

[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 433

[Docket No.: EERE-2011-BT-STD-0055]

RIN 1904-AC60

Energy Efficiency Design Standards for New Federal Commercial and Multi-Family High-Rise Residential Buildings

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

ACTION: Final rule.

SUMMARY: The U.S. Department of Energy (DOE) is publishing this final rule to implement provisions in the Energy Conservation and Production Act (ECPA) that require DOE to update the baseline Federal energy efficiency performance standards for the construction of new Federal commercial and multi-family high-rise residential buildings. This rule updates the baseline Federal commercial standard to the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010.

DATES: This rule is effective [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. The incorporation by reference of certain publications in the rule is approved by the Director of the Federal Register as of [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: This rulemaking can be identified by docket number EERE-2011-BT-STD-0055 and/or RIN number 1904-AC60.

Docket: The docket is available for review at <http://www.regulations.gov> including Federal Register Notices, public meeting attendee lists, transcripts, comments and other supporting documents/materials. All documents in the docket are listed in the <http://www.regulations.gov> index. However, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

For further information on how to review public comments or review hard copies of the docket in the resource room, contact Ms. Brenda Edwards at (202) 586-2945 or e-mail Brenda.Edwards@ee.doe.gov.

FOR FURTHER INFORMATION CONTACT: Mr. ~~Michael Erbesfeld~~Mohammed Khan, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, Mailstop EE-2J, 1000 Independence Avenue, SW, Washington, DC 20585, (202) ~~287-1874~~, e-mail: ~~Michael.Erbesfeld@ee.doe.gov~~, or Mr. ~~Christopher Calamita~~, 586-7892, e-mail: Mohammed.Khan@ee.doe.gov, or Ms. Ami Grace-Tardy Esq., U.S. Department of Energy, Office of the General Counsel, Forrestal Building, GC-71, 1000 Independence Avenue, SW, Washington, DC 20585, (202) 586-~~1777~~, e-mail: ~~Christopher.Calamita@hq.doe.gov~~, e-mail: Ami.Grace-Tardy@hq.doe.gov.

SUPPLEMENTARY INFORMATION:

This rulemaking incorporates by reference the following standard into [10 CFR](#) Part 433:

- ANSI/ASHRAE/IESNA Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings, 2010, American Society of Heating Refrigerating and Air-Conditioning Engineers, Inc., ISSN 1041-2336.

Copies of this standard are available from the American Society of Heating Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E. Atlanta, GA 30329, (404) 636-8400,

<http://www.ashrae.org/>.

~~A copy of this standard is available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this standard at NARA, call 202-741-6030, or go to:~~

~~<http://www.archives.gov/federal-register/code-of-federal-regulations/ibr-locations.html>.~~ Also, a copy of this standard is available for inspection at U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Building Technologies Program, 6th Floor, 950 L'Enfant Plaza, SW., Washington, DC 20024. For information on the availability of this standard at DOE, contact Ms. Brenda Edwards at (202) 586-2945 or e-mail Brenda.Edwards@ee.doe.gov.

I. Introduction

II. Executive Summary

III. Discussion of Today's Action

~~IIIIV.~~ Compliance Date

~~IVV.~~ Reference Resources

Comment [A1]: Change recommended by OIRA.

~~V~~VI. Regulatory Analysis

~~V~~VII. Congressional Notification

I. Introduction

Section 305 of the Energy Conservation and Production Act (ECPA), as amended, requires DOE to establish building energy efficiency standards for all new Federal buildings. (42 U.S.C. 6834(a)(1)) The standards established under section 305(a)(1) of ECPA must contain energy efficiency measures that are technologically feasible, economically justified, and meet the energy efficiency levels in the applicable voluntary consensus energy codes specified in section 305. (42 U.S.C. 6834(a)(1)-(3))

Under section 305 of ECPA, the referenced voluntary consensus code for commercial buildings (including multi-family high rise residential buildings) is the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1 and the referenced code for low-rise residential buildings is the International Energy Conservation Code (IECC). (42 U.S.C. 6834(a)(2)(A)) DOE codified these referenced codes as baseline Federal building standards into energy efficiency standards in 10 CFR parts 433, 434, and 435. Also under section 305 of ECPA, DOE must establish, by rule, revised Federal building energy efficiency performance standards for new Federal buildings that require such buildings be designed to achieve energy consumption levels that are at least 30 percent below the levels established in the referenced codes; (baseline Federal building standards), if life-cycle cost-effective. (42 U.S.C. 6834(a)(3)(A)(i)(I))

Comment [A2]: Change recommended by OIRA.

Comment [A3]: Change recommended by OIRA.

Under section 305 of ECPA, not later than one year after the date of approval of each

subsequent revision of the ASHRAE Standard or the IECC, DOE must determine whether to amend the baseline Federal building standards with the revised voluntary standard based on the cost-effectiveness of the revised voluntary standard. (42 U.S.C. 6834(a)(3)(B)) It is this requirement that today's rulemaking addresses. ASHRAE Standard 90.1 has been updated from the version currently referenced in DOE's regulations at 10 CFR part 433. DOE is now revising the latest baseline Federal building standard for 10 CFR part 433 from ASHRAE Standard 90.1-2007 to ASHRAE Standard 90.1-2010.

Comment [A4]: Change recommended by OIRA.

Comment [A5]: Change recommended by OIRA.

