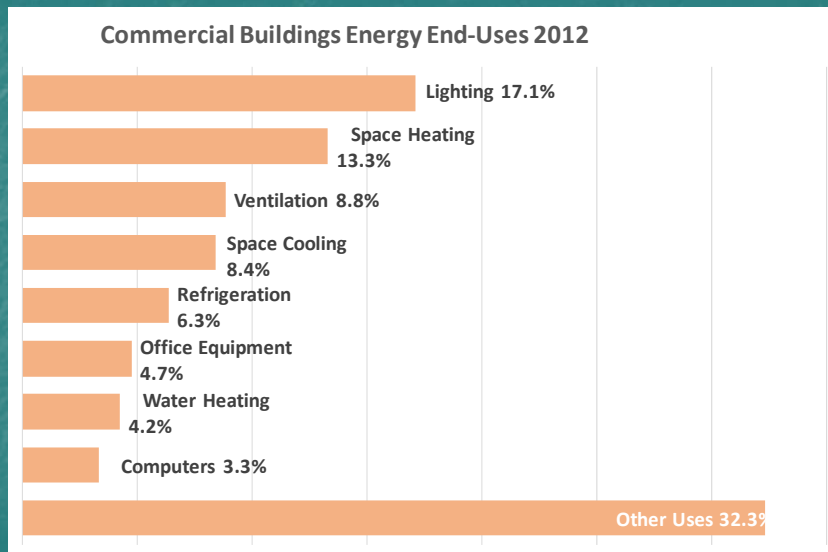


Standard 189.1: Structure, Requirements and Energy Savings

Drury B. Crawley, Ph.D.,
FASHRAE, BEMP, FIBPSA, AIA
Bentley Systems



U.S. Buildings' Energy Use



Status

- Since Standard 189.1-2009 was released in late 2009, 29 proposed addenda have been working through the committee during continuous maintenance
- Standard 189.1-2011 was released in December 2011
 - *Incorporates 19 of the addenda*
 - Project compliance option under IgCC
- Supplement published in 2013
 - 18 addenda since 2011; available on line

6

ASHRAE Standard 189.1

- What is it?
- Why was it created?
- Highlights

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



Standard 189.1 Background

Motivated by environmental impacts of buildings
U.S. buildings: 40 % of CO2 emissions; 40 % of energy;
13 % of water; 15 % of GDP
Site biodiversity; rainwater management; environmental
emissions; construction materials and waste

Committee started development in 2006
First version published in 2009
Four public reviews

Revision published in 2011
Project compliance option under IgCC

Supplement published in 2013
18 addenda since 2011; available on line



Standard 189.1 "101": The Basics

Provides minimum design requirements for high-performance green buildings (HPGB)

Co-sponsored by ASHRAE, IES and USGBC

ANSI standard in mandatory, enforceable language;
suitable for reference by building codes and other regulations

Not a guideline, labeling system, rating system or code.

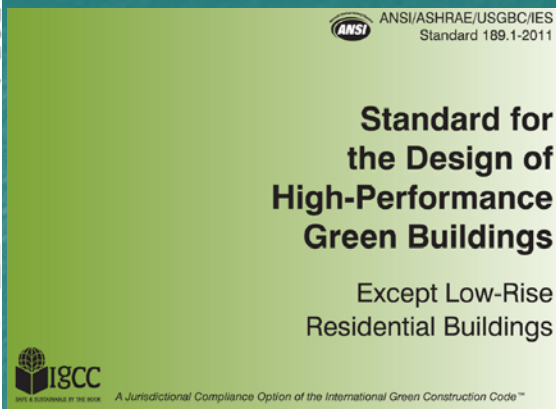
Builds on requirements in other ASHRAE standards,
primarily Standard 62.1 and 90.1, also Standard 55

Under revision via continuous maintenance procedures

Compare Standard 189.1 to LEED



- Voluntary vs. mandatory



- Std. 189.1:
 - Improvement in all topical areas
 - Pushes the envelope¹⁰

ASHRAE Standard 189.1-2011

- An optional compliance path ("Jurisdictional Compliance Option") to the International Green Construction Code (IGCC)

Official description of Standard 189.1 within U.S.



