ANSI/ASHRAE/ICC/USGBC/IES Addendum h to ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2023

Standard for the Design of High-Performance Green Buildings

Except Low-Rise Residential Buildings

The Complete Technical Content of the International Green Construction Code®

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FOREWORD

The performance approach to energy efficiency compliance in Standard 189.1 currently requires compliance with each of three different metrics: cost, source energy, and CO_2e. Requiring compliance with three metrics increases the overall stringency of the standard.

In recent years, the focus of the building industry has increasingly shifted to CO_2e emissions. Addendum h deletes the use of energy cost and source energy metrics as requirements of the performance approach to energy efficiency, leaving CO_2e as the sole performance approach metric. The current option of using either annual average emission factors or time varying factors has been retained. The Standard 90.1 backstop for energy efficiency has also been retained, and the language has been moved from the previous Section 7.6.1.1 to Section 7.6.1. This change simplifies Section 7.6 for users and simplifies the process of updating the section each cycle.

Informative Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum h to Standard 189.1-2023

Modify Section 7.6 as follows:

7.6 Performance Option. Buildings shall comply with Sections 7.6.1~~,~~ and 7.6.2~~, and 7.6.3~~ using the baseline building definition and modeling procedures as defined in Standard 90.1, Appendix G, and modified by Normative Appendix B of this standard.

On-site renewable energy systems in the *proposed design* shall be calculated using the procedures in Normative Appendix B. For mixed-use buildings, the building performance factor (BPF) shall be determined by weighting each building type by floor area. A *building project* served in whole or in part by a *district energy plant* shall follow the modeling requirements contained in Normative Appendix B, Section B1.4, in order to comply with this section.

Delete Section 7.6.1 in its entirety and renumber Section 7.6.1.1 to 7.6.1.

~~**7.6.1 Annual Energy Cost.** The *proposed building performance* cost index (PCI) shall be calculated in accordance with ANSI/ASHRAE/IES Standard 90.1, Normative Appendix G, and be equal to or less than the target PCI, as determined from the following equation:~~

$$\text{PCI}_{target} = \frac{[\text{EC}_{UBB} + (\text{EC}_{RBB} \times \text{BPF}_c)] \times (1 - \text{RF}_c)}{\text{EC}_{UBB} + \text{EC}_{RBB}}$$

~~where~~

~~PCI_{target}~~	=	~~target PCI required for achieving compliance with Section 7.6.1 of the standard, unitless~~
~~EC_{UBB}~~	=	~~annual energy cost of the baseline building resulting from *unregulated energy use*, $~~
~~EC_{RBB}~~	=	~~annual energy cost of the baseline building resulting from *regulated energy use*, $~~
~~BPF_e~~	=	~~building performance factor for cost taken from Table 7.6.1, unitless~~
~~RF_e~~	=	~~renewable energy production fraction for cost from Table 7.6.1, unitless~~

~~**7.6.1.1**~~ **7.6.1 Compliance with ANSI/ASHRAE/IES Standard 90.1 without Renewables.** The proposed building PCI shall comply with the requirements of ANSI/ASHRAE/IES Standard 90.1, Section 4.2.1.1. The energy cost credits from on-site renewable energy production shall not be subtracted from the *proposed design* energy costs for the purposes of this section.

Delete Table 7.6.1 in its entirety. Note that the normative text is not changed in Section 7.6.2.

Delete the "Source Energy Conversion Factors" column from Table 7.6.2.1.