Section 306(a) of ECPA provides that each Federal agency and the Architect of the Capitol must adopt procedures to ensure that new Federal buildings will meet or exceed the Federal building energy efficiency standards established under section 305. (42 U.S.C. 6835(a)) Section 306(b) bars the head of a Federal agency from expending Federal funds for the construction of a new Federal building unless the building meets or exceeds the applicable baseline Federal building energy standards established under section 305. (42 U.S.C. 6835(b)) This includes both the requirement that all new Federal buildings comply with the baseline standards in ASHRAE Standard 90.1 and the IECC and the requirement that new Federal buildings achieve energy consumption levels at least 30 percent below these minimum baseline standards where life-cycle cost-effective. (42 U.S.C. 6834 (a)(3)(A))

Comment [A6]: Change recommended by OIRA.

III. Executive Summary

Under the Energy Conservation and Production Act (ECPA) DOE must determine whether the energy efficiency standards for new Federal buildings should be updated to reflect revisions to ASHRAE Standard 90.1 based on the cost-effectiveness of the revisions. (42 U.S.C.

6834(a)(3)(B)) One of the objectives considered by the committee developing Standard 90.1-2010 is for the requirements to be cost-effective for use in the private sector. Using a scalar ratio for cost-effectiveness based on an ASTM standard, as described below, the Standard 90.1 committee determined that ASHRAE Standard 90.1-2010 is cost-effective. Therefore, in today's final rule, DOE updates the energy efficiency standards for new Federal buildings to ASHRAE Standard 90.1-2010 for buildings for which design for construction began on or after one year after today's rule is published in the Federal Register.

Comment [A7]: Change recommended by OIRA.

III. Discussion of Today's Action

DOE is issuing today's action as a final rule. As indicated above, DOE must determine whether the energy efficiency standards for new Federal buildings should be updated to reflect revisions to ASHRAE Standard 90.1 based on the cost-effectiveness of the revisions. (42 U.S.C. 6834(a)(3)(B)) In today's final rule, DOE determines that the energy efficiency standards for new Federal buildings should be updated to reflect the 2010 revisions to ASHRAE Standard 90.1 based on the cost-effectiveness of the revisions.

DOE reviewed ASHRAE Standard 90.1 for DOE's state building codes program and determined that the 2010 version of ASHRAE Standard 90.1 would achieve greater energy efficiency than the prior version. This determination was subject to notice and comment. See 76 FR 43298 (July 20, 2011). ~~In that determination~~ In that determination DOE found that the 2010 version of Standard 90.1 would save 18.2% more source energy than the 2007 version of Standard 90.1. (In a prior determination, DOE found that the 2007 version of Standard 90.1 would save

3.9% more source energy than the 2004 version of Standard 90.1 (76 FR 43287))

In DOE's determination for the state building codes program, and again in today's rule,

Comment [A8]: Change recommended by OIRA.

DOE states that the cost-effectiveness of revisions to the voluntary codes is considered through DOE's statutorily directed involvement in the codes process. See 76 FR 43300. Section 307 of ECPA requires DOE to participate in the ASHRAE code development process and to assist in determining the cost-effectiveness of the voluntary standards. (42 U.S.C. 6836) DOE is required to periodically review the economic basis of the voluntary building energy codes and participate in the industry process for review and modification, including seeking adoption of all technologically feasible and economically justified energy efficiency measures. (42 U.S.C. 6836(b))

ASHRAE Standard 90.1 is developed through an American National Standards Institute (ANSI) consensus process. The ANSI consensus process involves representatives of producers (industry), users (owners and designers), and general (advocates and government) segments of the building industry. Part of that process involves development of cost-effectiveness criteria to use in the development of Standard 90.1. Another part of the process is extensive public review and comment of each change to Standard 90.1. During the course of the public review and comment process, cost-effectiveness is often a topic. One of the objectives considered by the committee developing Standard 90.1 is for the requirements of Standard 90.1 to be cost-effective for use in the private sector. The As described below, the 90.1 committee uses used a scalar ratio for cost-effectiveness based on ASTM Standard E917- Standard Practice for Measuring Life-Cycle Costs of Buildings and Building Systems--to determine that ASHRAE Standard 90.1-2010 is cost-effective. The 90.1 committee simplified the life-cycle cost (LCC) model in ASTM Standard

E917 by condensing the economic variables into a single variable called the scalar ratio, which is simply a ratio of economic present worth factors. A scalar ratio of 20.2 was used in the development of Standard 90.1-2010. This is mathematically equivalent to a LCC analysis using the following parameters:

Economic Life – 40 years

Loan Interest Rate – 7%

Heating Fuel Escalation Rate – 3.7%

Cooling Fuel Escalation Rate – 3.7%

Federal Tax Rate – 34%

State Tax Rate – 5%

Discount Rate – 7%

The above parameters and ASTM Standard E917 form the basis of the Federal LCC requirements found in 10 CFR Part 436.

Comment [A9]: Changes recommended by OIRA.

In today's rule, DOE is amending the energy efficiency standards applicable to new Federal buildings based on the determinations made by DOE as to the energy efficiency improvements of ASHRAE Standard 90.1-2010, as compared to the predecessor version, and based on the considerations of cost-effectiveness incorporated into the codes processes, as well as DOE's involvement in those processes. This final rule amends 10 CFR part 433 to update the referenced baseline Federal energy efficiency performance standards. No other changes are proposed to 10 CFR part 433 by this rule.