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Sponsors and Project Committee

- Consensus process
- Sponsor and co-sponsors:
 - ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)
 - USGBC (U.S. Green Building Council)
 - IES (Illuminating Engineering Society)
- Project committee:
35+ voting members;
variety of disciplines,
industries & organizations



Standard 189.1: Intent

- What Standard 189.1 is:
 - a standard
 - applies to all buildings except low-rise residential buildings (same as ASHRAE Std 90.1)
 - intended for adoption into model building codes
- What Standard 189.1 is not:
 - not a design guide
 - not a rating system

*Even if not adopted by your local authorities,
this Standard is an indication of future industry trends*

Standard 189.1: Relation to Other ASHRAE Standards



Organization and What it Covers

- Similar to other ASHRAE standards and LEED

ANSI/ASHRAE/USGBC/IES Standard 189.1-2011 Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings

SECTION	PAGE
Foreword	2
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3 Definitions, Abbreviations, and Acronyms	6
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Standard 189.1 Basic Structure

- x.1: Scope *For Each Section*
- x.2: Compliance
- x.3: Mandatory
(required for all projects)
- x.4: Prescriptive path
(simple option, minimal choices, very few calculations)
- x.5: Performance path
(more sophisticated, flexibility, but more effort)

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Standard 189.1: Purpose and Scope

PURPOSE: Provide minimum requirements for high-performance, green buildings

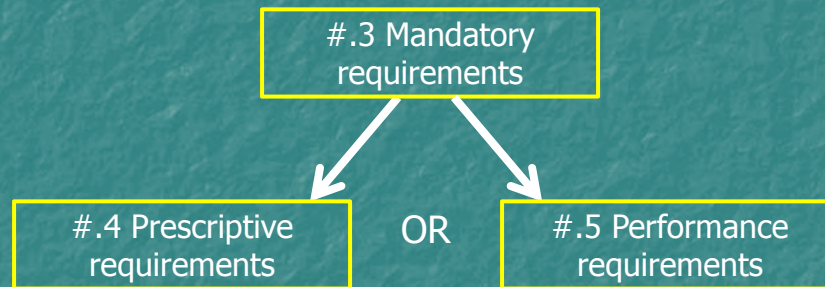
- ◆ Siting, design, construction & plan for operation
- ◆ Balance environmental responsibility, resource efficiency, occupant comfort and well being, and community sensitivity
- ◆ Support development that meets needs of present without compromising ability of future generations to meet their needs.

SCOPE:

- ◆ New buildings; new portions of buildings; new systems and equipment in existing buildings
- ◆ Commercial, institutional and high-rise residential buildings, essentially same as Standards 62.1 and 90.1

Section 4: Administration and Enforcement

Building projects shall comply with standard



Can do Prescriptive or Performance section-by-section, e.g., prescriptive for water but performance for energy

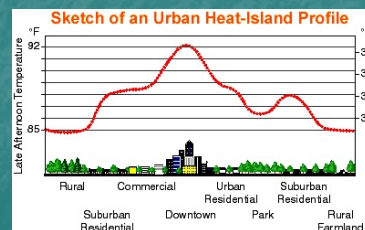
Section 5 - Site Sustainability

Mandatory provisions

- Allowable sites, where to build; or where not to allow a building
- Other areas that are addressed:
 - Urban heat island
 - Light "pollution" limitations

Prescriptive option

- Pervious surface area
- Greenfield site, maintaining or restoring existing native plants (20% of site)



Section 6 – Water Use Efficiency

Mandatory Provisions

- Site water use
- Building water use
- HVAC Systems, equipment
- Water consumption management



Section 6 – Water Use Efficiency

Mandatory Provisions

- **Site water use:**
 - Landscape design:* bio-diverse and adapted plantings for 60% of landscape
 - Irrigation design:* hydrozoning
 - Controls:* smart irrigation controllers



Section 6 – Water Use Efficiency

Mandatory Provisions

- **Building water use:**
 - (§6.3.2.1) plumbing fixtures & fittings per U.S. EPA WaterSense or ASME Standards, with specific limit on flow amount or rate
 - (§6.3.2.2) appliances per U.S. EPA EnergyStar, with water use factor for dwelling unit or public access



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Section 6 – Water Use Efficiency

Mandatory Provisions (cont.)