~~Table 7.6.1 Building Performance Factors for Cost (BPF_c) and Renewable Fraction (RF_c)~~

	~~Climate Zone~~	~~Building Type~~								
		~~Multifamily~~	~~Healthcare/ Hospital~~	~~Hotel/ Motel~~	~~Office~~	~~Restaurant~~	~~Retail~~	~~School~~	~~Warehouse~~	~~All Others~~
~~Building Performance Factor for Cost~~	~~0A~~	~~0.69~~	~~0.62~~	~~0.64~~	~~0.51~~	~~0.63~~	~~0.46~~	~~0.51~~	~~0.25~~	~~0.55~~
	~~0B~~	~~0.68~~	~~0.60~~	~~0.63~~	~~0.52~~	~~0.61~~	~~0.44~~	~~0.54~~	~~0.27~~	~~0.55~~
	~~1A~~	~~0.72~~	~~0.63~~	~~0.66~~	~~0.50~~	~~0.61~~	~~0.42~~	~~0.55~~	~~0.21~~	~~0.61~~
	~~1B~~	~~0.69~~	~~0.60~~	~~0.61~~	~~0.51~~	~~0.60~~	~~0.42~~	~~0.54~~	~~0.24~~	~~0.54~~
	~~2A~~	~~0.73~~	~~0.60~~	~~0.61~~	~~0.46~~	~~0.60~~	~~0.38~~	~~0.51~~	~~0.20~~	~~0.58~~
	~~2B~~	~~0.73~~	~~0.56~~	~~0.61~~	~~0.47~~	~~0.60~~	~~0.36~~	~~0.52~~	~~0.21~~	~~0.59~~
	~~3A~~	~~0.74~~	~~0.57~~	~~0.60~~	~~0.45~~	~~0.62~~	~~0.36~~	~~0.50~~	~~0.21~~	~~0.57~~
	~~3B~~	~~0.76~~	~~0.57~~	~~0.62~~	~~0.48~~	~~0.62~~	~~0.37~~	~~0.50~~	~~0.20~~	~~0.60~~
	~~3C~~	~~0.68~~	~~0.54~~	~~0.59~~	~~0.40~~	~~0.62~~	~~0.35~~	~~0.52~~	~~0.17~~	~~0.48~~
	~~4A~~	~~0.74~~	~~0.58~~	~~0.62~~	~~0.45~~	~~0.64~~	~~0.37~~	~~0.47~~	~~0.27~~	~~0.56~~
	~~4B~~	~~0.75~~	~~0.56~~	~~0.59~~	~~0.46~~	~~0.64~~	~~0.37~~	~~0.47~~	~~0.21~~	~~0.56~~
	~~4C~~	~~0.74~~	~~0.53~~	~~0.60~~	~~0.43~~	~~0.65~~	~~0.38~~	~~0.50~~	~~0.23~~	~~0.54~~
	~~5A~~	~~0.73~~	~~0.57~~	~~0.63~~	~~0.48~~	~~0.66~~	~~0.37~~	~~0.49~~	~~0.32~~	~~0.59~~
	~~5B~~	~~0.76~~	~~0.54~~	~~0.62~~	~~0.48~~	~~0.65~~	~~0.37~~	~~0.48~~	~~0.26~~	~~0.57~~
	~~5C~~	~~0.75~~	~~0.55~~	~~0.60~~	~~0.46~~	~~0.67~~	~~0.40~~	~~0.47~~	~~0.23~~	~~0.54~~
	~~6A~~	~~0.72~~	~~0.58~~	~~0.65~~	~~0.49~~	~~0.67~~	~~0.37~~	~~0.48~~	~~0.35~~	~~0.57~~
	~~6B~~	~~0.73~~	~~0.57~~	~~0.62~~	~~0.49~~	~~0.65~~	~~0.39~~	~~0.45~~	~~0.30~~	~~0.53~~
	~~7~~	~~0.71~~	~~0.59~~	~~0.64~~	~~0.48~~	~~0.67~~	~~0.38~~	~~0.47~~	~~0.32~~	~~0.56~~
	~~8~~	~~0.73~~	~~0.60~~	~~0.66~~	~~0.52~~	~~0.69~~	~~0.40~~	~~0.48~~	~~0.34~~	~~0.61~~
~~Renewable Fraction~~		~~0.50~~	~~0.35~~	~~0.50~~	~~0.50~~	~~0.10~~	~~0.50~~	~~0.50~~	~~0.50~~	~~0.50~~