~~DOE notes that the 2012 IECC was finalized this summer— 2011. On May 17, 2012, DOE is currently working on issuing a preliminary final determination for the 2012 IECC. If DOE finalizes this determination, the Department intends to update 10 CFR part 435 with that the 2012 IECC would achieve greater energy efficiency in low-rise residential buildings than the previous editions of the IECC. (77 FR 29322).~~

~~DOE also notes that there are a number of statutory provisions, regulations, Executive Orders, and memoranda of understanding that govern energy consumption in new Federal buildings. These include, but are not limited to, Executive Order 13514 (74 FR 52117 (October 8, 2009)); sections 323, 433, 434, and 523 of EISA 2007; Executive Order 13423 (72 FR 3919 (January 26, 2007)); the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings originally adopted in the Federal Leadership in High Performance and Sustainable Buildings MOU; section 109 of the Energy Policy Act of 2005 (Pub. L. 109-58); and 10 CFR Parts 433 and 435. Today's rule supports and does not supplant these other applicable legal requirements for new Federal buildings. For example, by designing buildings to meet the ASHRAE 90.10-2010 baseline, Federal agencies also help achieve the energy intensity reductions mandated under section 431 of EISA 2007.~~

IV. Compliance Date

Today's final rule applies to new Federal buildings for which design for construction begins on or after one year from the date of this ~~notice~~ rulemaking. Such buildings must be designed to exceed the energy efficiency level of the appropriate updated voluntary standard by 30

Formatted: Font: Times New Roman, 12 pt, Font color: Auto, English (Canada)

Formatted: Font: Times New Roman, 12 pt, Font color: Auto, English (Canada)

Formatted: Normal (Web)

Formatted: Font: Times New Roman, 12 pt, Font color: Auto, English (Canada)

Formatted: Font: Times New Roman, 12 pt, Font color: Auto, English (Canada)

Formatted: Font: Times New Roman, 12 pt, Font color: Auto, English (Canada)

Formatted: Font: Times New Roman, 12 pt, Font color: Auto, English (Canada)

Formatted: Font: Times New Roman, 12 pt, Font color: Auto, English (Canada)

Formatted: English (Canada)

Comment [A10]: Change recommended by OIRA.

percent if life-cycle cost-effective. However, at a minimum, such buildings must achieve the energy efficiency equal to that of the appropriate updated voluntary standard. One year lead time before the design for construction begins is consistent with DOE's previous updates to the energy efficiency baselines and the original statutory mandate for Federal building standards. One year lead time before design for construction begins helps minimize compliance costs to agencies, which may have planned buildings in various stages of design, and allows for design changes to more fully consider life-cycle cost-effective measures (as opposed to having to revise designs in development, which may make incorporation of energy efficiency measure more difficult or expensive.)

Comment [A11]: Change recommended by OIRA.

IV. Reference Resources

The Department originally prepared this list of resources to help Federal agencies achieve building energy efficiency levels of at least 30 percent below ASHRAE Standard 90.1-2004. The Department has reviewed these resources and believes that they are still applicable to helping agencies achieve building energy efficiency levels of at least 30% better than ASHRAE Standard 90.1-2010. The Department has updated this resource list as necessary. These resources come in many forms and in a variety of media. Resources are provided for all buildings, and also specifically for commercial and multi-family high-rise residential buildings.

Resources for Commercial and Multi-Family High-Rise Residential Buildings

Energy Efficient Products – U.S. DOE Federal Energy Management Program and U.S.

Environmental Protection Agency (EPA) ENERGY STAR Program

<http://www.eere.energy.gov/femp/procurement>

<http://www.energystar.gov/products>

Federal agencies are required by the Energy Policy Act of 2005 to specify Federal Energy Management Program (FEMP) designated or ENERGY STAR equipment, including building mechanical and lighting equipment and builder-supplied appliances, for purchase and installation in all new construction. This equipment is generally more efficient than the corresponding requirements of ASHRAE Standard 90.1-2010, and may be used to achieve part of the savings required of Federal building designs. (Today's rule does not specifically address the use of this equipment, but this website is listed for convenience because it is a very useful resource for achieving part of the energy savings required by the rule.)

Life-Cycle Cost Analysis – U.S. DOE Federal Energy Management Program

http://www.access.gpo.gov/nara/cfr/waisidx_04/10cfr436_04.html

The life-cycle cost analysis rules promulgated in 10 CFR part 436 Subpart A *Life-Cycle Cost Methodology and Procedures* conform to requirements in the Federal Energy Management Improvement Act of 1988 (Pub. L. 100-615) and subsequent energy conservation legislation, as well as Executive Order 13123, *Greening the Government through Efficient Energy Management*. The life-cycle cost guidance and required discount rates and energy price projections are determined annually by FEMP and the Energy Information Administration, and are published in the Annual Supplement to The National Institute of Standards and Technology Handbook 135: “Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis”

<http://www1.eere.energy.gov/femp/pdfs/ashb10.pdf>. FEMP also provides guidance on the life-

cycle cost requirements of Executive Order 13123 at

http://www1.eere.energy.gov/femp/information/download_bfcc.html.

ENERGY STAR Buildings –U.S. Environmental Protection Agency and U.S. Department of Energy

http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder (non-residential buildings)

ENERGY STAR is a Government-backed program helping businesses and individuals protect the environment through superior energy efficiency. The benchmarking tool and other information at the ENERGY STAR Target Finder website can be useful in determining an annual energy target for building design and computer simulations, evaluating cost-effectiveness of efficiency measures, and tracking a building's actual energy performance after construction.¹

Comment [A12]: Footnote added as recommended by OIRA.

