3 million, or a change of −11.3 percent to −6.3 percent. At this level, free cash flow is estimated to decrease to $0.6 million, or a decrease of 78.2 percent compared to the base-case value of $2.9 million in the year 2018, the year before the standards year. DOE does expect a standard at this level to require changes to manufacturing equipment, thereby resulting in capital conversion costs. The engineering analysis suggests that manufacturers would reach this amended standard by increasing heat exchanger size. Roughly sixty-five percent of the SPVU models listed in the AHRI Directory would need to be updated to meet this amended standard level. Estimated industry conversion costs total $6.5 million.

At TSL 2, the standard for all equipment classes with capacity less than 65,000 Btu/h is set at 11.0 EER/3.3 COP. The standards for all equipment classes with capacity greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h and greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h remain at baseline as in TSL 1. DOE estimates impacts on INPV to range from $1.5 million to −$3.3 million, or a change in INPV of 4.1 percent to −9.0 percent. At this level, free cash flow is estimated to decrease to $0.4, or a change of −85.0 percent compared to the base-case value of $2.9 million in the year 2018. Based on the engineering analysis, DOE expects manufacturers to reach this level of efficiency by further increasing the size of the heat exchanger. Product updates and associated testing expenses would further increase conversion costs for the industry to $7.2 million.

At TSL 3, the standard increases to 11.75 EER/3.9 COP for equipment with capacity less than 65,000 Btu/h. The standards for SPVAC and SPVHP equipment with capacity greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h and greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h remain at baseline as in TSLs 1 and 2. DOE estimates impacts on INPV to range from $12.7 million to −9.0 million, or a change in INPV of 34.9 percent to −24.7 percent. At this level, free cash flow is estimated to decrease to less than zero, to −$2.1 million, or a change of −174.0 percent compared to the base-case value of $2.9 million in the year 2018. The engineering analysis suggests that manufacturers would reach this amended standard by once again increasing heat exchanger size and by switching to more-efficient two-stage compressors. Manufacturers that produce heat exchangers in-house may need to add coil fabrication equipment to accommodate the size of the heat exchanger necessary to meet the standard. Additionally, the new heat exchanger size may require manufacturers to invest additional capital into their sheet metal bending lines. Ninety-four percent of the SPVU models listed in the AHRI Directory would require redesign at this amended standard level. DOE estimates total conversion costs to be $16.1 million for the industry.

At TSL 4, the standard increases to 12.3 EER/COP of 3.9 for SPVAC and SPVHP equipment with capacity less than 65,000 Btu/h. The standards for SPVAC and SPVHP equipment with capacity greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h and greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h remain at baseline as in TSLs 1, 2, and 3. DOE estimates impacts on INPV to range from $10.9 million to −33.4 million, or a change in INPV of 29.9 percent to −91.7 percent. At this level, free cash flow is estimated to decrease to −$9.5 million, or a decrease of 428.2 percent compared to the base-case value of $2.9 million in the year 2018. TSL 4 represents the max-tech standard level. DOE expects manufacturers to meet the amended standard by dramatically increasing the size of the evaporating heat exchanger and incorporating two condensing heat exchangers. Ninety-eight percent of all SPVU models listed in the AHRI Directory would require redesign at this amended standard level. Additionally, DOE expects designs to use BPMs for both the indoor and outdoor motors. Total conversion costs are expected to reach $33.9 million for the industry.

b. Impacts on Direct Employment

To quantitatively assess the potential impacts of amended energy conservation standards on direct employment, DOE used the GRIM to estimate the domestic labor expenditures and number of direct employees in the base case and at each TSL from 2014 through 2048. DOE used statistical data from the U.S. Census Bureau's 2011 Annual Survey of Manufacturers,[104] the results of the engineering analysis, and interviews with manufacturers to determine the inputs necessary to calculate industry-wide labor expenditures and domestic direct employment levels. Labor expenditures related to manufacturing of the product are a function of the labor intensity of the product, the sales volume, and an assumption that wages remain fixed in real terms over time. The total labor expenditures in each year are calculated by multiplying the MPCs by the labor percentage of MPCs. DOE estimates that 95 percent of SPVU units are produced domestically.

The total labor expenditures in the GRIM were then converted to domestic production employment levels by dividing production labor expenditures by the annual payment per production worker (production worker hours times the labor rate found in the U.S. Census Bureau's 2011 Annual Survey of Manufacturers). 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 materials handling tasks using forklifts, are also included as production labor. DOE's estimates only account for production workers who manufacture the specific products covered by this rulemaking. To estimate an upper bound to employment change, DOE assumes all domestic manufacturers would choose to continue producing products in the U.S. and would not move production to foreign countries. To estimate a lower bound to employment, DOE estimated the maximum portion of the industry that would choose leave the industry rather than make the necessary product conversions. A complete description of the assumptions used to generate these upper and lower bounds can be found in chapter 12 of the NOPR TSD.

Using the GRIM, DOE estimates that in the absence of amended energy conservation standards, there would be 454 domestic production workers for SPVU equipment. As noted previously, DOE estimates that 95 percent of SPVU units sold in the United States are manufactured domestically. Table V.9 below shows the range of the impacts of potential amended energy conservation standards on U.S. production workers of SPVUs.

TABLE V.9—POTENTIAL CHANGES IN THE TOTAL NUMBER OF SPVU PRODUCTION WORKERS IN 2019

	Trial standard level*				
	Base case	1	2	3	4
Total Number of Domestic Production Workers in 2019	412	389 to 421	389 to 432	339 to 461	285 to 559
Potential Changes in Domestic Production Workers in 2019	....	(23) to 9	(23) to 20	(73) to 49	(127) to 147

*Parentheses indicate negative values.

c. Impacts on Manufacturing Capacity

According to SPVU manufacturers interviewed, demand for SPVUs, which roughly correlates to trends in telecommunications spending and construction of new schools, peaked in the 2001–2006 time frame. As a result, excess capacity exists in the industry today.

Except at the max-tech level, any necessary redesign of SPVU models would not fundamentally change the assembly of the equipment. Any bottlenecks are more likely to come from the redesign, testing, and certification process rather than from production capacity. To that end, some interviewed manufacturers expressed concern that the redesign of all products to include BPM motors would require a significant portion of their engineering resources, taking resources away from customer responsiveness and R&D efforts. Furthermore, some manufacturers noted that an amended

[104] U.S. Census Bureau, Annual Survey of Manufacturers: General Statistics: Statistics for Industry Groups and Industries (2011) (Available at *http://www.census.gov/manufacturing/asm/index.html*).

standard requiring BPMs would monopolize their testing resources and facilities—to their point when some manufacturers anticipated the need to build new psychometric test labs just to have enough in-house testing capacity to meet the amended standard. Once all products have been redesigned to meet an amended energy conservation standard, manufacturers did not anticipate any production constraints.

d. Impacts on Subgroups of Manufacturers

Small manufacturers, niche equipment manufacturers, and manufacturers exhibiting a cost structure substantially different from the industry average could be affected disproportionately. As discussed in section IV.I using average cost assumptions developed for an industry cash-flow estimate is inadequate to assess differential impacts among manufacturer subgroups.

For SPVU equipment, DOE identified and evaluated the impact of amended energy conservation standards on one subgroup, specifically small manufacturers. The SBA defines a ''small business'' as having 750 employees or less for NAICS 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' Based on this definition, DOE identified two domestic manufacturers in the industry that qualifies as a small business. For a discussion of the impacts on the small manufacturer subgroup, see the regulatory flexibility analysis in section VI.B of this NOPR and chapter 12 of the NOPR TSD.

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. 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.

For the cumulative regulatory burden analysis, DOE looks at other regulations that could affect SPVU manufacturers that will take effect approximately three years before or after the compliance date of amended energy conservation standards for these products. For equipment with proposed standards that are more stringent than those contained in ASHRAE Standard 90.1–2013, the compliance date is four years after publication of an energy conservation standards final rule (*i.e.,* compliance date assumed to be 2019 for the purposes of MIA). For equipment with proposed standards that are set at the levels contained in ASHRAE Standard 90.1–2013, the compliance date is two or three years after the effective date of the requirements in ASHRAE Standard 90.1–2013, depending on equipment size (*i.e.,* 2015 or 2016). For this cumulative regulatory burden analysis, DOE considered regulations that could affect SPVU manufacturers that take effect from 2012 to 2022, to account for the range of compliance years.