Table 7.6.2.1 ~~Source Energy Conversion Factors and~~ CO_2e Emission Factors

		CO_2e Emissions, kg/MWh		
	~~Source Energy Conversion Factor~~	Combustion	Precombustion	Total
Fossil fuels delivered to buildings				
Natural gas	~~1.092~~	184	93	277
Liquefied petroleum gas or propane	~~1.151~~	229	66	295
Fuel oil (residual)	~~1.191~~	265	70	334
Fuel oil (distillate)	~~1.158~~	255	69	324
Coal	~~1.048~~	332	51	382
Gasoline	~~1.187~~	255	82	337
Other fuels not specified in this table	~~1.048~~	332	51	382
Electricity				
AKGD–ASCC Alaska Grid	~~2.47~~	514	159	673
AKMS–ASCC miscellaneous	~~1.35~~	289	93	383
AZNM –WECC Southwest	~~2.57~~	444	121	565
CAMX–WECC California	~~1.66~~	255	88	343

Table 7.6.2.1 ~~Source Energy Conversion Factors and~~ CO_2e Emission Factors *(Continued)*

		CO_2e Emissions, kg/MWh		
	~~Source Energy Conversion Factor~~	Combustion	Precombustion	Total
ERCT–ERCOT all	~~2.32~~	431	126	558
FRCC–FRCC all	~~2.78~~	442	155	596
HIMS–HICC miscellaneous	~~3.15~~	681	211	892
HIOA–HICC Oahu	~~3.87~~	895	233	1128
MROE–MRO East	~~2.92~~	770	150	920
MROW–MRO West	~~2.21~~	534	94	628
NEWE–NPCC New England	~~2.66~~	287	96	383
NWPP–WECC Northwest	~~1.48~~	349	76	426
NYCW–NPCC NYC/Westchester	~~2.89~~	269	110	379
NYLI–NPCC Long Island	~~2.84~~	481	169	650
NYUP–NPCC Upstate NY	~~1.81~~	132	48	180
PRMS–Puerto Rico Miscellaneous	~~3.27~~	731	214	944
RFCE–RFC East	~~2.90~~	350	106	456
RFCM–RFC Michigan	~~2.93~~	594	133	727
RFCW–RFC West	~~2.97~~	532	113	645
RMPA–WECC Rockies	~~2.16~~	580	120	699
SPNO–SPP North	~~2.21~~	515	93	608
SPSO–SPP South	~~2.05~~	460	123	583
SRMV–SERC Mississippi Valley	~~2.84~~	418	137	555
SRMW–SERC Midwest	~~3.09~~	779	134	913
SRSO–SERC South	~~2.89~~	496	133	629
SRTV–SERC Tennessee Valley	~~2.82~~	473	104	577
SRVC–SERC Virginia/Carolina	~~2.91~~	360	97	456
All other electricity	~~2.51~~	436	111	547
Thermal Energy				
Chilled water	~~0.60~~	104	26	131
Steam	~~1.84~~	309	157	466
Hot water	~~1.73~~	292	148	440

Informative Note: The CO_2e emission factors presented in this table are based on U.S. data and a 20-year time horizon for methane (CH_4) and nitrous oxide (N_2O). When comparing or combining CO_2e values, care should be taken to ensure that a consistent time horizon is used for all estimates of CO_2e. Informative Appendix I, Table I-10, has emission rates based on a 100-year time horizon for use when the use of 100-year time horizons is necessary.

Delete Section 7.6.3 in its entirety and renumber Section 7.6.4 as 7.6.3.