Commercial Building Initiative – U.S. DOE Building Technologies Program

http://www1.eere.energy.gov/buildings/commercial_initiative/

A collection of design approaches, tools, technologies and case studies focused on high performance buildings that achieve savings of 30 percent to 50 percent better than generally accepted good practice. One specific resource on the Commercial Building Initiative site are the Fifty Percent Technical Support Documents available at

http://apps1.eere.energy.gov/buildings/commercial_initiative/resource_database/ (enter “50% technical support document” in search window). This is a set of technical support documents for

¹ [The use of EPA's Target Finder tool during the design process of applicable new Federal buildings helps ensure that buildings are on a pathway to meet the existing building Federal Sustainable Building Guiding Principle \(Energy Efficiency: Option 1\), which is to receive an ENERGY STAR score of 75 or higher in EPA's Portfolio Manager.](#)

users who wish to go beyond Standard 90.1. The technical support documents are targeted at 50% better than ASHRAE Standard 90.1-2004 (which translates to approximately 20% better than Standard 90.1-2010).

Building Energy Software Tools – U.S. DOE Building Technologies Program

http://apps1.eere.energy.gov/buildings/tools_directory/

This directory provides information on building software tools for evaluation energy efficiency, renewable energy, and sustainability in buildings.

ASHRAE Standard 90.1-2010 – ASHRAE

http://www.techstreet.com/standards/ashrae/90_1_2010_ip?product_id=1739526

The baseline energy efficiency standard for commercial and multi-family high-rise buildings is ANSI/ASHRAE/IESNA Standard 90.1-2010. This link also contains a link to a read-only version of Standard 90.1-2010 under the Preview button.

Whole Building Design Guide – National Institute of Building Sciences

<http://www.wbdg.org>

A portal providing one-stop access to up-to-date information on a wide range of building-related guidance, criteria and technology from a “whole buildings” perspective.

Advanced Energy Design Guides – ASHRAE

<http://www.ashrae.org/publications/page/aedg50pct>

A set of design guides for users who wish to go beyond Standard 90.1. The design guides are targeted at 50 percent better than ASHRAE Standard 90.1-2004 (which translates to approximately 20 percent better than Standard 90.1-2010). The design guides are available for free download.

Advanced BuildingsTM Core Performance GuideTM – New Buildings Institute

<http://www.newbuildings.org/advanced-design/advanced-buildings>

A set of guidelines for the design, construction, and operation of new and renovated nonresidential buildings targeted at 30 percent better than ASHRAE Standard 90.1-2004 (which translates to approximately the same level as ASHRAE Standard 90.1-2010).

Labs for the 21st Century – U.S. EPA and U.S. DOE

<http://www.labs21century.gov/>

A website focused on improving the energy efficiency and environmental performance of laboratory space. This site includes training and educational resources and design tools focused on laboratories.

VI. Regulatory Analysis

A. Review under Executive Order 12866, "Regulatory Planning and Review"

Today's final rule is ~~not~~ a "significant regulatory action" under Executive Order 12866, "Regulatory Planning and Review." 58 FR 51735 (October 4, 1993). Accordingly, today's action

Comment [A13]: Changes recommended by OIRA.

was ~~not~~ subject to review by the Office of Information and Regulatory Affairs in the Office of Management and Budget (OMB). ~~OMB has completed its review. As discussed previously in this notice, DOE is required to determine, based on the cost-effectiveness, whether the standards for Federal buildings should be updated to reflect an amendment to the ASHRAE standard. As stated above DOE complied with the statutory language by relying on the cost-effectiveness criteria used in the ASHRAE development process. The ASHARE development process used a scalar ratio for cost-effectiveness based on ASTM E917.~~

~~The Environmental Assessment for this rulemaking identified a rate of new Federal commercial construction of 22 million square feet per year with a distribution of building types as shown in Table 1. As described in the referenced Environmental Assessment, the distribution of building types is based on the 2007 and 2008 GSA Federal real property reports. Table 1 also shows the prototype buildings used for computer simulations utilized for estimating energy use in each building type. DOE derived these prototype buildings from 16 building types in 17 climate zones using its Commercial Reference Building models.²~~

~~Table 1. New Federal Commercial and High-Rise Multi-Family Construction Volume by Building Type~~

Building Type	Fraction of Federal Construction Volume (by floor area)	Assumed Prototypes
Office	0.63	Small Office, Medium Office, Large Office
Education	0.083	Primary School, Secondary School
Dorm/Barracks	0.09	Small Hotel, Mid-Rise Apartment
Warehouse	0.15	Non-Refrigerated Warehouse
Hospital	0.04	Outpatient Healthcare, Hospital

² ~~DOE's prototype buildings are described at http://www.energycodes.gov/development/commercial/90.1_models.~~

Notes:

1. **Bold font** in Assumed Prototypes column indicates prototypes for which costs are available (See Table 2)
2. Note that first cost data is not available for the prototypes assumed for warehouses and hospitals. As described below, DOE considered costs for the warehouse and hospital to be equivalent to the weighted cost for offices, education, and dorm/barracks, which represents 81% of the Federal building stock.

DOE has preliminarily determined incremental cost and the life-cycle cost net savings information for the building types and climate zones analyzed. This information is shown in Tables 2 and 3.