- **HVAC Systems (§6.3.2.3):**
 - Subsystem metering above thresholds
 - Efficient drift eliminators (0.002% counterflow, 0.005% cross-flow)
 - Condensate collection from units >19 kW (65,000 Btu/h) in areas with mean coincident wet bulb >72°F (22°C)

Annual condensate collection

Georgia: ~12.6 gal/cfm Outdoor air
or about 100 liters water/(l/s)

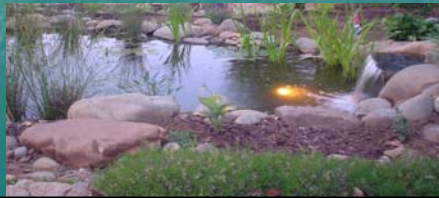


Section 6 – Water Use Efficiency

Prescriptive Option

■ **Building Water Use (§6.4.2):**

- Cooling tower cycles of concentration
- Commercial food service
 - Use high efficiency equipment (Energy Star or equivalent)
 - Air cooled ice machines only
- Other requirements for medical and laboratory facilities
- Water features



Section 6 – Water Use Efficiency

Performance Option

■ **Site water use reduction:**

Potable water for irrigation
<35% of landscape water demand

■ **Building use:**

Proposed use < [mandatory + prescriptive]

Energy – Section 7

Highlights for Energy (Section 7)

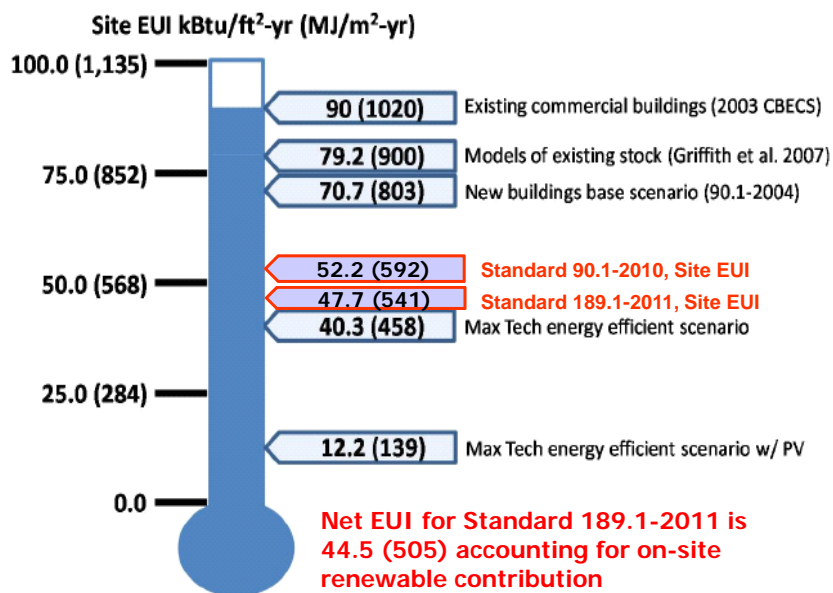
Energy – General Highlights:

- Original goal 30% lower than Standard 90.1-2007 **INCLUDING PROCESS**
- Appendix G from Standard 90.1 is incorporated as a Normative Appendix
- Other areas increase stringency beyond Standard 90.1