~~**7.6.3 Zero Energy Performance Index.** The zero energy performance index ($zEPI_{2004}$) of the proposed design, including on-site renewable energy systems, shall be less than the target ($zEPI_{2004\ Target}$). $zEPI_{2004}$ and $zEPI_{2004\ Target}$ shall be calculated as follows:~~

$$zEPI_{2004} = \frac{\sum_i PDSE_i \times r_i - \sum_k RE_k \times REPF_k \times r_e}{\sum_i BBSE_i \times r_i}$$

~~where~~

~~$zEPI_{2004}$~~ = ~~zero energy performance index relative to the Standard 90.1 *baseline building design* as defined in the performance rating method of Standard 90.1, Normative Appendix G~~

~~$PDSE_i$~~ = ~~*proposed design* site energy use for energy type *i*~~

~~$BBSE_i$~~ = ~~baseline building site energy use for energy type *i*; created following the rules in Standard 90.1, Normative Appendix G~~

~~r_i~~ = ~~source energy conversion factor for energy type *i*; taken from Table 7.6.2.1~~

~~RE_k~~ = ~~annual renewable energy electricity production for renewable energy procurement method *k* (see Table 7.4.1.2)~~

~~$REPF_k$~~ = ~~renewable energy factor from Table 7.4.1.2 for renewable energy procurement method *k*~~

~~r_e~~ = ~~source energy conversion factor taken from Table 7.6.2.1 for electricity. U.S. Locations shall use values for eGRID subregions from Table 7.6.2.1 for electricity. Locations outside the U.S. shall use the value for "All other electricity" or locally derived values.~~

$$zEPI_{2004Target} = \frac{[BBUSE + (BBRSE \times BPF_e)] \times (1 - RF_e)}{BBUSE + BBRSE}$$

~~where~~

~~$zEPI_{2004\ Target}$~~ = ~~zero energy performance index target required for achieving compliance with the standard, unitless~~

~~BBUSE~~ = ~~baseline building *unregulated energy use* expressed in source units~~

~~BBRSE~~ = ~~baseline building *regulated energy use* expressed in source units.~~

~~BPF_e~~ = ~~building performance factor for cost taken from Table 7.6.1, unitless~~

~~RF_e~~ = ~~renewable fraction for cost from Table 7.6.1, unitless~~

~~***Informative Notes:***~~

1. ~~On-site thermal energy and renewable energy contributions to *district energy plants* are accounted for in the $PDSE_i$ term through reductions in electricity and/or gas use. The RE_k term will always be electricity.~~
2. ~~Informative Appendix H details a methodology for converting $zEPI_{2004}$ to zEPI. $zEPI_{2004}$ uses Standard 90.1, Normative Appendix G, to define the baseline building. The traditional definition of zEPI uses the median energy of the existing building stock in the year 2000 as the baseline. The traditional zEPI definition is used by the Architecture 2030 program and other programs.~~
3. ~~The values in Table 7.6.2.1 are derived from United States data. The procedures in Informative Appendix I may be used to develop source energy conversion factors when conditions are different.~~

~~**7.6.4**~~ **7.6.3 [JO] Energy Simulation Aided Design.** For building projects that exceed 25,000 ft² (2300 m²) of gross floor area, the building project shall comply with the requirements of ANSI/ASHRAE Standard 209, Section 4.2.1.

Delete Informative Appendix H, "zEPI Conversion Methodology," in its entirety and reletter all subsequent appendices.

~~INFORMATIVE APPENDIX H~~
~~ZEPI CONVERSION METHODOLOGY~~

~~The procedures in Section 7.6.3 result in a zEPI target ($zEPI_{2004\ Target}$) and a zEPI rating ($zEPI_{2004}$) that use Standard 90.1, Normative Appendix G, to define the baseline building. The traditional baseline for zEPI uses CBECS 2003 to approximate the building stock at the turn of the millennium. Both $zEPI_{2004\ Target}$ and $zEPI_{2004}$ can be converted to the traditional baseline by applying the multipliers in Table H-1.~~

$$zEPI = zEPI_{2004} \times M$$

$$zEPI_{Target} = zEPI_{2004\ Target} \times M$$

~~where~~

~~zEPI~~ = ~~zero energy performance index using CBECS 2003 as the baseline~~

~~$zEPI_{2004}$~~ = ~~zero energy performance index using Standard 90.1, Appendix G, as the baseline~~

~~$zEPI_{Target}$~~ = ~~zero energy performance index target using CBECS 2003 as the baseline~~