In interviews, manufacturers cited Federal regulations on equipment other than SPVUs that contribute to their cumulative regulatory burden. In particular, manufacturers noted that some of them also produce residential central air conditioners and heat pumps, residential furnaces, room air conditioners, and water-heating equipment. These products have amended energy conservation standards that go into effect within three years of the compliance date for any amended SPVU standards. The compliance years and expected industry conversion costs are listed below:

TABLE V.10—COMPLIANCE DATES AND EXPECTED CONVERSION EXPENSES OF FEDERAL ENERGY CONSERVATION STANDARDS AFFECTING SPVU MANUFACTURERS

Federal energy conservation standards	Approximate compliance date	Estimated total industry conversion expense
2008 Packaged Terminal Air Conditioners and Heat Pumps 73 FR 58772 (Oct. 7, 2008)	2012	$33.7M (2007$).
2011 Room Air Conditioners 76 FR 22454 (April 21, 2011); 76 FR 52854 (August 24, 2011)	2014	$171M (2009$).
2007 Residential Furnaces & Boilers 72 FR 65136 (Nov. 19, 2007)	2015	$88M (2006$).*
2011 Residential Furnaces 76 FR 37408 (June 27, 2011); 76 FR 67037 (Oct. 31, 2011)	2015	$2.5M (2009$).**
2011 Residential Central Air Conditioners and Heat Pumps 76 FR 37408 (June 27, 2011); 76 FR 67037 (Oct. 31, 2011).	2015	$26.0M (2009$).**
2010 Gas Fired and Electric Storage Water Heaters 75 FR 20112 (April 16, 2010)	2015	$95.4M (2009$).
Walk-in Coolers and Freezers 79 FR 32050 (June 3, 2014)	2017	$33.6M (2012$).
Dishwashers***	2018	TBD.
Commercial Warm-Air Furnaces***	2018	TBD.
Commercial Packaged Air Conditioners and Heat Pumps*** 79 FR 58948 (September 18, 2014)	2019	$226.4M (2013$).
Furnace Fans 79 FR 38130 (July 3, 2014)	2019	$40.6M (2013$).
Packaged Terminal Air Conditioners and Heat Pumps*** 79 FR 55538 (September 16, 2014)	2019	$14.3M (2013$).
Miscellaneous Residential Refrigeration***	2019	TBD.
Commercial Water Heaters***	2019	TBD.
Commercial Packaged Boilers***	2020	TBD.
Residential Water Heaters***	2021	TBD.
Clothes Dryers***	2022	TBD.
Central Air Conditioners***	2022	TBD.
Room Air Conditioners***	2022	TBD.

*Conversion expenses for manufacturers of oil-fired furnaces and gas-fired and oil-fired boilers associated with the November 2007 final rule for residential furnaces and boilers are excluded from this figure. The 2011 direct final rule for residential furnaces sets a higher standard and earlier compliance date for oil-fired furnaces than the 2007 final rule. As a result, manufacturers will be required to design the 2011 direct final rule standard. The conversion costs associated with the 2011 direct final rule are listed separately in this table. EISA 2007 legislated higher standards and earlier compliance dates for residential boilers than were in the November 2007 final rule. As a result, gas-fired and oil-fired boiler manufacturers were required to design to the EISA 2007 standard beginning in 2012. The conversion costs listed for residential gas-fired and oil-fired boilers in the November 2007 residential furnaces and boilers final rule analysis are not included in this figure.

**Estimated industry conversion expense and approximate compliance date reflect a court-ordered April 24, 2014 remand of the residential non-weatherized and mobile home gas furnaces standards set in the 2011 Energy Conservation Standards for Residential Furnaces and Residential Central Air Conditioners and Heat Pumps. The costs associated with this rule reflect implementation of the amended standards for the remaining furnace product classes (*i.e.,* oil-fired furnaces).

***The final rule for this energy conservation standard has not been published. The compliance date and analysis of conversion costs have not been finalized at this time. (If a value is provided for total industry conversion expense, this value represents an estimate from the NOPR.)

Additionally, manufacturers cited increasing ENERGY STAR standards for room air conditioners and packaged terminal air conditioners as a source of regulatory burden. In response, the Department does not consider ENERGY STAR in its presentation of cumulative regulatory burden, because ENERGY STAR is a voluntary program and is not Federally mandated.

3. National Impact Analysis

a. Significance of Energy Savings

For each TSL, DOE projected energy savings for SPVUs purchased in the 30-year period that begins in the year of compliance with amended standards (2015–2044 for the ASHRAE level and 2019–2048 for higher efficiency levels). The savings are measured over the entire lifetime of equipment purchased in the 30-year period. DOE quantified the energy savings attributable to each TSL as the difference in energy consumption between each standards case and the ASHRAE base case. DOE also compared the energy consumption of SPVUs under the ASHRAE Standard 90.1–2013 efficiency levels to energy consumption of SPVUs under the EPCA base case (*i.e.,* the current Federal standard).

Table V.11 presents the estimated primary energy savings for the ASHRAE level and for each considered TSL, and Table V.12 presents the estimated FFC energy savings. The approach is further described in section IV.G.1. As mentioned previously, NES (and NPV) were not calculated for equipment classes with no shipments.

TABLE V.11—CUMULATIVE NATIONAL PRIMARY ENERGY SAVINGS FOR SPVU TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2015–2044 (ASHRAE) OR 2019–2048 (HIGHER)

	ASHRAE baseline	Trial standard level			
		1	2	3	4
	*quads**				
SPVAC <65,000 Btu/h	0.14	0.06	0.13	0.21	0.23
SPVHP <65,000 Btu/h	0.07	0.04	0.10	0.15	0.16
SPVAC ≥65,000 Btu/h to <135,000 Btu/h	0.01				
Total—All Classes	0.22	0.09	0.22	0.36	0.39

* All energy savings from TSLs above the ASHRAE Standard 90.1–2013 level are calculated with those ASHRAE levels as a baseline.
Note: Components may not sum to total due to rounding.

TABLE V.12—CUMULATIVE NATIONAL FULL-FUEL-CYCLE ENERGY SAVINGS FOR SPVU TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2015–2044 (ASHRAE) OR 2019–2048 (HIGHER)

	ASHRAE baseline	Trial standard level			
		1	2	3	4
	*quads**				
SPVAC <65,000 Btu/h	0.15	0.06	0.13	0.22	0.24
SPVHP <65,000 Btu/h	0.07	0.04	0.10	0.15	0.16
SPVAC ≥65,000 Btu/h to <135,000 Btu/h	0.01				
Total—All Classes	0.22	0.09	0.23	0.37	0.39

* All energy savings from TSLs above the ASHRAE Standard 90.1–2013 level are calculated with those ASHRAE levels as a baseline.
Note: Components may not sum to total due to rounding.

Circular A–4 requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs.[105] Circular A–4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this rulemaking, DOE undertook a sensitivity analysis using nine rather than 30 years of product shipments. The choice of a nine -year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[106] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing

[105] U.S. Office of Management and Budget, ''Circular A–4: Regulatory Analysis'' (Sept. 17, 2003) (Available at: *http://www.whitehouse.gov/omb/circulars_a004_a-4/*).

[106] EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. (42 U.S.C. 6313(a)(6)(C)) While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6-year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some consumer products, the compliance period is 5 years rather than 3 years.

cycles, or other factors specific to SPVUs. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES results based on a nine-year analytical period are presented in Table V.13. The impacts are counted over the lifetime of products purchased in 2015–2023 for the ASHRAE level and for 2019–2027 for higher levels.

TABLE V.13—CUMULATIVE NATIONAL PRIMARY ENERGY SAVINGS FOR SPVU TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2015–2023 (ASHRAE) OR 2019–2027 (HIGHER)

	ASHRAE baseline	Trial standard level			
		1	2	3	4
	*quads**				
SPVAC <65,000 Btu/h	0.04	0.01	0.03	0.06	0.07
SPVHP <65,000 Btu/h	0.01	0.01	0.02	0.04	0.05
SPVAC ≥65,000 Btu/h to <135,000 Btu/h	0.00	....	....	....	....
Total—All Classes	0.06	0.02	0.05	0.10	0.11

* All energy savings from TSLs above the ASHRAE Standard 90.1–2013 level are calculated with those ASHRAE levels as a baseline.
Note: Components may not sum to total due to rounding.

b. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the TSLs considered for SPVUs. In accordance with OMB's guidelines on regulatory analysis,[107] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.14 shows the consumer NPV results for each TSL considered for SPVUs using the ASHRAE baseline. In each case, the impacts cover the lifetime of equipment purchased in 2019–2048. DOE conducted all economic analyses relative to the ASHRAE baseline; because the ASHRAE level is max-tech for classes greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h, DOE did not include results for these classes in the NPV tables. Results for all equipment classes using the EPCA baseline can be found in chapter 10 of the NOPR TSD.

TABLE V.14—CUMULATIVE NET PRESENT VALUE OF CUSTOMER BENEFIT FOR SPVU TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2019–2048

Equipment class	*Discount rate (%)*	Trial standard level			
		1	2	3	4
	*billion 2013$**				
SPVAC <65,000 Btu/h	3	0.13	0.13	(0.64)	(1.05)
	7	0.04	0.01	(0.38)	(0.66)
SPVHP <65,000 Btu/h	3	0.13	0.32	0.14	(0.06)
	7	0.04	0.10	0.01	(0.12)
Total—All Classes	3	0.26	0.44	(0.50)	(1.10)
	7	0.09	0.11	(0.37)	(0.78)

* Numbers in parentheses indicate negative NPV.
Note: Components may not sum to total due to rounding.

The NPV results based on the aforementioned nine-year analytical period are presented in Table V.15. The impacts are counted over the lifetime of products purchased in 2019–2027. As mentioned previously, this information is presented for informational purposes only and is not indicative of any change in DOE's analytical methodology or decision criteria.