ASHRAE Energy Goals

- ASHRAE goal to have net-zero energy and carbon by 2030
- ASHRAE's Tech Council will suggest EUI targets for Standards 189.1 and 90.1
- Monitoring of progress based on standardized computer modeling
- Goal is to have 189.1 reach Net Energy Use Intensity targets (but not net zero) by 2020

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Highlights for Energy (Section 7)

■ Mandatory Requirements:

- On-site renewable power (§7.3.2)

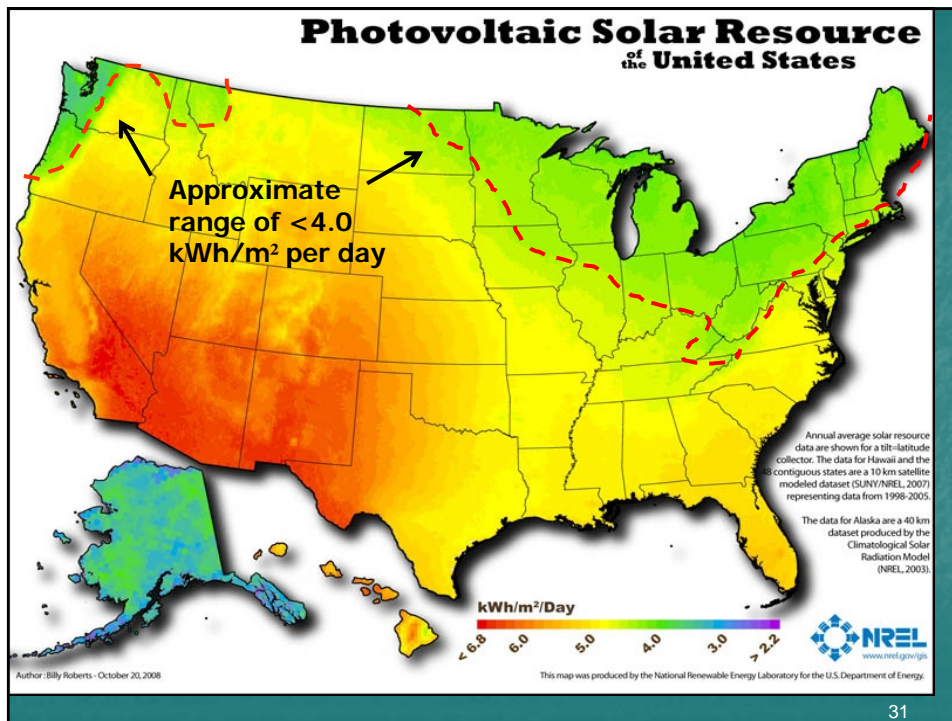
Provisions for future installation annual energy production ≥ 6 kBtu/ft² (20 kWh/m²)

single-story; ≥ 10 kBtu/ft² (32 kWh/m²) multi-story

Exception for areas with low incident solar (4.0 kWh/m²/day), *account for local shading*



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Highlights for Energy (Section 7)

Energy – Mandatory (*cont.*):

- **Remote or automatic energy monitoring (§7.3.3)**
criteria based on size
 - Energy sources (Table 7.3.3-1)
 - Key systems (Table 7.3.3-2)
- Meters communicate to central recording system
- Data storage for minimum 36 months

Exception: Residential portions of buildings complying with this Standard

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Energy Metering Thresholds

TABLE 7.3.3.1A Energy Source Thresholds

Energy Source	Threshold
Electrical service	>200 kVA
On-site renewable electric power	All systems > 1 kVA (peak)
Gas and district services	>1,000,000 Btu/h (300 kW)
<i>Geothermal</i> energy	>1,000,000 Btu/h (300 kW) heating
On-site renewable thermal energy	>100,000 Btu/h (30 kW)