~~$zEPI_{2004\ Target}$~~ = ~~zero energy performance index target using Standard 90.1, Appendix G, as the baseline~~

~~**Table H-1 zEPI Conversion Factors, *M***~~

	1A	2A	3A	4A	5A	6A	7	2B	3B	4B	5B	6B	3C	4C	8
Multifamily	0.93	0.86	0.81	0.78	0.79	0.79	0.76	0.86	0.91	0.80	0.80	0.79	0.82	0.77	0.74
Health care/hospital	0.82	0.83	0.82	0.83	0.86	0.86	0.87	0.81	0.82	0.82	0.85	0.86	0.87	0.83	0.85
Hotel/motel	0.80	0.85	0.88	0.92	0.95	0.98	1.01	0.83	0.87	0.91	0.95	0.97	0.91	0.93	1.03
Office	0.75	0.76	0.71	0.71	0.72	0.72	0.70	0.75	0.73	0.71	0.72	0.72	0.78	0.72	0.68
Restaurant	0.92	0.93	0.92	0.92	0.92	0.91	0.90	0.93	0.94	0.92	0.92	0.92	0.94	0.93	0.88
Retail	0.61	0.62	0.59	0.61	0.61	0.61	0.61	0.61	0.59	0.61	0.60	0.62	0.61	0.64	0.61
School	0.83	0.83	0.79	0.81	0.82	0.84	0.83	0.82	0.81	0.80	0.83	0.84	0.84	0.80	0.75
Semiheated warehouse	2.07	0.94	0.80	0.68	0.61	0.56	0.54	1.02	1.06	0.74	0.66	0.60	0.88	0.75	0.49
All others	0.93	0.81	0.78	0.78	0.78	0.78	0.79	0.81	0.83	0.78	0.78	0.80	0.81	0.79	0.77

~~*Note:* For climate zones 0A/0B, use the values for 1A/1B, respectively.~~

Delete Section I.1 of Informative Appendix I, "Source Energy Conversion Factors" and Tables I.1–I.3. and renumber all subsequent sections and table numbers. The remainder of Informative Appendix I remains unchanged.

INFORMATIVE APPENDIX I
DERIVATION OF CO_2E EMISSION FACTORS

This informative appendix documents the procedures used to develop the CO_2e emission factors in Standard 189.1 and provides guidance on how the data can be modified for non-United States locations. Example data used to illustrate the procedure is for the entire United States electric grid in 2019. A similar procedure was used to develop source energy conversion factors and CO_2e emission factors for the eGRID subregions based on EPA eGRID data for 2019, the only difference being the mix of electric generators.

The GHG emission rates in this appendix are applicable to the operation of the building and are keyed to building energy use. This appendix does not address the embodied carbon emissions related to building construction or demolition and recycling at the end-of-life.

~~I1. SOURCE ENERGY CONVERSION FACTORS~~

~~**I1.1 Source Energy Conversion Factors for Fossil Fuels.** For the United States, the source energy conversion factors for fossil fuel delivered to buildings or power plants are listed in Table I-1. These factors represent the additional energy required to extract, process, and deliver the fuel to a building or power plant. The values for bituminous coal are assumed for all U.S. coal-fired power plants.~~

~~**I1.2 Source Conversion Factors for Electricity.** For electricity, the source energy conversion factors represent the energy required to extract, process, and deliver fuel to power plants plus the energy used at the power plant to generate electricity. Transmission and distribution losses are also accounted for.~~

~~**I1.2.1 Distribution Efficiency.** For 2019 the U.S. Energy Information Agency (EIA) reports that, 3,965 billion kWh were generated at domestic power plants in the United States and that 211 billion kWh (5.3%) were lost through the transmission and distribution (T&D) system. This results in a distribution efficiency of 94.7%. These data are taken from Table 7.1 of the EIA Monthly Energy Report (MER). The nation-wide distribution efficiency is assumed for each of the eGRID subregions in the U.S. T&D losses in the U.S. have been fairly stable for the last 30 years or so, averaging about 7.2%. When the procedure in this appendix is applied to the electric grid in other countries, the assumption on T&D losses should be updated based on local conditions.~~