TABLE V.15—CUMULATIVE NET PRESENT VALUE OF CUSTOMER BENEFIT FOR SPVU TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2019–2027

Equipment class	*Discount rate (%)*	Trial standard level			
		1	2	3	4
	*billion 2013$**				
SPVAC <65,000 Btu/h	3	0.06	0.09	(0.04)	(0.34)
	7	0.02	0.03	(0.08)	(0.30)

[107] OMB Circular A–4, section E (Sept. 17, 2003) (Available at: *http://www.whitehouse.gov/omb/circulars_a004_a-4*).

TABLE V.15—CUMULATIVE NET PRESENT VALUE OF CUSTOMER BENEFIT FOR SPVU TRIAL STANDARD LEVELS FOR UNITS SOLD IN 2019–2027—Continued

Equipment class	*Discount rate (%)*	Trial standard level			
		1	2	3	4
SPVHP <65,000 Btu/h	3	0.05	0.09	0.14	(0.01)
	7	0.02	0.04	0.05	(0.05)
Total—All Classes	3	0.10	0.19	0.09	(0.35)
	7	0.05	0.08	(0.03)	(0.36)

* Numbers in parentheses indicate negative NPV.
Note: Components may not sum to total due to rounding.

The results presented in this section reflect an assumption of no change in SPVU prices over the forecast period. In addition, DOE conducted sensitivity analysis using alternative price trends: one in which prices decline over time, and one in which prices increase. These price trends, and the associated NPV results, are described in appendix 10B of the NOPR TSD.

c. Indirect Impacts on Employment

DOE expects energy conservation standards for SPVUs to reduce energy costs for equipment owners, with the resulting net savings being redirected to other forms of economic activity. Those shifts in spending and economic activity could affect the demand for labor. As described in section IV.M, DOE used an input/output model of the U.S. economy to estimate indirect employment impacts of the TSLs that DOE considered in this rulemaking. DOE understands that there are uncertainties involved in projecting employment impacts, especially changes in the later years of the analysis. Therefore, DOE generated results for near-term time frames (2019–2023), where these uncertainties are reduced.

The results suggest that these proposed standards would be likely to have negligible impact on the net demand for labor in the economy. The net change in jobs is so small that it would be imperceptible in national labor statistics and might be offset by other, unanticipated effects on employment. Chapter 16 of the NOPR TSD presents more detailed results about anticipated indirect employment impacts.

4. Impact on Utility or Performance of Equipment

DOE has tentatively concluded that the amended standards it is proposing in this NOPR would not lessen the utility or performance of SPVUs.

5. Impact of Any Lessening of Competition

DOE has also considered any lessening of competition that is likely to result from new and 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 in writing to the Secretary, together with an analysis of the nature and extent of such impact. (42 U.S.C. 6313(a)(6)(B)(ii)(V))

To assist the Attorney General in making such a determination, DOE has provided DOJ with copies of this notice and the TSD for review. DOE will consider DOJ's comments on the proposed rule in preparing the final rule, and DOE will publish and respond to DOJ's comments in that document.

6. Need of the Nation To Conserve Energy

An improvement in the energy efficiency of the products subject to this 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. Reductions in national electric generating capacity estimated for each considered TSL are reported in chapter 15 of the NOPR TSD.

Energy savings from amended standards for the SPVU equipment classes covered in the NOPR could also produce environmental benefits in the form of reduced emissions of air pollutants and greenhouse gases associated with electricity production. Table V.16 provides DOE's estimate of cumulative emissions reductions projected to result from the TSLs considered in this rulemaking using the ASHRAE baseline, while results using the EPCA baseline can be found in chapter 13 of the NOPR TSD. The table includes both power sector emissions and upstream emissions. The upstream emissions were calculated using the multipliers discussed in section IV.G. DOE reports annual CO_2, NO_X, and Hg emissions reductions for each TSL in chapter 13 of the NOPR TSD. As discussed in section IV.J, DOE 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 CSAPR.

TABLE V.16—CUMULATIVE EMISSIONS REDUCTION FOR POTENTIAL STANDARDS FOR SPVUS

	TSL			
	1	2	3	4
Power Sector and Site Emissions*				
CO_2 *(million metric tons)*	8.0	20	32	34
SO_2 *(thousand tons)*	22	53	86	90
NO_X *(thousand tons)*	3.6	8.9	14	14
Hg *(tons)*	0.03	0.06	0.10	0.11
N_2O *(thousand tons)*	0.11	0.27	0.44	0.46
CH_4 *(thousand tons)*	0.60	1.4	2.4	2.5

TABLE V.16—CUMULATIVE EMISSIONS REDUCTION FOR POTENTIAL STANDARDS FOR SPVUs—Continued

	TSL			
	1	2	3	4
Upstream Emissions				
CO_2 *(million metric tons)*	0.28	0.68	1.1	1.2
SO_2 (*thousand tons*)	0.06	0.15	0.24	0.26
NO_X *(thousand tons)*	3.9	9.4	16	17
Hg (*tons*)	0.0002	0.0004	0.0006	0.0006
N_2O (*thousand tons*)	0.003	0.007	0.011	0.012
CH_4 (*thousand tons*)	24	57	94	101
Total Emissions				
CO_2 *(million metric tons)*	8.3	20	33	35
SO_2 (*thousand tons*)	22	53	86	91
NO_X *(thousand tons)*	7.4	18	30	31
Hg (*tons*)	0.03	0.06	0.11	0.11
N_2O (*thousand tons*)	0.11	0.28	0.45	0.47
CH_4 (*thousand tons*)	24	59	97	103

* Includes emissions from additional gas use of more-efficient SPVUs.

Note: These results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant decrease in cumulative emissions reductions for CO_2, estimated at 33%, and an increase in NO_X, estimated at 13%. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

As part of the analysis for this NOPR, DOE estimated monetary benefits likely to result from the reduced emissions of CO_2 and NO_X estimated for each of the TSLs considered for SPVUs. As discussed in section IV.K, for CO_2, DOE used values for the SCC developed by an interagency process. The interagency group selected four sets of SCC values for use in regulatory analyses. Three sets are based on the average SCC from three integrated assessment models, at discount rates of 2.5 percent, 3 percent, and 5 percent. The fourth set, 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. The four SCC values for CO_2 emissions reductions in 2015, expressed in 2013$, are $12.0/ton, $40.5/ton, $62.4/ton, and $119/ton. The values for later years are higher due to increasing emissions-related costs as the magnitude of projected climate change increases.

Table V.17 presents the global value of CO_2 emissions reductions at each TSL using the ASHRAE baseline, while results using the EPCA baseline are available in chapter 14 of the NOPR TSD. DOE calculated domestic values as a range from 7 percent to 23 percent of the global values, and these results are presented in chapter 14 of the NOPR TSD for both the ASHRAE and EPCA baselines.

TABLE V.17—GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION FOR POTENTIAL STANDARDS FOR SPVUs

TSL	SCC Scenario* million 2013$			
	5% discount rate, average	3% discount rate, average	2.5% discount rate, average	3% discount rate, 95th percentile
Power Sector and Site Emissions **				
1	50	241	386	747
2	120	584	937	1812
3	202	969	1552	3006
4	216	1035	1656	3209
Upstream Emissions				
1	1.8	8.5	14	26
2	4.3	21	33	64
3	7.2	34	55	107
4	7.8	37	59	114
Total Emissions				
1	52	249	400	773
2	124	605	970	1875
3	209	1003	1607	3112
4	224	1072	1715	3324

* For each of the four cases, the corresponding SCC value for emissions in 2015 is $12.0, $40.5, $62.4 and $119 per metric ton (2013$).[108]

** Includes site emissions associated with additional use of natural gas by more-efficient SPVUs.

DOE is well aware that scientific and economic knowledge about the contribution of CO_2 and other greenhouse gas (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 NOPR the most recent values and analyses resulting from the 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 the SPVU equipment that is the subject of this NOPR. The dollar-per-ton values that DOE used are discussed in section IV.K. Table V.18 presents the present value of cumulative NO_X emissions reductions for each TSL using the ASHRAE baseline calculated using the average dollar-per-ton values and 7-percent and 3-percent discount rates. Results using the EPCA baseline are available in chapter 14 of the NOPR TSD.

TABLE V.18—PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR POTENTIAL STANDARDS FOR SPVUS [109]

TSL	million 2013$	
	3% Discount rate	7% Discount rate
Power Sector and Site Emissions **		
1	3.6	1.0
2	9.1	2.6
3	15	4.2
4	15	4.3
Upstream Emissions		
1	4.8	2.0
2	11	4.7
3	19	8.2
4	21	9.0
Total Emissions		
1	8.4	3.0
2	21	7.3
3	34	12
4	36	13

* Includes site emissions associated with additional use of natural gas by more-efficient SPVUs.

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.19 presents 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 using the ASHRAE baseline, at both a 7-percent and a 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 discussed above.