Table 2. Incremental Construction First Cost (2012\$) for ASHRAE 90.1-2010 vs. ASHRAE 90.1-2007

Prototype	Value	ASHRAE Climate Zone ³				
		2A	3A	3B	4A	5A
Small Office	First Cost	\$4,024	\$2,987	\$3,651	\$9,988	\$2,987
	\$/ft ²	\$0.73	\$0.54	\$0.66	\$1.82	\$0.54
Large Office	First Cost	\$86,463	\$157,083	\$90,665	\$131,058	-\$112,435
	\$/ft ²	\$0.17	\$0.32	\$0.18	\$0.26	-\$0.23
Primary School	First Cost	\$161,793	\$177,029	\$43,243	\$177,400	\$133,745
	\$/ft ²	\$2.19	\$2.39	\$0.58	\$2.40	\$1.81
Small Hotel	First Cost	-\$48,706	-\$56,732	-\$51,337	-\$48,880	-\$64,202
	\$/ft ²	-\$1.13	-\$1.31	-\$1.19	-\$1.13	-\$1.49
Mid-rise	First Cost	\$19,024	\$19,024	\$19,024	\$19,024	\$19,024

³ Briggs, R.S, R.G. Lucas, and Z.T. Taylor. 2003. "Climate classification for building energy codes and standards: Part 1 – Development Process." ASHRAE Transactions 109(1): 109:121. American Society of Heating, Refrigerating and Air-Conditioning Engineers. Atlanta, Georgia. The 90.1-2010 climate zone map may be viewed as Figure B.1 of the online version of Standard 90.1-2010 at http://openpub.realread.com/rrserver/browser?title=/ASHRAE_1/ashrae_90_1_2010_IP_1024.

Apartment	\$/ft ²	\$0.56	\$0.56	\$0.56	\$0.56	\$0.56
-----------	--------------------	--------	--------	--------	--------	--------

Notes:

1. Costs shown are preliminary, and still undergoing final review as of June 2013.
2. Negative costs indicate a reduction in cost due to changes in the code, usually due to reduced HVAC capacity.⁴

Data from Table 1 and Table 2 were used to calculate preliminary values for overall incremental first cost of construction for Federal commercial and high-rise multi-family residential buildings. DOE calculated the incremental first cost of the Federal building types based on the DOE prototypes shown in bold font in Table 1. DOE then calculated the weighted average incremental cost for Federal building types based on the office, education, and dorm/barracks building types which represent an estimated 81% of new Federal construction. This weighted incremental cost was assigned to the warehouse and hospital building types and a total weighted incremental cost was calculated by multiplying the incremental cost for each Federal building type by the fraction of Federal construction shown in Table 1. For warehouses and hospitals DOE considered costs to be equivalent to the weighted cost for offices, education, and dorm/barracks⁵.

The national total incremental first cost for building types was developed by multiplying the average (across climate zones) incremental first cost of the prototypes (determined from the 90.1 cost-effectiveness analysis) by the fraction of the Federal sector construction volume shown in Table 1⁶. The resulting building type incremental first costs were then summed together to

⁴ In this particular transition from 90.1-2007 to 90.1-2010, the cost reduction was mainly because of smaller and less expensive HVAC equipment since the building load had decreased. This cost reduction is part of the first cost calculation. Note that in addition to reduced equipment costs, there is reduced ductwork or piping costs as well.

⁵ There is no data for those years for warehouses or hospitals. It could be expected that costs to a warehouses would be less since it is a simpler building. We assumed both the warehouse and the hospital were the "average" of the data we did have. And so, the warehouse value is likely higher than it might have been and the hospital value is likely lower than it might have been had there been data available.

⁶ For the Federal office building, the small and large office prototype first costs were averaged. For the Federal

determine an overall incremental first cost for the entire Federal commercial and high-rise multi-family residential buildings sector. The resulting preliminary total incremental first cost estimate is \$12 million per year. The average first cost increase is \$0.54 per square foot.

Turning to LCC net savings, Table 3 shows preliminary annual LCC net savings by prototype buildings. For LCC net savings, a similar approach to that used for incremental first cost was used. That is, the national total annual LCC net savings⁷ for building types was developed by multiplying the average (across climate zones) LCC net savings (determined from the 90.1 cost-effectiveness analysis) by the fraction of the federal sector construction volume shown in Table 1⁸. The results of the building type LCC net savings were then summed together to determine the overall annual LCC net savings for the entire Federal commercial and high-rise multi-family buildings sector. The resulting total LCC net savings for 22 million square feet of annual construction was estimated to be \$58 million. The average life-cycle cost net savings in year one was estimated to be \$2.64 per square foot. Note the annual LCC savings are for one year of Federal commercial and high-rise multi-family residential construction and that those savings would accumulate over the LCC evaluation period. For the purpose of this analysis DOE relied on a 30 year period.

Table 3. Annual Life-Cycle Cost (LCC) Net Savings for ASHRAE 90.1-2010 vs. ASHRAE 90.1-

education building, the primary school prototype first cost was used. For the Federal dorm/barracks building type, the small hotel and mid-rise apartment prototype first costs were averaged.

⁷ The energy costs used were the national average energy costs used by ASHRAE in the development of Standard 90.1-2010. To quote the cost-effectiveness analysis report “Energy rates used to calculate the energy costs from the modeled energy usage are \$1.22/therm and \$0.0939/kWh. These rates were used for 90.1-2010 energy analysis, and derived from the US DOE Energy Information Administration (EIA 2006), as reported in Energy and Cost Savings Analysis of ASHRAE Standard 90.1-2010 the 30% Goal. These are the values approved by the SSPC 90.1 for cost-effectiveness for the evaluation of individual addenda during the development of 90.1-2010.”

⁸ For the Federal office building, the small and large office prototype life cycle costs were averaged. For the Federal education building, the primary school prototype life cycle cost was used. For the Federal dorm/barracks building type, the small hotel and mid-rise apartment prototype life cycle costs were averaged.