TABLE 7.3.3.1B System Energy Use Thresholds

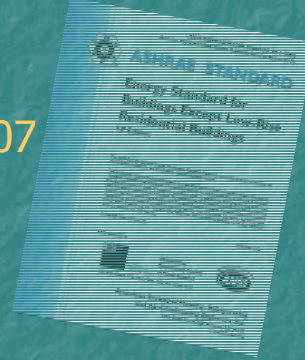
Use (Total of All Loads)	Subsystem Threshold
HVAC system	Connected electric load > 100kVA
HVAC system	Connected gas or district services load > 500,000 Btu/h (150 kW)
People moving	Sum of all feeders > 50 kVA
Lighting	Connected load > 50 kVA
Process and plug process	Connected load > 50 kVA Connected gas or district services load > 250,000 Btu/h (75 kW)

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Highlights for Energy (Section 7)

R_x Prescriptive Option (General)

- From DOE Study –
Std. 189.1-2009 30.2
lower than Standard 90.1-2007
(9% due to renewables)
Average EUI = 50.4 kBtu/ft²
- Standard 189.1 builds
from Standard 90.1...



7.4.1 General Comprehensive Prescriptive Requirements. When a requirement is provided below, it supersedes the requirement in ASHRAE/IESNA Standard 90.1. For all other criteria, the *building project* shall comply with the requirements of ASHRAE/IESNA Standard 90.1.

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Highlights for Energy (Section 7)

Prescriptive Option



- Prescriptive Option: Renewable Energy
 - On-site renewable energy system with ≥ 6 kBtu/ft²-yr [20 kWh/m²-yr] single story or 10.0 kBtu/ft²-yr [32 kWh/m²-yr] multiple story, *based on roof area*

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Highlights for Energy (Section 7)

Prescriptive Option



- Prescriptive Option: Renewable Energy (Continued)

Exception (meet both of these):

- Low incident solar locations (<4.0 kWh/m²/day)
- Purchase of green power in terms of "7 kWh/ft²-yr [75 kWh/m²-yr]" annually until cumulative purchase of 70 kWh/ft²-yr [750 kWh/m²-yr]

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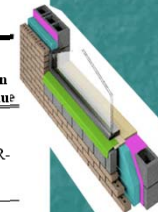
Highlights for Energy (Section 7)

Prescriptive Option (Building Envelope)

- Comply with Standard 90.1, Section 5 with modifications ...
- Replaces Table 5.5-1 thru 8 on building envelope in 90.1, for example: **(\$7.4.2)**

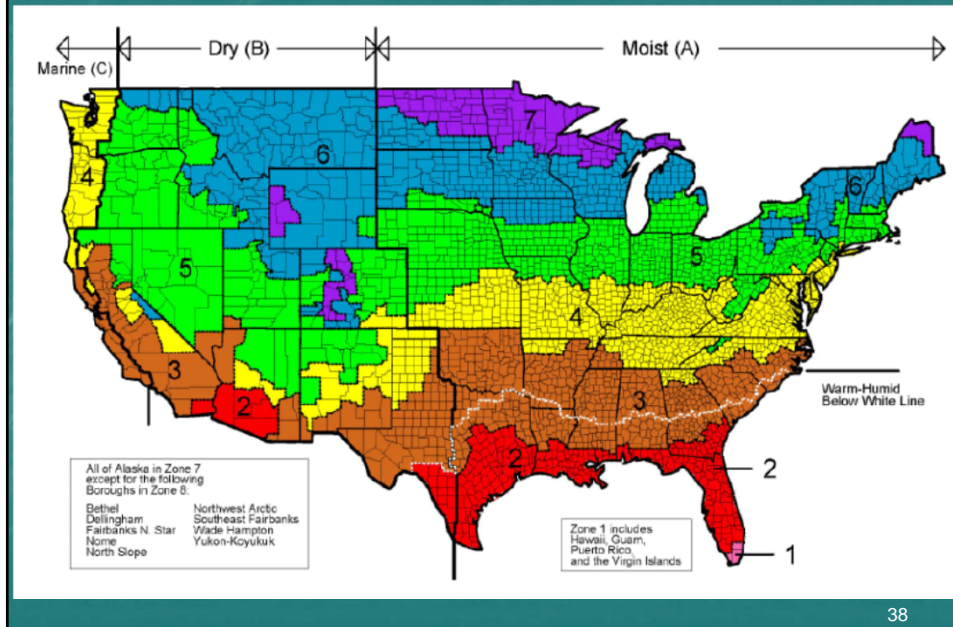
Table A-3 (supersedes Table 5.5-3 in ASHRAE/IESNA Standard 90.1)
Building Envelope Requirements For Climate Zone 3 (A,B,C) (I-P)