TABLE V.19—SPVU TSLS: NET PRESENT VALUE OF CONSUMER SAVINGS COMBINED WITH NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS

TSL	Consumer NPV at 3% discount rate added with:			
	SCC Value of $12.0/metric ton CO_2* and medium value for NO_X**	SCC Value of $40.5/metric ton CO_2* and medium value for NO_X**	SCC Value of $62.4/metric ton CO_2* and medium value for NO_X**	SCC Value of $119/metric ton CO_2* and medium value for NO_X**
1	0.32	0.52	0.67	1.0
2	0.59	1.1	1.4	2.3
3	(0.26)	0.54	1.1	2.6
4	(0.84)	0.005	0.65	2.3
1	0.14	0.34	0.49	0.86

[108] These results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant decrease in cumulative emissions reductions for CO_2, estimated at 33%. The monetized benefits from GHG reductions would likely change by a comparable amount. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

[109] These results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in an increase in NO_X emissions reductions, estimated at 13%. The monetized benefits from NO_X reductions would likely change by a comparable amount. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

TABLE V.19—SPVU TSLS: NET PRESENT VALUE OF CONSUMER SAVINGS COMBINED WITH NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS—Continued

TSL	Consumer NPV at 3% discount rate added with:			
	SCC Value of $12.0/metric ton CO_2* and medium value for NO_X**	SCC Value of $40.5/metric ton CO_2* and medium value for NO_X**	SCC Value of $62.4/metric ton CO_2* and medium value for NO_X**	SCC Value of $119/metric ton CO_2* and medium value for NO_X**
2	0.24	0.72	1.1	2.0
3	(0.15)	0.65	1.3	2.8
4	(0.54)	0.31	0.95	2.6

[1] Billion 2013$.
Note: Parentheses indicate negative values.
* These label values represent the global SCC in 2015, in 2013$. The present values have been calculated with scenario-consistent discount rates.[110]
** Medium Value corresponds to $2,684 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. customer 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 2019–2048. 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 CO_2 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)) No other factors were considered in this analysis.

C. Proposed Standards

EPCA contains criteria for prescribing new or amended energy conservation standards. For commercial HVAC equipment such as SPVUs, DOE must adopt as national standards the levels in amendments to ASHRAE Standard 90.1 unless DOE determines, supported by clear and convincing evidence, that standards more stringent than those levels ''would result in significant additional conservation of energy and [be] technologically feasible and economically justified.'' (42 U.S.C. 6313(a)(6)(A)(ii)(II)) In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens by, to the greatest extent practicable, considering the seven statutory factors discussed previously. (42 U.S.C. 6313(a)(6)(B)(ii))

In this rulemaking, DOE has evaluated whether standards more stringent than the efficiency levels in ASHRAE Standard 90.1–2013 for SPVUs are justified under the above criteria. As stated in sections III.C.1 and III.D.2, DOE has tentatively determined, based on clear and convincing evidence, that all of the more-stringent standard levels considered in this rulemaking are technologically feasible and would save significant additional amounts of energy. For this NOPR, DOE considered the impacts of amended standards for SPVUs at each TSL, beginning with the maximum technologically feasible level, to determine whether that level was economically justified. Where the max-tech level was not 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 in understanding the benefits and/or burdens of each TSL, tables in this section summarize the quantitative analytical results for each TSL, based on the assumptions and methodology discussed herein. The efficiency levels contained in each TSL are described in section V.A. 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 who may be disproportionately affected by a national standard, and impacts on employment. Section V.B.1.b presents the estimated impacts of each TSL for these subgroups. DOE discusses the impacts on direct employment in SPVU manufacturing in section V.B.2.b, and discusses the indirect employment impacts in section V.B.3.c.

1. Benefits and Burdens of Trial Standard Levels Considered for SPVUs

Table V.20, Table V.21, and Table V.22 summarize the quantitative impacts estimated for each TSL for SPVUs using the ASHRAE baseline. The national impacts are measured over the lifetime of SPVUs purchased in the 30-year period that begins in the year of compliance with amended standards (2019–2048). The energy savings, emissions reductions, and value of emissions reductions refer to full-fuel-cycle results. Results for the proposed standard level using the EPCA baseline can be found in Tables V.24 through V.28.

[110] These results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant decrease in cumulative emissions reductions for CO_2, estimated at 33%, and in increase in cumulative emissions reductions for NO_X, estimated at 13%. The monetized benefits from GHG reductions would likely change by a comparable amount. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

[111] These results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant change in cumulative emissions reductions for CO_2 and most other pollutants. For example, the estimated change for CO_2 emissions reductions is a decrease of 33%, while the estimated change for NO_X emissions reductions is an increase of 13%. The monetized benefits from GHG reductions would likely change by a comparable amount. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

TABLE V.20—SUMMARY OF ANALYTICAL RESULTS FOR SPVUS: NATIONAL IMPACTS [111]

Category	TSL 1	TSL 2	TSL 3	TSL 4
National Energy Savings *quads*	0.09	0.23	0.37	0.39.
NPV of Customer Benefits (2013$ billion)				
3% discount rate	0.26	0.44	(0.50)	(1.10).
7% discount rate	0.09	0.11	(0.37)	(0.78).
Cumulative Emissions Reduction (Total FFC Emissions)				
CO_2 *(million metric tons)*	8.3	20	33	35.
SO_2 (*thousand tons*)	22	53	86	91.
NO_X *(thousand tons)*	7.4	18	30	31.
Hg (*tons*)	0.03	0.06	0.11	0.11.
N_2O (*thousand tons*)	0.11	0.28	0.45	0.47.
CH_4 (*thousand tons*)	24	59	97	103.
Value of Emissions Reduction (Total FFC Emissions)				
CO_2 (2013$ million)*	52 to 773	124 to 1875	209 to 3112	224 to 3324.
NO_X—3% discount rate (*2013$ million*)	8.4	21	34	36
NO_X—7% discount rate (*2013$ million*)	3.0	7.3	12	13.

* Range of the economic value of CO_2 reductions is based on estimates of the global benefit of reduced CO_2 emissions.
Note: Parentheses indicate negative values.

TABLE V.21—NPV OF CONSUMER BENEFITS BY EQUIPMENT CLASS

Equipment class	Discount rate (%)	Trial Standard Level			
		1	2	3	4
SPVAC	3	0.13	0.13	(0.64)	(1.05)
<65,000 Btu/h	7	0.04	0.01	(0.38)	(0.66)
SPVHP	3	0.13	0.32	0.14	(0.06)
<65,000 Btu/h	7	0.04	0.10	0.01	(0.12)
Total—All Classes	3	0.26	0.44	(0.50)	(1.10)
	7	0.09	0.11	(0.37)	(0.78)

[1] Billion 2013$.
Note: Parentheses indicate negative values.

TABLE V.22—SUMMARY OF ANALYTICAL RESULTS FOR SPVUS: MANUFACTURER AND CONSUMER IMPACTS

[ASHRAE baseline]

	TSL 1	TSL 2	TSL 3	TSL 4
Manufacturer Impacts				
Industry NPV relative to a base case value of 36.5 (2013$ millions)	32.4 to 34.2	33.2 to 38.0	27.5 to 49.2	3.0 to 47.4
Industry NPV (% change)	(11.3) to (6.3)	(9.0) to 4.1	(24.7) to 34.9	(91.7) to 29.9
Consumer Mean LCC Savings (2013$)				
SPVAC <65,000 Btu/h	116	179	(24)	(825)
SPVHP <65,000 Btu/h	358	424	819	(177)
Consumer Median PBP (years)				
SPVAC <65,000 Btu/h	7.9	8.4	14.4	27.3
SPVHP <65,000 Btu/h	4.1	4.8	6.2	13.6
Distribution of Consumer LCC Impacts				
SPVAC <65,000 Btu/h:				
Net Cost (%)	25	37	62	87
Net Benefit (%)	49	62	38	13
No Impact (%)	26	1	0	0
SPVHP <65,000 Btu/h:				
Net Cost (%)	0	1	7	68
Net Benefit (%)	74	98	92	32

TABLE V.22—SUMMARY OF ANALYTICAL RESULTS FOR SPVUS: MANUFACTURER AND CONSUMER IMPACTS—Continued
[ASHRAE baseline]

	TSL 1	TSL 2	TSL 3	TSL 4
No Impact (%)	26	1	0	0

Note: Parentheses indicate negative values.

First, DOE considered TSL 4, which would save an estimated total of 0.39 quads of energy, an amount DOE considers significant. TSL 4 has an estimated NPV of customer benefit of negative $0.78 billion using a 7-percent discount rate, and negative $1.10 billion using a 3-percent discount rate.

The cumulative emissions reductions at TSL 4 are 35 million metric tons of CO_2, 31 thousand tons of NO_X, and 0.11 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 4 ranges from $224 million to $3,324 million.[112]

At TSL 4, the average LCC savings ranges from a negative $825 to a negative $177 depending on equipment class. The fraction of consumers with positive LCC benefits range from 13 percent for SPVACs less than 65,000 Btu/h to 32 percent for SPVHPs less than 65,000 Btu/h.

At TSL 4, the projected change in INPV ranges from a decrease of $33.4 million to an increase of $10.9 million. At TSL 4, DOE recognizes the risk of negative impacts if manufacturers' expectations concerning reduced profit margins are realized. If the lower bound of the range of impacts is reached, as DOE expects, TSL 4 could result in a net loss of up to 91.7 percent in INPV for manufacturers.