2007

<u>Prototype</u>	<u>ASHRAE Climate Zone</u>					
	<u>2A</u>	<u>3A</u>	<u>3B EI</u>	<u>4A</u>	<u>5A</u>	
	<u>Houston</u>	<u>Memphis</u>	<u>Paso</u>	<u>Baltimore</u>	<u>Chicago</u>	
<u>Life Cycle Cost Net Savings (2012\$)</u>						
<u>Small Office</u>	<u>Total</u>	<u>\$13,300</u>	<u>\$15,300</u>	<u>\$14,200</u>	<u>\$7,200</u>	<u>\$16,900</u>
	<u>\$/ft²</u>	<u>\$2.42</u>	<u>\$2.78</u>	<u>\$2.58</u>	<u>\$1.31</u>	<u>\$3.07</u>
<u>Large Office</u>	<u>Total</u>	<u>\$2,040,000</u>	<u>\$1,730,000</u>	<u>\$1,220,000</u>	<u>\$1,620,000</u>	<u>\$1,850,000</u>
	<u>\$/ft²</u>	<u>\$4.09</u>	<u>\$3.47</u>	<u>\$2.45</u>	<u>\$3.25</u>	<u>\$3.71</u>
<u>Primary School</u>	<u>Total</u>	<u>\$58,000</u>	<u>\$49,000</u>	<u>\$207,000</u>	<u>\$52,000</u>	<u>\$162,000</u>
	<u>\$/ft²</u>	<u>\$0.78</u>	<u>\$0.66</u>	<u>\$2.80</u>	<u>\$0.70</u>	<u>\$2.19</u>
<u>Small Hotel</u>	<u>Total</u>	<u>\$119,890</u>	<u>\$140,000</u>	<u>\$127,000</u>	<u>\$103,500</u>	<u>\$144,000</u>
	<u>\$/ft²</u>	<u>\$2.77</u>	<u>\$3.24</u>	<u>\$2.94</u>	<u>\$2.40</u>	<u>\$3.33</u>
<u>Mid-rise Apartment</u>	<u>Total</u>	<u>\$26,800</u>	<u>\$33,900</u>	<u>\$25,300</u>	<u>\$29,900</u>	<u>\$50,200</u>
	<u>\$/ft²</u>	<u>\$0.79</u>	<u>\$1.00</u>	<u>\$0.75</u>	<u>\$0.89</u>	<u>\$1.49</u>

B. Administrative Procedure Act

DOE notes that the determination regarding the updated voluntary consensus code was subject to notice and comment in evaluating the voluntary consensus codes in the context of State building codes. See 76 FR 43298 (July 20, 2011) for the preliminary determination and 76 FR 64904 (October 19, 2011) for the final determination. The determinations made in the context of the State codes are equally applicable in the context of Federal buildings. DOE finds that providing notice and comment on the determinations again in the context of Federal buildings would be unnecessary. The fact that the voluntary consensus codes apply to Federal buildings as opposed to the general building stock does not require a different evaluation of energy efficiency and cost-effectiveness. Additionally, DOE notes that today's rule, amending standards on energy efficiency performance standards for the design and construction of new Federal buildings, is a

rule relating to public property, and therefore, is not subject to the rulemaking requirements of the Administrative Procedure Act, including the requirement to publish a notice of proposed rulemaking. (See, 5 U.S.C. 553(a)(2))

C. Review under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires the preparation of an initial regulatory flexibility analysis 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. The Department has made its procedures and policies available on the Office of General Counsel's website: <http://www.gc.doe.gov>.

DOE has determined that a notice of proposed rulemaking is not required by 5 U.S.C. 553 or any other law for issuance of this rule. As such the analytical requirements of the Regulatory Flexibility Act do not apply.

D. Review under the Paperwork Reduction Act of 1995

This rulemaking will impose no new information or record keeping requirements. Accordingly, Office of Management and Budget (OMB) clearance is not required under the Paperwork Reduction Act. (44 U.S.C. 3501 *et seq.*)

E. Review under the National Environmental Policy Act of 1969

The Department prepared an Environmental Assessment (EA) (DOE/EA-1918) entitled, “Environmental Assessment for Final Rule, 10 CFR part 433, ‘Energy Efficiency Standards for New Federal Commercial and Multi-Family High-Rise Residential Buildings,’ Baseline Standards Update,” pursuant to the Council on Environmental Quality’s (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR parts 1500-1508), the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 et seq.), and DOE’s NEPA Implementing Procedures (10 CFR part 1021).

The EA addresses the possible incremental environmental effects attributable to the application of the final rule. The only anticipated impact would be a decrease in outdoor air pollutants resulting from decreased fossil fuel burning for energy use in Federal buildings. Therefore, DOE has issued a Finding of No Significant Impact (FONSI), pursuant to NEPA, the regulations of the Council on Environmental Quality (40 CFR parts 1500–1508), and DOE’s regulations for compliance with NEPA (10 CFR part 1021).

To identify the potential environmental impacts that may result from implementing the final rule on new Federal commercial buildings, DOE compared the final rule with the “no-action alternative” of using the current Federal standards. This comparison essentially compares the baseline standards – ANSI/ASHRAE/IESNA Standards 90.1-2007 and 90.1-2010 for Federal commercial and multi-family high-rise residential buildings. This comparison is identical to that undertaken by DOE in its determinations of energy savings of those standards and codes. For the purposes of this environmental assessment, DOE also investigated the impact of buildings

achieving energy consumption below Standard 90.1-2010 in increments of 10 percent, up to 50 percent.