I1.2.2 Heat Rates. ~~The efficiency of power plants is commonly stated in terms of a heat rate, which represents the amount of fuel needed to generate a unit of electricity. The common units in the U.S. are Btu/kWh. The heat rate for coal, petroleum and nuclear power plants has not changed much in the last 20 years, but the heat rate of natural gas power plants has significantly declined, mainly because new plants use more efficient combined-cycle technology. Heat rates are reported by EIA in Table A6 of their MER and are listed here in Table I-2. The heat rate for biomass plants is not directly reported by EIA, but is calculated by dividing the heat input to wood and waste power plants from Table 10.2c of EIA's MER by the electricity generated by these plants which is reported in Table 7.2b of EIA's MER. The heat rate of non-combustible renewable power plants (wind, solar, hydro, and geothermal) is assumed to be zero.~~

The power plant efficiency is determined by dividing the heat content of a kWh of electricity (3,412 Btu/kWh) by the heat rate.

I1.2.3 Source Energy Conversion Factor for Power Plant Types. The source energy conversion factor for each type of power plant is calculated as shown in Equation I1. Calculated values for each type of power plant are shown in Table I-2.

$$SECF_{PowerPlant} = \frac{SECF_{fuel}}{DeliveryEfficiency \times PowerPlantEfficiency} \quad \text{(I-1)}$$

where

$SECF_{PowerPlant}$ = Source energy conversion factor for each power plant type (unitless)

$SECF_{Fuel}$ = Source energy conversion factor of the fuel used at the power plant (unitless) taken from Table I1.

$HeatRate_{PowerPlant}$ = Heat_rate (efficiency) of the power plant (Btu/kWh)

DeliveryEfficiency = Delivery efficiency (see I1.2.1)

PowerPlantEfficiency= Power plant efficiency, determined by dividing 3412 Btu/kWh by the heat rate.

I1.2.4 Source Energy Conversion Factors for Electric Generation Mix. The source energy conversion factor for the United States and for each eGRID subregion is calculated as the weighted average of the source energy conversion factors for each power plant type from Table I-2, based on the generation mix for each electric grid or sub-grid (see Equation I-2).

$$SECF_{GenMix} = \sum_{i=1}^{n} SECF_i \times GenMix_i \quad \text{(I-2)}$$

where

$SECF_{GenMix}$ = Overall SECF for the mix of generator types in the electric grid

$SECF_i$ = Source energy conversion factor of the i^{th} generator type

$GenMix_i$ = The fraction of total electric generation provided by the i^{th} generator type

i = Index for the i^{th} generator type

n = The number of generator types in the electric grid

Table I-3 shows the mix of electricity generated in the United States in 2019 (from EIA MER Table 7.2b) and illustrates how the source energy conversion factor is calculated as a weighted average. A similar process was used to calculate the SECF for each eGRID subregion, the only difference being the mix of generator types.

Table I-1 Source Energy Conversion Factors for Fuel Delivered to Buildings

Fuel	Source Energy Conversion Factor ($SECF_{fuel}$)
Anthracite coal	1.029
Bituminous coal	1.048
Sub-bitumious coal	1.066
Lignite coal	1.102
Natural gas	1.092
Residual fuel oil	1.191
Distillate fuel oil	1.158
Gasoline	1.187
Liquefied petroleum gas	1.151
Kerosene	1.205

Source: Technical Report NREL/TP-550-38617, Table 5. Data were derived from the U.S. life-cycle inventory (LCI) database maintained by NREL.