Accordingly, the Secretary tentatively concludes that at TSL 4 for SPVUs, the benefits of energy savings, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by negative NPV of consumer benefit overall, negative LCC savings for both equipment classes (SPVAC and SPVHP less than 65,000 Btu/h), and the significant burden on the industry. Consequently, DOE has concluded that TSL 4 is not economically justified.

Next, DOE considered TSL 3, which would save an estimated total of 0.37 quads of energy, an amount DOE considers significant. TSL 3 has an estimated NPV of consumer benefit of negative $0.37 billion using a 7-percent discount rate, and negative $0.50 billion using a 3-percent discount rate.

The cumulative emissions reductions at TSL 3 are 33 million metric tons of CO_2, 30 thousand tons of NO_X, and 0.11 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 3 ranges from $209 million to $3,112 million.[113]

At TSL 3, the average LCC savings are range from a negative $24 to a positive $819 depending on equipment class. The fraction of consumers with positive LCC benefits ranged from 38 percent for SPVACs less than 65,000 Btu/h to 92 percent for SPVHPs less than 65,000 Btu/h.

At TSL 3, the projected change in INPV ranges from a decrease of $9.0 million to an increase of $12.7 million. If the lower bound of the range of impacts is reached, TSL 3 could result in a net loss of up to 24.7 percent in INPV for manufacturers.

Accordingly, the Secretary tentatively concludes that at TSL 3 for SPVUs, the benefits of energy savings, emission reductions, and the estimated monetary value of the CO_2 emissions reductions would be outweighed by the negative NPV of consumer benefits, negative LCC savings for SPVAC less than 65,000 Btu/h, and the negative INPV on manufacturers. Consequently, DOE has tentatively concluded that TSL 3 is not economically justified.

Next, DOE considered TSL 2, which would save an estimated total of 0.23 quads of energy, an amount DOE considers significant. TSL 2 has an estimated NPV of consumer benefit of $0.11 billion using a 7-percent discount rate, and $0.44 billion using a 3-percent discount rate.

The cumulative emissions reductions at TSL 2 are 20 million metric tons of CO_2, 18 thousand tons of NO_X, and 0.06 tons of Hg. The estimated monetary value of the CO_2 emissions reductions at TSL 3 ranges from $124 million to $1,875 million.[114]

At TSL 2, the average LCC savings range from $179 to $424 depending on equipment class. The fraction of consumers with positive LCC benefits range from 62 percent for SPVACs less than 65,000 Btu/h to 98 percent for SPVHPs less than 65,000 Btu/h.

At TSL 2, the projected change in INPV ranges from a decrease of $3.3 million to an increase of $1.5 million. At TSL 2, DOE recognizes the risk of negative impacts if manufacturers' expectations concerning reduced profit margins are realized. If the lower bound of the range of impacts is reached, as DOE expects, TSL 2 could result in a net loss of up to 9.0 percent in INPV for manufacturers.

After considering the analysis and weighing the benefits and the burdens, DOE has tentatively concluded that at TSL 2 for SPVUs, the benefits of energy savings, positive NPV of consumer benefit, positive average consumer LCC savings, emission reductions, and the estimated monetary value of the emissions reductions would outweigh the potential reduction in INPV for manufacturers. The Secretary of Energy has tentatively concluded that TSL 2 would save a significant amount of energy, is technologically feasible and economically justified, and is supported by clear and convincing evidence. For the above reasons, DOE proposes to

[112] These results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant change in cumulative emissions reductions for CO_2 and most other pollutants. For example, the estimated change for CO_2 emissions reductions is a decrease of 33%, while the estimated change for NO_X emissions reductions is an increase of 13%. The monetized benefits from GHG reductions would likely change by a comparable amount. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

[113] These results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant change in cumulative emissions reductions for CO_2 and most other pollutants. For example, the estimated change for CO_2 emissions reductions is a decrease of 33%, while the estimated change for NO_X emissions reductions is an increase of 13%. The monetized benefits from GHG reductions would likely change by a comparable amount. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

[114] These results are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant change in cumulative emissions reductions for CO_2 and most other pollutants. For example, the estimated change for CO_2 emissions reductions is a decrease of 33%, while the estimated change for NO_X emissions reductions is an increase of 13%. The monetized benefits from GHG reductions would likely change by a comparable amount. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

adopt the energy conservation standards for SPVUs at TSL 2. Table V.23 presents the proposed energy conservation standards for SPVUs. As mentioned previously, for SPVHPs greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h and for SPVUs greater than or equal to 135,000 Btu/h and less than 240,000 Btu/h, there are no models on the market, and, therefore, DOE had no basis with which to develop higher efficiency levels or conduct analyses. For SPVACs greater than or equal to 65,000 Btu/h and less than 135,000 Btu/h, there are no models on the market higher than the ASHRAE 90.1–2013 level, and, therefore, DOE has no clear and convincing evidence with which to adopt higher levels.

As a result, DOE is proposing amended standards for SPVUs equivalent to those in ASHRAE Standard 90.1–2013 for these four equipment classes, as required by law.

TABLE V.23—PROPOSED ENERGY CONSERVATION STANDARDS FOR SPVUS

Equipment class	Cooling capacity Btu/h	Efficiency level
Single Package Vertical Air Conditioner	<65,000 Btu/h	EER =11.0.
Single Package Vertical Air Conditioner	≥65,000 Btu/h and <135,000 Btu/h	EER = 10.0.
Single Package Vertical Air Conditioner	≥135,000 Btu/h and <240,000 Btu/h	EER = 10.0.
Single Package Vertical Heat Pump	<65,000 Btu/h	EER = 11.0. COP = 3.3.
Single Package Vertical Heat Pump	≥65,000 Btu/h and <135,000 Btu/h	EER = 10.0. COP = 3.0.
Single Package Vertical Heat Pump	≥135,000 Btu/h and <240,000 Btu/h	EER = 10.0. COP = 3.0.

Table V.24 through Table V.28 present the benefits and burdens on the consumer, the manufacturer, and the Nation in comparison to a base case including the current Federal standards (*i.e.,* the EPCA baseline), although only the incremental quantitative impacts from the ASHRAE baseline to the various TSL standard levels under consideration was used to propose these standards. The results compared to the ASHRAE baseline are also included for comparison.

TABLE V.24—CONSUMER IMPACT RESULTS FOR SPVU PROPOSED TRIAL STANDARD LEVEL

[Baseline Comparison]

Equipment class	Baseline	Life-cycle cost, all customers *2013$*			Life-cycle cost savings				Median payback period *years*
		Installed cost	Discounted operating cost	LCC	Affected customers' average savings *2013$*	% of Consumers that experience			
						Net cost	No impact	Net benefit	
SPVAC <65 kBtu/h	ASHRAE	5,083	11,839	16,922	179	37	1	62	8.4
	EPCA	5,083	11,839	16,922	261	42	1	57	10.4
SPVHP <65 kBtu/h	ASHRAE	5,695	29,618	35,313	424	1	1	98	4.8
	EPCA	5,695	29,618	35,313	382	21	1	78	9.3
SPVAC 65–135 kBtu/h	ASHRAE								
	EPCA	6,659	19,805	26,464	737	16	29	55	7.0
SPVHP 65–135 kBtu/h	ASHRAE								
	EPCA	7,409	56,078	63,487	241	34	29	37	10.9

TABLE V.25—MANUFACTURER IMPACT ANALYSIS RESULTS FOR SPVU PROPOSED TRIAL STANDARD LEVEL

[Baseline Comparison]

	ASHRAE baseline	EPCA baseline
Base Case INPV (2013$ millions)	36.5	33.9.
Standards Case INPV (2013$ millions)	33.2 to 38.0	24.0 to 40.2.
Change in INPV (% Change)	(9.0) to 4.1	(29.2) to 18.6.

TABLE V.26—CUMULATIVE NATIONAL PRIMARY AND FULL-FUEL-CYCLE ENERGY SAVINGS AND NET PRESENT VALUE OF CUSTOMER BENEFIT FOR SPVU PROPOSED TRIAL STANDARD LEVEL FOR UNITS SOLD IN 2019–2048

[Baseline Comparison]

	National primary energy savings (quads)		National FFC energy savings (quads)		NPV at 3% (billion 2013$)		NPV at 7% (billion 2013$)	
	ASHRAE baseline	EPCA baseline	ASHRAE baseline	EPCA baseline	ASHRAE baseline	EPCA baseline	ASHRAE baseline	EPCA baseline
SPVAC <65,000 Btu/h	0.13	0.28	0.13	0.28	0.13	0.51	0.01	0.10
SPVHP <65,000 Btu/h	0.10	0.17	0.10	0.17	0.32	0.53	0.10	0.15
SPVAC ≥65,000 Btu/h to <135,000 Btu/h	....	0.01	....	0.01	....	0.02	....	0.01
Total—All Classes	0.22	0.45	0.23	0.46	0.44	1.07	0.11	0.26

Note: Components may not sum to total due to rounding.