The 2011 *Annual Energy Outlook* ([2011 AEO](#)) projects approximately 2.2 billion square feet of commercial floor space will be added annually to the U.S. building stock

(<http://www.eia.gov/forecasts/aeo/>). Since Federal buildings represent about 1 percent of total U.S.

building stock, about 22 million square feet of new Federal buildings are added each year.⁹

~~Federal multi-family high-rise residential buildings are rare. Looking just at Federal commercial buildings, and assuming that new Federal buildings meet but do not exceed the new minimum requirement and that buildings would have otherwise met but not exceeded the existing requirement, 30,415 metric tons of carbon dioxide will be avoided (relative to the existing 10 CFR part 433) in the first year the final rule is in effect. These savings would compound in future years as more and more Federal construction occurs. Again, assuming that new Federal buildings meet but do not exceed the new minimum requirement and that buildings would have otherwise met but not exceeded the existing requirement, 137.5 metric tons of methane emissions will be avoided, 30 metric tons of nitrogen oxide emissions will be avoided, and 75 metric tons of sulfur dioxide emissions will be avoided, all in the first year the rule is in effect. Federal multi-family high-rise residential buildings are rare. Table 4 summarizes the estimated emissions impacts for each of the alternatives for the Federal building energy efficiency standard.⁹ It shows cumulative changes in emissions for CO₂, NO_x, and Hg for a thirty year period for each of the alternatives. Cumulative CO₂, NO_x, and Hg emissions are reduced compared to the reference case for all alternatives. For~~

Comment [A14]: Change recommended by OIRA.

⁹ The alternatives and the methodology used to determine these emissions impacts may be found in the Environmental Assessment (EA) (DOE/EA-1918) entitled, "Environmental Assessment for Final Rule, 10 CFR part 433, 'Energy Efficiency Standards for New Federal Commercial and Multi-Family High-Rise Residential Buildings,' Baseline Standards Update".

comparison, the cumulative power sector emissions in the 2011 AEO reference case, over the period 2014 through 2043, are 74,571 Million metric tons for CO₂, 61,625 thousand metric tons for NO_x, and 917 metric tons for Hg.

Formatted: Font: Bold

Table 4 Air Emissions Reductions in Metric Tons (30-Years of Commercial Construction)

<u>Baseline (no-action alternative)</u>	<u>Final Rule- Code or Standard</u>	<u>Carbon Dioxide</u>	<u>Nitrogen Oxides</u>	<u>Mercury</u>
<u>ASHRAE 90.1-2007</u>	<u>90.1-2010</u>	<u>89,888,200</u>	<u>91,851</u>	<u>1.2795</u>
	<u>10% below 90.1-2010</u>	<u>126,091,100</u>	<u>128,857</u>	<u>1.7950</u>
	<u>20% below 90.1-2010</u>	<u>162,293,900</u>	<u>165,864</u>	<u>2.3105</u>
	<u>30% below 90.1-2010</u>	<u>198,496,800</u>	<u>202,870</u>	<u>2.8260</u>
	<u>40% below 90.1-2010</u>	<u>234,699,600</u>	<u>239,876</u>	<u>3.3415</u>
	<u>50% below 90.1-2010</u>	<u>270,902,400</u>	<u>276,882</u>	<u>3.8570</u>
<u>30% Below ASHRAE 90.1-2007</u>	<u>30% below 90.1-2010</u>	<u>62,921,800</u>	<u>64,296</u>	<u>0.8957</u>
	<u>40% below 90.1-2010</u>	<u>99,124,600</u>	<u>101,302</u>	<u>1.4112</u>
	<u>50% below 90.1-2010</u>	<u>135,327,500</u>	<u>138,308</u>	<u>1.9267</u>

F. Review under Executive Order 13132, "Federalism"

Executive Order 13132, "Federalism," 64 FR 43255 (August 4, 1999), imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the

intergovernmental consultation process it will follow in the development of such regulations, 65 FR 13735. DOE examined this rule and determined that it does not preempt State law and does 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. No further action is required by Executive Order 13132.

G. Review under Executive Order 12988, "Civil Justice Reform"

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, "Civil Justice Reform," 61 FR 4729 (February 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; and (3) provide a clear legal standard for affected conduct, rather than a general standard and promote simplification and burden reduction. 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 rule

meets the relevant standards of Executive Order 12988.

H. Review under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) (Pub. L. 104-4) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and tribal governments and the private sector. 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) and (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and tribal governments on a proposed “significant intergovernmental mandate” and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA (62 FR 12820) (also available at <http://www.gc.doe.gov>). This final rule contains neither an intergovernmental mandate nor a mandate that may result in the expenditure of \$100 million or more in any year by State, local, and tribal governments, in the aggregate, or by the private sector, so these requirements under the Unfunded Mandates Reform Act do not apply.

I. Review under the Treasury and General Government Appropriations Act of 1999

Section 654 of the Treasury and General Government Appropriations Act of 1999 (Pub. L. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This final 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.

J. Review under Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights"

The Department has determined, under Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights" 53 FR 8859 (March 18, 1988), that this rule would not result in any takings which might require compensation under the Fifth Amendment to the United States Constitution.

K. Review under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516, note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (February 22, 2002), and DOE's guidelines were published at 67 FR 62446 (October 7, 2002). DOE has reviewed today's final rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

L. Review under Executive Order 13211, “Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use”

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 the Office of Information and Regulatory Affairs (OIRA), Office of Management and Budget, a Statement of Energy Effects for any proposed significant energy action. A “significant energy action” is defined as any action by an agency that promulgated 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. This final rule would not have a significant adverse effect on the supply, distribution, or use of energy and, therefore, is not a significant energy action. Accordingly, DOE has not prepared a Statement of Energy Effects.

M. Review Under Section 32 of the Federal Energy Administration Act of 1974

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91), DOE must comply with section 32 of the Federal Energy Administration Act of 1974 (Pub. L. 93–275), as amended by the Federal Energy Administration Authorization Act of 1977 (Pub. L. 95–70). (15 U.S.C. 788) Section 32 provides that where a proposed rule authorizes or requires use of

commercial standards, the NOPR must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Department of Justice (DOJ) and the Federal Trade Commission (FTC) concerning the impact of the commercial or industry standards on competition.