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Max.	Insulation Min. R-Value	Assembly Max.	Insulation Min. R-Value	Assembly Max.	Insulation Min. R-Value
<i>Roofs</i>						
Insulation Entirely above Deck	U-0.039	R-25.0 ci	U-0.039	R-25.0 ci	U-0.119	R-7.6 ci
Metal Building	U-0.035	R-19.0 + R-11.0 Ls	U-0.035	R-19.0 + R-11.0 Ls	U-0.068	R-13.0 + R-19.0
Attic and Other	U-0.021	R-49.0	U-0.021	R-49.0	U-0.034	R-30.0
<i>Walls, Above-grade</i>						
Mass	U-0.104	R-9.5 ci	U-0.090	R-11.4 ci	U-0.151 ^a	R-5.7 ci ^a
Metal Building	U-0.079	R-13.0 + R-6.5 ci	U-0.052	R-13.0 + R-13.0 ci	U-0.079	R-13.0 + R-6.5 ci
Steel Framed	U-0.077	R-13.0 + R-5.0 ci	U-0.055	R-13.0 + R-10.0 ci	U-0.084	R-13.0 + R-3.8 ci
Wood Framed and Other	U-0.064	R-13.0 + R-3.8 ci	U-0.064	R-13.0 + R-3.8 ci	U-0.064	R-13.0 + R-3.8 ci