TABLE V.27—CUMULATIVE EMISSIONS REDUCTION, GLOBAL PRESENT VALUE OF CO_2 EMISSIONS REDUCTION, AND PRESENT VALUE OF NO_X EMISSIONS REDUCTION FOR PROPOSED STANDARDS FOR SPVUS

[Baseline Comparison]

	Power sector and site emissions *		Upstream emissions		Total emissions	
	ASHRAE baseline	EPCA baseline	ASHRAE baseline	EPCA baseline	ASHRAE baseline	EPCA baseline
Cumulative Emissions Reductions						
CO_2 (*million metric tons*)	20	40	0.68	1.4	20	41
SO_2 (*thousand tons*)	53	107	0.15	0.30	53	108
NO_X (*thousand tons*)	8.9	18	9.4	19	18	37
Hg (*tons*)	0.06	0.13	0.0004	0.0007	0.06	0.13
N_2O (*thousand tons*)	0.27	0.55	0.007	0.014	0.28	0.56
CH_4 (*thousand tons*)	1.4	3.0	57	116	59	119
Global Present Value of CO_2 Emissions Reduction, SCC Scenario ** (million 2013$)						
5% discount rate, average	120	247	4.3	8.8	124	256
3% discount rate, average	584	1194	21	42	605	1236
2.5% discount rate, average	937	1914	33	67	970	1982
3% discount rate, 95th percentile	1812	3704	64	131	1875	3834
Present Value of NO_X Emissions Reduction (million 2013$)						
3% discount rate	9.1	18	11	24	21	42
7% discount rate	2.6	5.3	4.7	9.7	7.3	15

* Includes site emissions associated with additional use of natural gas by more-efficient SPVUs.
** For each of the four cases, the corresponding SCC value for emissions in 2015 is $12.0, $40.5, $62.4 and $119 per metric ton (2013$).

TABLE V.28—SPVU PROPOSED TSL: NET PRESENT VALUE OF CONSUMER SAVINGS COMBINED WITH NET PRESENT VALUE OF MONETIZED BENEFITS FROM CO_2 AND NO_X EMISSIONS REDUCTIONS

[Baseline Comparison]

	SCC Value of $12.0/metric ton CO_2* and medium value for NO_X**		SCC Value of $40.5/metric ton CO_2* and medium value for NO_X**		SCC Value of $62.4/metric ton CO_2* and medium value for NO_X**		SCC Value of $119/metric ton CO_2* and medium value for NO_X**	
	ASHRAE baseline	EPCA baseline	ASHRAE baseline	EPCA baseline	ASHRAE baseline	EPCA baseline	ASHRAE baseline	EPCA baseline
	billion 2013$							
Consumer NPV at 3% Discount Rate added with each SCC and NO_X value	0.59	1.4	1.1	2.3	1.4	3.1	2.3	4.9
Consumer NPV at 7% Discount Rate added with each SCC and NO_X value	0.24	0.53	0.72	1.5	1.1	2.3	2.0	4.1

Note: Parentheses indicate negative values.

* These label values represent the global SCC in 2015, in 2013$. The present values have been calculated with scenario-consistent discount rates.

** Medium Value corresponds to $2,684 per ton of NO_X emissions.

2. Summary of Benefits and Costs (Annualized) of the Proposed Standards

The benefits and costs of the proposed 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 2013$, 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.[115] 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.

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 SCC are performed with different methods that use different time frames for analysis. The national operating cost savings is measured for the lifetime of products shipped in 2019–2048. 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 CO_2 in each year. These impacts continue well beyond 2100.

Table V.29 shows the annualized values for the proposed standards for SPVUs compared to the ASHRAE baselines. The results under the primary estimate are as follows. (All monetary values below are expressed in 2013$.) Using a 7-percent discount rate for benefits and costs other than CO_2 reduction, for which DOE used a 3-percent discount rate along with the SCC series corresponding to a value of $40.5/ton in 2015, the cost of the SPVU standards proposed in the NOPR is $29 million per year in increased equipment costs, while the benefits are $38 million per year in reduced equipment operating costs, $29 million in CO_2 reductions, and $0.57 million in reduced NO_X emissions. In this case, the net benefit amounts to $38 million per year. Using a 3-percent discount rate for all benefits and costs and the SCC series corresponding to a value of $40.5/ton in 2015, the cost of the SPVU standards proposed in the NOPR is $37 million per year in increased equipment costs, while the benefits are $58 million per year in reduced operating costs, $29 million in CO_2 reductions, and $0.97 million in reduced NO_X emissions. In this case, the net benefit amounts to $51 million per year.[116]

TABLE V.29—ANNUALIZED BENEFITS AND COSTS OF PROPOSED STANDARDS (TSL 2) FOR SPVUs

	Discount rate	million 2013$/year		
		Primary estimate*	Low net benefits estimate*	High net benefits estimate*
Benefits:				
Operating Cost Savings	7%	38	36	39
	3%	58	55	61
CO_2 Reduction Monetized Value ($12.0/t case)**	5%	7.7	7.6	7.7
CO_2 Reduction Monetized Value ($40.5/t case)**	3%	29	28	29
CO_2 Reduction Monetized Value ($62.4/t case)**	2.5%	43	42	43
CO_2 Reduction Monetized Value $119/t case)**	3%	89	88	89
NO_X Reduction at $2,684/ton**	7%	0.57	0.56	0.57
	3%	0.97	0.97	0.98
Total Benefits†	7% plus CO_2 range	46 to 127	44 to 125	48 to 129
	7%	67	65	69
	3% plus CO_2 range	67 to 148	63 to 144	70 to 151
	3%	88	84	91
Costs:				
Incremental Equipment Costs	7%	29	40	28
	3%	37	53	36
Net Benefits/Costs:				
Total:	7% plus CO_2 range	17 to 98	4 to 85	19 to 101
	7%	38	25	40
	3% plus CO_2 range	30 to 111	11 to 91	34 to 115

[115] 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 2014, 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 3 and 7 percent for all costs and benefits except for the value of CO_2 reductions. For the latter, DOE used a range of discount rates. From the present value, DOE then calculated the fixed annual payment over a 30-year period, starting in 2013 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.

[116] All CO_2 and NO_X results shown in this paragraph are based on emissions factors in *AEO 2013*, the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant decrease in cumulative emissions reductions for CO_2, estimated at 33%, and an increase in cumulative NO_X reductions, estimated at 13%. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014*, depending on the timing of the issuance of the next rulemaking document.

TABLE V.29—ANNUALIZED BENEFITS AND COSTS OF PROPOSED STANDARDS (TSL 2) FOR SPVUs—Continued

	Discount rate	million 2013$/year		
		Primary estimate*	Low net benefits estimate*	High net benefits estimate*
	3%	51	31	55

* This table presents the annualized costs and benefits associated with SPVUs shipped in 2019–2048. These results include benefits to consumers which accrue after 2048 from the products purchased in 2019–2048. Costs incurred by manufacturers, some of which may be incurred in preparation for the rule, are not directly included, but are indirectly included as part of incremental equipment costs. The Primary, Low Benefits, and High Benefits Estimates utilize projections of energy prices and building growth from the *AEO 2013* Reference case, Low Estimate, and High Estimate, respectively. In addition, incremental equipment costs reflect constant real prices for the Primary Estimate, an increase for projected equipment price trends for the Low Benefits Estimate, and a decline for projected equipment price trends for the High Benefits Estimate. The methods used to derive projected price trends are explained in section IV.F.2.a.

** The CO_2 values represent global monetized values of the SCC, in 2013$, in 2015 under several scenarios. The values of $12.0, $40.5, and $62.4 per metric ton are the averages of SCC distributions calculated using 5%, 3%, and 2.5% discount rates, respectively. The value of $119/t represents the 95th percentile of the SCC distribution calculated using a 3% discount rate. The SCC time series used by DOE incorporate an escalation factor. The value for NO_X (in 2013$) is the average of the low and high values used in DOE's analysis.[117]

† Total benefits for both the 3-percent and 7-percent cases are derived using the series corresponding to SCC value of $40.5/t. In the rows labeled "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 the proposed standards address are as follows:

(1) There are external benefits resulting from improved energy efficiency of SPVUs 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. DOE attempts to quantify some of the external benefits through use of Social Cost of Carbon values.

In addition, the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB) has determined that this regulatory action is a ''significant regulatory action'' under Executive Order 12866. DOE has also prepared a regulatory impact analysis (RIA) for the proposed rule.

DOE has also reviewed this regulation pursuant to Executive Order 13563, issued on January 18, 2011 (76 FR 3281 (Jan. 21, 2011)). Executive Order 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.

DOE emphasizes 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 the NOPR is consistent with these principles, including the requirement that, to the extent permitted by law, benefits justify costs and that net benefits are maximized.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (IRFA) 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 (August 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 (*www.energy.gov/gc/office-general-counsel*).

DOE has determined that it cannot certify that the proposed rule, if promulgated, would not have a significant effect on a substantial number of small manufacturers. Therefore, DOE has prepared an initial regulatory flexibility analysis (IRFA), as presented in sections VI.B.1 through VI.B.4, for this rulemaking.

[117] All CO_2 and NO_X results shown in this paragraph are based on emissions factors in *AEO 2013,* the most recent version available at the time of this analysis. Use of emissions factors in *AEO 2014* would result in a significant decrease in cumulative emissions reductions for CO_2, estimated at 33%, and an increase in cumulative NO_X reductions, estimated at 13%. In the next phase of this rulemaking, DOE plans to use emissions factors based on the most recent *AEO* available, which may or may not be *AEO 2014,* depending on the timing of the issuance of the next rulemaking document.