Although section 32 specifically refers to the proposed rule state, DOE is meeting these requirements at the final rule stage because there was no proposed rule for today's action. Today's final rule incorporates testing methods contained in the following commercial standard: ANSI/ASHRAE/IESNA Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings, 2010, American Society of Heating Refrigerating and Air-Conditioning Engineers, Inc., ISSN 1041-2336.

DOE has evaluated these standards and is unable to conclude whether they fully comply with the requirements of section 32(b) of the FEAA (i.e. whether they were developed in a manner that fully provides for public participation, comment, and review.) DOE has consulted with both the Attorney General and the Chairman of the FTC about the impact on competition of using the methods contained in these standards and has received no comments objecting to their use.

VII. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule prior to its effective date. The report will state that it has been determined that the rule is not a

“major rule” as defined by 5 U.S.C. 804(2).

List of Subjects in 10 CFR Part 433

Buildings and facilities, Energy conservation, Engineers, Federal buildings and facilities,
Housing, Incorporation by reference.

Issued in Washington, DC, on XX, XX XXXX

~~Henry Kelly~~David Danielson
~~Acting~~ Assistant Secretary
Energy Efficiency and Renewable Energy

For the reasons set forth in the preamble, the Department of Energy amends chapter II of title 10 of the Code of Federal Regulations as set forth below:

**PART 433 -- ENERGY EFFICIENCY STANDARDS FOR NEW FEDERAL
COMMERCIAL AND MULTI-FAMILY HIGH-RISE RESIDENTIAL BUILDINGS**

1. The authority citation for part 433 continues to read as follows:

Authority: 42 U.S.C. 6831-6832; 6834-6835; 42 U.S.C. 7101 *et seq.*

2. Amend § 433.2 to add in alphabetical order the definition of “ASHRAE Baseline Building 2010” to read as follows:

§ 433.2 Definitions.

* * * * *

ASHRAE Baseline Building 2010 means a building that is otherwise identical to the proposed building but is designed to meet, but not exceed, the energy efficiency specifications in ANSI/ASHRAE/IESNA Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings, 2010 (incorporated by reference, see § 433.3).

* * * * *

3. Amend §433.3 by adding new paragraph (b)(3) to read as follows:

§ 433.3 Materials incorporated by reference.

* * * * *

(b) * * *

(3) ANSI/ASHRAE/IESNA 90.1-2010, (“ASHRAE 90.1-2010”), Energy Standard for Buildings Except Low-Rise Residential Buildings, 2010, ISSN 1041-2336, IBR approved for §§ 433.2, 433.4, 433.5.

4. Section 433.4 is amended by:

- a. Revising introductory paragraph (a)(2); and
- b. Adding a new paragraph (a)(3) to read as follows:

§ 433.4 Energy efficiency performance standard.

(a) * * *

(2) All Federal agencies shall design new Federal buildings that are commercial and multi-family high-rise residential buildings, for which design for construction began on or after August 10, 2012, but before **[INSERT DATE ONE YEAR AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]** to:

* * * * *

(3) All Federal agencies shall design new Federal buildings that are commercial and multi-family high-rise residential buildings, for which design for construction began on or after **[INSERT DATE ONE YEAR AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, to:

(i) Meet ASHRAE 90.1-2010, (incorporated by reference, see § 433.3); and

(ii) If life-cycle cost-effective, achieve energy consumption levels, calculated consistent with paragraph (b) of this section, that are at least 30 percent below the levels of the ASHRAE Baseline Building 2010.

* * * * *

5. Section 433.5 is amended by:

~~(a)~~ Revising paragraph (a)(2); and

~~(b)~~ Adding a new paragraph (a)(3) to read as follows:

§ 433.5 Performance level determination.

(a) * * *

(2) For Federal buildings for which design for construction began on or after August 10, 2012, but before **[INSERT DATE ONE YEAR AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, each Federal agency shall determine energy consumption levels for

both the ASHRAE Baseline Building 2007 and proposed building by using the Performance Rating Method found in Appendix G of ASHRAE 90.1-2007 (incorporated by reference, see § 433.3), except the formula for calculating the Performance Rating in paragraph G1.2 shall read as follows:

Percentage improvement = $100 \times ((\text{Baseline building consumption} - \text{Receptacle and process loads}) - (\text{Proposed building consumption} - \text{Receptacle and process loads})) / (\text{Baseline building consumption} - \text{Receptacle and process loads})$ (which simplifies as follows):

Percentage improvement = $100 \times (\text{Baseline building consumption} - \text{Proposed building consumption}) / (\text{Baseline building consumption} - \text{Receptacle and process loads})$.

(3) For Federal buildings for which design for construction began on or after **[INSERT DATE ONE YEAR AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, each Federal agency shall determine energy consumption levels for both the ASHRAE Baseline Building 2010 and proposed building by using the Performance Rating Method found in Appendix G of ASHRAE 90.1-2010 (incorporated by reference, see § 433.3), except the formula for calculating the Performance Rating in paragraph G1.2 shall read as follows:

Percentage improvement = $100 \times ((\text{Baseline building consumption} - \text{Receptacle and process loads}) - (\text{Proposed building consumption} - \text{Receptacle and process loads})) /$

(Baseline building consumption--Receptacle and process loads) (which simplifies as follows):

Percentage improvement = $100 \times (\text{Baseline building consumption} - \text{Proposed building consumption}) / (\text{Baseline building consumption} - \text{Receptacle and process loads})$.

* * * * *