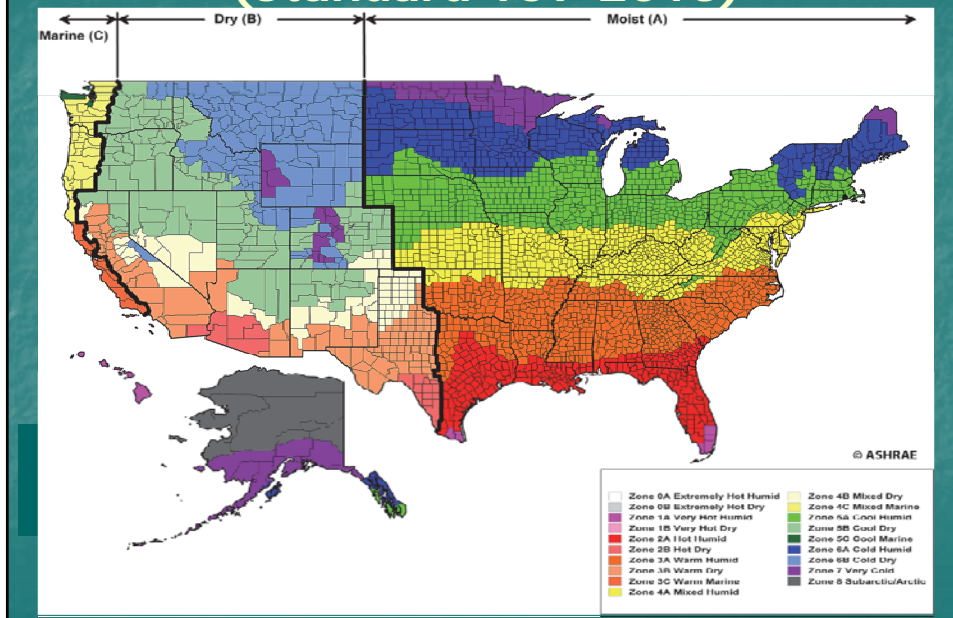


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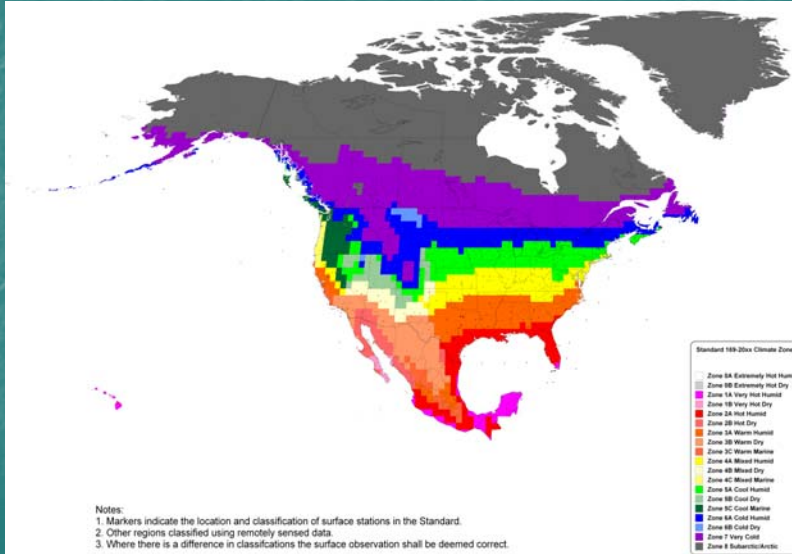
Climate Zones



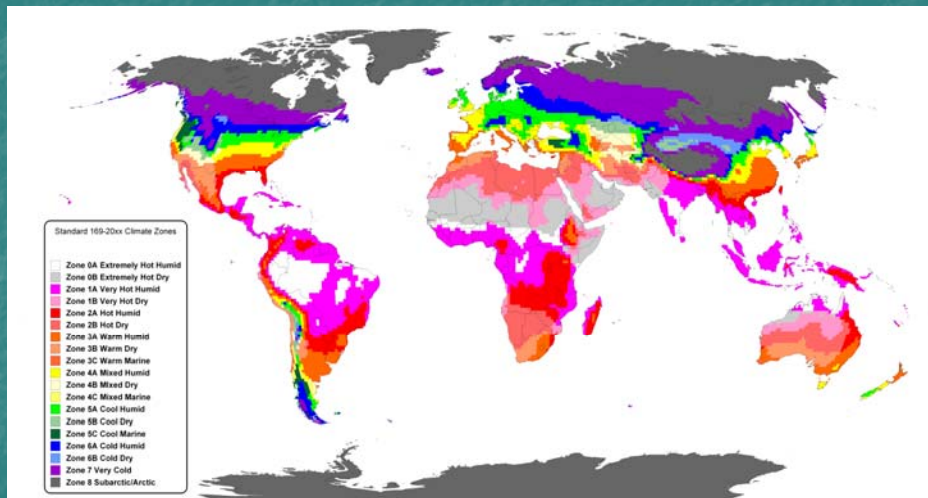
Sneak Peak at New Climate Zones (Standard 169-2013)



North America



169-2013 Worldwide Climate Zones



Highlights for Energy (Section 7)

(§7.4.2)

Prescriptive Option (Building Envelope)

- Example comparisons:

Example:

Climate zone 3 Std 90.1 Std 189.1

Insulation above deck R-20 → R-25

- More stringent SHGC **R=3.5** **R=4.4 (SI)**

Both 90.1 and 189.1 limit to <40%
window area :

Climate zone 5 SHGC ; all orientations

Std. 90.1: 0.40

Std. 189.1: 0.35

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Highlights for Energy (Section 7)

Prescriptive Option (Building Envelope)

- Vertical fenestration
<40% gross wall area
(§7.4.2.4)



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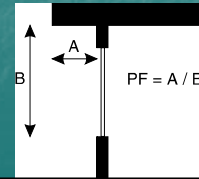
Highlights for Energy (Section 7)

Prescriptive Option (Building Envelope)

- Overhang: PF > 0.5
(§7.4.2.5)
*Exceptions for
< 250 hours/yr direct sun,
dynamic glazing,
or automated shading*



- West, east & south orientations
- Climate zones 1-5



Highlights for Energy (Section 7)

Prescriptive Option (Building Envelope)

- Push toward "smarter" window placement and selection (§7.4.2.8)

Exception

Buildings adjacent to or shaded by other buildings, hills, etc.