1. Description and Estimated Number of Small Entities Regulated

For manufacturers of SPVUs, 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, 30848 (May 15, 2000), as amended at 65 FR 53533, 53544 (Sept. 5, 2000) and codified at 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at *http://www.sba.gov/content/table-small-business-size-standards.* SPVU manufacturing is classified under NAICS 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' The SBA sets a threshold of 750 employees or less for an entity to be considered as a small business for this category.

DOE reviewed the proposed energy conservation standards for SPVUs considered in the notice of proposed rulemaking under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. 68 FR 7990. To better assess the potential impacts of this rulemaking on small entities, DOE conducted a more focused inquiry of the companies that could be small business manufacturers of equipment covered by this rulemaking. DOE used available public information to identify potential small manufacturers. DOE's research involved industry trade association membership directories (including AHRI), the DOE certification database, individual company Web sites, and marketing research tools (*e.g.,* Hoovers reports) to create a list of companies that manufacture or sell SPVU systems covered by this rulemaking. DOE also asked stakeholders and industry representatives if they were aware of any other small manufacturers during manufacturer interviews and at previous DOE public meetings. DOE reviewed the publicly-available data and contacted companies on its list, as necessary, to determine whether they met the SBA's definition of a small business manufacturer of SPVU equipment. DOE screened out companies that did not offer equipment covered by this rulemaking, did not meet the definition of a ''small business,'' or are foreign-owned and operated.

DOE identified seven companies that produce equipment covered under the single package vertical unit energy conservation standard rulemaking. Two of the seven companies are foreign-owned and operated. Of the remaining five businesses, two companies met the SBA definition of a ''small business.'' One small business manufacturer has the largest market share in the SPVU industry and 48 percent of the active listings in the AHRI Directory.[118] The other has a more modest market share and 5 percent of active listings in the AHRI Directory.

2. Description and Estimate of Compliance Requirements

At the time of analysis, the domestic small manufacturer with the large market share had 229 active listings. Fifty-four of those listings, or 24 percent, would meet the proposed standards. The other 76 percent of the listings would not meet the proposed standard. The small manufacturer would need to either redesign those products or drop those products and move their customers to more-efficient offerings. However, DOE notes that the small manufacturer had more product listings than any other manufacturer that could meet the proposed standard.

The domestic small manufacturer with the smaller market share had 27 active listings. None of those listings would meet the proposed standards. At the proposed standard level, this manufacturer would need to redesign its entire product offering or leave the SPVU market.

If small manufacturers chose to redesign their products that do not meet the proposed standard, they would need to make capital conversion and product conversion investments. DOE estimated an average total conversion cost of $1.49 million per manufacturer. DOE expects this investment, which is roughly 12% of an average manufacturer's annual revenue, to be made over the four-year period between the publication of the final rule and the effective date of the standard. Since small businesses may have a greater difficulty obtaining credit or may obtain less favorable terms than larger businesses, the small manufacturers may face higher overall costs if they choose to finance the conversion costs resulting from the change in standard.

DOE notes that the small manufacturer with the larger market share produces more SPVU units than its larger competitors. The company could potentially spread the conversion costs over a larger number of units than its competitors. However, the small manufacturer did express concern in MIA interviews that such an effort would tie up their available engineering resources and prevent them from focusing on technology advancements and customer-driven feature requests. Larger manufacturers, which do not have the same shipment volumes as the small manufacturer, may have fewer engineers dedicated to SPVU equipment but potentially could marshal engineering and testing resources across their organization. The concern about adequate availability of engineering resources would also likely apply to the small manufacturer with the smaller market share.

Smaller manufacturers generally pay higher prices for purchased parts, such as BPMs, relative to larger competitors. Even the small manufacturer with the larger market share, and the highest number of SPVU shipments of any manufacturer in the industry, could pay higher prices for component than the larger competition. If their competitors have centralized sourcing, those companies could combine component purchases for SPVU product lines with purchases for other non-SPVU product lines and obtain higher volume discounts than those available to small manufacturers.

Due to the potential conversion costs, the potential engineering and testing effort, and the potential increases in component prices that result from a standard, DOE conducted this regulatory flexibility analysis. Based on DOE's analysis, including interviews with manufacturers, the Department believes one of the identified small businesses would be able to meet the proposed standard. That small manufacturer has the strong market share, technical expertise, and the production capability to meet the amended standard. The company successfully competes in both the current baseline-efficiency and premium-efficiency market segments. The other small business has significantly less market share and does not compete in the premium-efficiency market today. Given the lack of existing product that meets the standard, potential conversion costs, and disadvantages in financing costs as well as in pricing for sourced components, the second small business may face headwinds in meeting the proposed standard.

[118] Based on model listings in the AHRI directory accessed on June 6, 2012 (Available at: *http://www.ahridirectory.org/ahridirectory/pages/ac/defaultSearch.aspx*).

3. Duplication, Overlap, and Conflict with Other Rules and Regulations

DOE is not aware of any rules or regulations that duplicate, overlap, or conflict with the rule being considered.

4. Significant Alternatives to the Rule

The discussion in section VI.B.2 analyzes impacts on small businesses that would result from DOE's proposed rule. In addition to the other TSLs being considered, the proposed rulemaking TSD includes a regulatory impact analysis (RIA). For SPVUs, the RIA discusses the following policy alternatives: (1) No change in standard; (2) consumer rebates; (3) consumer tax credits; (4) manufacturer tax credits; (5) voluntary energy efficiency targets; (6) early replacement; and (7) bulk government purchases. While these alternatives may mitigate to some varying extent the economic impacts on small entities compared to the standards, DOE determined that the energy savings of these regulatory alternatives are from 0.01 to 0.5 percent smaller than those that would be expected to result from adoption of the proposed standard levels. Thus, DOE rejected these alternatives and is proposing the standards set forth in this rulemaking. (See chapter 17 of the NOPR TSD for further detail on the policy alternatives DOE considered.)

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of single package vertical air conditioners and single package vertical heat pumps must certify to DOE that their products comply with any applicable energy conservation standards. In certifying compliance, manufacturers must test their equipment according to the applicable DOE test procedures for SPVACs and SPVHPs, including any amendments adopted for those test procedures on the date that compliance is required. DOE has established regulations for the certification and recordkeeping requirements for all covered customer products and commercial equipment, including SPVACs and SPVHPs. 76 FR 12422 (March 7, 2011). 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 approved by OMB under OMB Control Number 1910–1400. 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 of 1969

Pursuant to the National Environmental Policy Act (NEPA) of 1969, DOE has determined that the proposed rule fits within the category of actions included in Categorical Exclusion (CX) B5.1 and otherwise meets the requirements for application of a CX. *See* 10 CFR part 1021, App. B, B5.1(b); 1021.410(b) and Appendix B, B(1)–(5). The proposed rule fits within the category of actions because it is a rulemaking that establishes energy conservation standards for customer products or industrial equipment, and for which none of the exceptions identified in CX B5.1(b) apply. Therefore, DOE has made a CX determination for this rulemaking, and DOE does not need to prepare an Environmental Assessment or Environmental Impact Statement for this proposed rule. DOE's CX determination for this proposed rule is available at *http://cxnepa.energy.gov/.*

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. 64 FR 43255 (August 10, 1999). 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 that it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has tentatively determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed 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). Therefore, Executive Order 13132 requires no further action.

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; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), 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 proposed 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. Pub. L. 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 them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *www.energy.gov/gc/office-general-counsel.*

Although the proposed rule, which proposes amended energy conservation standards for SPVUs, does not contain a Federal intergovernmental mandate, it may require annual expenditures of $100 million or more by the private sector. Specifically, the proposed rule would likely result in a final rule that could require expenditures of $100 million or more, including: (1) Investment in research and development and in capital expenditures by SPVUs manufacturers in the years between the final rule and the compliance date for the amended standards, and (2) incremental additional expenditures by consumers to purchase higher-efficiency SPVUs, starting at the compliance date for the applicable standard.

Section 202 of UMRA authorizes a Federal 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 the NOPR and the ''Regulatory Impact Analysis'' section of the TSD for this proposed 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 proposed 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. 6313(a), the proposed rule would establish amended energy conservation standards for SPVUs 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 TSD for the proposed rule.