~~Table I-2 Calculation of Source Energy Conversion Factor for Power Plant Types~~

~~Power Plant Type~~	~~$HeatRate_{PowerPlant}$~~	~~Power Plant Efficiency~~	~~$SECF_{fuel}$~~	~~Delivery Efficiency~~	~~$SECF_{PowerPlant}$~~
~~Coal~~	~~10,551~~	~~32.3%~~	~~1.048~~	~~94.7%~~	~~3.42~~
~~Petroleum~~	~~11,135~~	~~30.6%~~	~~1.191~~	~~94.7%~~	~~4.11~~
~~Natural gas~~	~~7732~~	~~44.1%~~	~~1.092~~	~~94.7%~~	~~2.61~~
~~Other gases~~	~~7732~~	~~44.1%~~	~~1.092~~	~~94.7%~~	~~2.61~~
~~Nuclear~~	~~10,442~~	~~32.7%~~	~~1.000~~	~~94.7%~~	~~3.23~~
~~Pumped storage~~	~~8904~~	~~38.3%~~	~~1.000~~	~~94.7%~~	~~2.76~~
~~Hydroelectric~~	~~0~~	~~N/A~~	~~N/A~~	~~94.7%~~	~~0~~
~~Wood~~	~~16,682~~	~~20.5%~~	~~1.025~~	~~94.7%~~	~~5.29~~
~~Waste~~	~~15,388~~	~~22.2%~~	~~1.025~~	~~94.7%~~	~~4.88~~
~~Geothermal~~	~~0~~	~~N/A~~	~~N/A~~	~~94.7%~~	~~0~~
~~Solar~~	~~0~~	~~N/A~~	~~N/A~~	~~94.7%~~	~~0~~
~~Wind~~	~~0~~	~~N/A~~	~~N/A~~	~~94.7%~~	~~0~~

~~Sources:~~

a. ~~Heat rates for 2019 are taken from the 2021 Energy Information Administration (EIA) monthly energy review (MER), Table A6.~~

b. ~~The heat rate for wood and waste is 2019 fuel consumption from the 2021 EIA MER, Table 10.2c, divided by the 2019 biomass net generation from of the 2021 MER, Table 7.2b.~~

~~Table I-3 U.S. Electricity Generation Mix for 2019~~

~~(Source: 2021 Energy Information Agency, Monthly Energy Report, Table 7.2b)~~

~~Generator Type~~	~~Percent of Generation~~		~~Source Energy Conversion Factor for Generator Type~~		~~Product~~
~~Coal~~	~~24.2%~~	~~×~~	~~3.42~~	=	~~0.83~~
~~Petroleum~~	~~0.4%~~	~~×~~	~~4.11~~	=	~~0.02~~
~~Natural Gas~~	~~37.3%~~	~~×~~	~~2.61~~	=	~~0.97~~
~~Other Gases~~	~~0.1%~~	~~×~~	~~2.61~~	=	~~0.00~~
~~Nuclear~~	~~20.4%~~	~~×~~	~~3.23~~	=	~~0.66~~
~~Pumped Storage~~	~~-0.1%~~	~~×~~	~~2.76~~	=	~~(0.00)~~
~~Hydroelectric~~	~~7.2%~~	~~×~~	~~0~~	=	—
~~Wood~~	~~0.3%~~	~~×~~	~~5.29~~	=	~~0.02~~
~~Waste~~	~~0.4%~~	~~×~~	~~4.88~~	=	~~0.02~~
~~Geothermal~~	~~0.4%~~	~~×~~	~~0~~	=	—
~~Solar~~	~~1.8%~~	~~×~~	~~0~~	=	—
~~Wind~~	~~7.4%~~	~~×~~	~~0~~	=	—
				~~Sum product~~	~~2.51~~

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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Standard 189.1 and the International Green Construction Code

Standard 189.1 serves as the complete technical content of the International Green Construction Code® (IgCC). The IgCC creates a regulatory framework for new and existing buildings, establishing minimum green requirements for buildings and complementing voluntary rating systems. For more information, visit www.iccsafe.org.

About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

To stay current with this and other ASHRAE Standards and Guidelines, visit www.ashrae.org/standards, and connect on LinkedIn, Facebook, Twitter, and YouTube.

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IMPORTANT NOTICES ABOUT THIS STANDARD

To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit www.ashrae.org/standards to download them free of charge.

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