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

Pursuant to Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (March 15, 1988), DOE has determined that this proposed rule would not result in any takings that 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 Federal agencies to review most disseminations of information to the public under information quality 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 this NOPR 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 tentatively concluded that this regulatory action, which sets forth proposed energy conservation standards for SPVUs, 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 this proposed 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 Policy (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.'' *Id.* at 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: *energy.gov/eere/buildings/peer-review.*

VII. Public Participation

A. Attendance at the Public Meeting

The time, date, and location of the public meeting are listed in the **DATES** and **ADDRESSES** sections at the beginning of this proposed rule. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586–2945 or *Brenda.Edwards@ee.doe.gov.* Please note that foreign nationals participating in the public meeting are subject to advance security screening procedures which require advance notice prior to attendance at the public meeting. If a foreign national wishes to participate in the public meeting, please inform DOE as soon as possible by contacting Ms. Regina Washington at (202) 586–1214 or by email: *foreignvisit@ee.doe.gov* so that the necessary procedures can be completed. Please also note that any person wishing to bring a laptop computer into the Forrestal Building will be required to obtain a property pass. Visitors should avoid bringing laptops, or allow an extra 45 minutes

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's Web site at: *http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx?ruleid=107.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Requests to Speak and Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this notice, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the public meeting. Such persons may hand-deliver requests to speak to the address shown in the **ADDRESSES** section at the beginning of this proposed rule between 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays. Requests may also be sent by mail or email to: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121, or *Brenda.Edwards@ee.doe.gov.* Persons who wish to speak should include with their request a computer diskette or CD–ROM in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

DOE requests persons scheduled to make an oral presentation to submit an advance copy of their statements at least one week before the public meeting. DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Program. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

C. Conduct of the Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the public meeting. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the public meeting, interested parties may submit further comments on the proceedings, as well as on any aspect of the rulemaking, until the end of the comment period.

The public meeting will be conducted in an informal, conference style. DOE will present summaries of comments received before the public meeting, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will allow, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting.

A transcript of the public meeting will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this proposed rule and will be accessible on the DOE Web site. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule before or after the public meeting, but no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this proposed rule.

Submitting comments via www.regulations.gov. The *www.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 itself 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. Otherwise, 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 *www.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 *www.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 below.

DOE processes submissions made through *www.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 *www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery/courier, or mail. Comments and documents submitted via email, hand delivery, or mail also will be posted to *www.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 in 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. If you submit via mail or hand delivery/courier, please provide all items on a CD, if feasible, in which case it is not necessary to submit printed copies. No telefacsimiles (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, that are written in English, and that 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. Pursuant 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/courier 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).

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

1. DOE seeks comment on its tentative conclusion that the creation of a space-constrained equipment class for SPVUs is not warranted. (See section III.B.1 of this preamble for additional information.)

2. DOE seeks comment on the EER and COP pairings for SPVHPs and its method of deriving the pairings. (See section IV.C.1 of this preamble for additional information.)

3. DOE requests comment on its elimination of technologies from consideration based upon the criteria using in the screening analysis. (See section IV.B of the preamble for additional information.)

4. DOE seeks comment as to whether switching to a BPM motor at 10 EER represents the most probable option of achieving that efficiency level for manufacturers. (See section IV.C.2 of this preamble for additional information.)

5. DOE seeks comment on its derivation of the cost efficiency curves for SPVHPs and SPVACs with a cooling capacity ≥65,000 Btu/h and <135,000 Btu/h. (See section IV.C.5 of this preamble for additional information.)

6. DOE seeks input on its analysis of market channels for the SPVU equipment classes. (See section IV.D of this preamble for additional information.)

7. DOE seeks input on its analysis of unit energy consumption (UEC) for the above equipment classes and its use in establishing the energy savings potential for more-stringent standards. Of a particular interest to DOE is input on shipments of SPVHP equipment to telecommunication shelters and the frequency of use of economizers in equipment serving these shelters. (See section IV.E of this preamble for additional information.)

8. DOE also recognizes that there may be regional differences between the shipments of heat pumps and air conditioners to warmer or cooler climates, and requests stakeholder input on how or if such differences can be taken into account in the energy use characterization. (See section IV.E of this preamble for additional information.)

9. DOE requests comments on the most appropriate trend to use for real (inflation-adjusted) SPVU prices. (See section IV.F.2.a of this preamble for additional information.)

10. DOE seeks comments on its assumption that installation costs would not increase for higher-efficiency SPVUs. (See section IV.F.2.b of this preamble for additional information.)

11. DOE seeks comment on whether a rebound effect should be included in the determination of annual energy savings. If a rebound effect should be included, DOE seeks data to assist in calculation of the rebound effect. (See section IV.G.1.a of this preamble for additional information.)

12. DOE seeks comment on whether amended standards would affect shipments, and if so, DOE also requests data with which to estimate the elasticity of shipments for SPVUs as a function of first costs, repair costs, or operating costs. (See section IV.G.2 of this preamble for additional information.)

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed rulemaking.

List of Subjects in 10 CFR Part 431

Administrative practice and procedure, Confidential business information, Energy conservation, Reporting and recordkeeping requirements.

Issued in Washington, DC, on December 10, 2014.

David T. Danielson,

Assistant Secretary of Energy, Energy Efficiency and Renewable Energy.

For the reasons set forth in the preamble, DOE proposes to amend part 431 of Chapter II, Subchapter D, of Title 10 of the Code of Federal Regulations as set forth below:

PART 431—ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 431 continues to read as follows:

Authority: 42 U.S.C. 6291–6317.

■ 2. Section 431.97 is amended by:

■ a. Revising paragraph (d); and

■ b. Redesignating Table 7 in paragraph (e) as Table 9, and Table 8 in paragraph (f) as Table 10;

The revisions read as follows:

§ 431.97 Energy efficiency standards and their compliance dates.

* * * * *

(d)(1) Each single package vertical air conditioner and single package vertical heat pump manufactured on or after January 1, 2010, but before October 9, 2015 (for models ≥65,000 Btu/h and <135,000 Btu/h) or October 9, 2016 (for models ≥135,000 Btu/h and <240,000 Btu/h), must meet the applicable minimum energy conservation standard level(s) set forth in Table 6 of this section.

TABLE 6 TO § 431.97—MINIMUM EFFICIENCY STANDARDS FOR SINGLE PACKAGE VERTICAL AIR CONDITIONERS AND SINGLE PACKAGE VERTICAL HEAT PUMPS

Equipment type	Cooling capacity	Sub-category	Efficiency level	Compliance date: products manufactured on and after . . .
Single package vertical air conditioners and single package vertical heat pumps, single-phase and three-phase.	<65,000 Btu/h	AC	EER = 9.0	January 1, 2010.
		HP	EER = 9.0 COP = 3.0	January 1, 2010.
Single package vertical air conditioners and single package vertical heat pumps.	≥65,000 Btu/h and <135,000 Btu/h	AC	EER = 8.9	January 1, 2010.
		HP	EER = 8.9 COP = 3.0	January 1, 2010.
Single package vertical air conditioners and single package vertical heat pumps.	≥135,000 Btu/h and <240,000 Btu/h	AC	EER = 8.6	January 1, 2010.
		HP	EER = 8.6 COP = 2.9	January 1, 2010.

(2) Each single package vertical air conditioner and single package vertical heat pump manufactured on and after October 9, 2015 (for models ≥65,000 Btu/h and <135,000 Btu/h) or October 9, 2016 (for models ≥135,000 Btu/h and <240,000 Btu/h), but before [*date 4 years after publication of a final rule*] must meet the applicable minimum energy conservation standard level(s) set forth in Table 7 of this section.

TABLE 7 TO § 431.97—MINIMUM EFFICIENCY STANDARDS FOR SINGLE PACKAGE VERTICAL AIR CONDITIONERS AND SINGLE PACKAGE VERTICAL HEAT PUMPS

Equipment type	Cooling capacity	Sub-category	Efficiency level	Compliance date: products manufactured on and after . . .
Single package vertical air conditioners and single package vertical heat pumps, single-phase and three-phase.	<65,000 Btu/h	AC	EER = 9.0	January 1, 2010.
		HP	EER = 9.0 COP = 3.0	January 1, 2010.
Single package vertical air conditioners and single package vertical heat pumps.	≥65,000 Btu/h and <135,000 Btu/h	AC	EER = 10.0	October 9, 2015.
		HP	EER = 10.0 COP = 3.0	October 9, 2015.
Single package vertical air conditioners and single package vertical heat pumps.	≥135,000 Btu/h and <240,000 Btu/h	AC	EER = 10.0	October 9, 2016.
		HP	EER = 10.0 COP = 3.0	October 9, 2016.

(3) Each single package vertical air conditioner and single package vertical heat pump manufactured on and after [*date 4 years after publication of a final rule*] must meet the applicable minimum energy conservation standard level(s) set forth in Table 8 of this section.

TABLE 8 TO § 431.97—UPDATED MINIMUM EFFICIENCY STANDARDS FOR SINGLE PACKAGE VERTICAL AIR CONDITIONERS AND SINGLE PACKAGE VERTICAL HEAT PUMPS

Equipment type	Cooling capacity	Sub-category	Efficiency level	Compliance date: products manufactured on and after . . .
Single package vertical air conditioners and single package vertical heat pumps, single-phase and three-phase.	<65,000 Btu/h	AC	EER = 11.0	[*Date 4 years after publication of final rule*].
		HP	EER = 11.0 COP = 3.3	[*Date 4 years after publication of final rule*].
Single package vertical air conditioners and single package vertical heat pumps.	≥65,000 Btu/h and <135,000 Btu/h	AC HP	EER = 10.0 EER = 10.0 COP = 3.0	October 9, 2015. October 9, 2015.
Single package vertical air conditioners and single package vertical heat pumps.	≥135,000 Btu/h and <240,000 Btu/h	AC HP	EER = 10.0 EER = 10.0 COP = 3.0	October 9, 2016. October 9, 2016.

* * * * *

[FR Doc. 2014–29865 Filed 12–29–14; 8:45 am]

BILLING CODE 6450–01–P