- a. For climate zones 1, 2, 3, and 4:

$$(A_N \times SHGC_N + A_S \times SHGC_S) \geq 1.1 \times (A_E \times SHGC_E + A_W \times SHGC_W)$$

- b. For climate zones 5 and 6:

$$1/3 \times (A_N \times SHGC_N + A_S \times SHGC_S + A_E \times SHGC_E) \geq 1.1 \times (A_W \times SHGC_W)$$

Highlights for Energy (Section 7)

Prescriptive Option (Building Envelope)

- Continuous air barrier requirement
(§7.4.2.9) **Addendum in process**
- Complies with Normative Appendix B to control air leakage in and out
- Detailed on construction documents
- Not required for semi-heated spaces that comply with Std. 90.1 Section 5.4.3.1
(that defines areas of envelope to be sealed, caulked, gasketed or weather-stripped)

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§7.4.3 HVAC

ASHRAE STANDARD
90.1 (current version)
Energy Standard for
Buildings Except Low-Rise
Residential Buildings

Adopt, with
modifications

General Concept:

*Based on Standard 90.1, but
modify to gain improved
energy performance over
code minimum standards*

ANSI/ASHRAE/USGBC/IES
Standard 189.1-2011

**Standard for
the Design of
High-Performance
Green Buildings**

Except Low-Rise
Residential Buildings



A Jurisdictional Compliance Option of the International Green Construction Code™

§7.4.3 HVAC

- Overview of modifications to Std. 90.1
 - §7.4.3.1 Minimum equipment efficiency
incentives for higher efficient equipment

Equipment Efficiency Compliance Options

"Code Minimum" EPC Act Baseline (Standard 90.1)

Use equipment with EPC Act baseline efficiency levels, and:

- Renewable energy system producing **6.0 kBtu/ft²** roof area annually (1-story)
- Peak electrical load reduction of **10%**

Higher efficiency

Use higher efficiency of Energy Star requirements and Appendix C, and:

- Renewable energy system producing **4.0 kBtu/ft²** roof area annually (1-story)
- Peak electrical load reduction of **5%**

§7.4.3 HVAC

- §7.4.3.2 Lowers occupancy threshold for demand-controlled ventilation (DCV)

ASHRAE STANDARD 90.1 (current version)

Energy Standard for
Buildings Except Low-Rise
Residential Buildings

Standard 90.1-2010: 40 people/1000 ft²
(100 m²) and area >500 ft² (50 m²)

ANSI/ASHRAE/USGBC/IES
Standard 189.1-2011

Standard for
the Design of
High-Performance
Green Buildings

Except Low-Rise
Residential Buildings

25 people/1000 ft²

If with CO₂ sensors,
install per §7.4.3.2

Note: Type of DCV
used is not specified in
Standard 189.1



A Jurisdictional Compliance Option of the International Green Construction Code™

§7.4.3 HVAC

■ §7.4.3.3 Economizer requirement changes from Standard 90.1

TABLE 7.4.3.3 Minimum System Size for Which an Economizer is Required

Climate Zones	Cooling Capacity for Which an Economizer is Required*
1A, 1B	No economizer requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	≥33,000 Btu/h (9.7 kW) ^a

*Where economizers are required, the total capacity of all systems without economizers shall not exceed 480,000 Btu/h (140 kW) per building or 20% of the building's air economizer capacity, whichever is greater.

Standard 90.1-2010 Requirement

-Capacity > 54,000 Btu/h (15.8 kW), and same climate zones

- Rooftop units <5 tons: two stage (first stage economizer, second stage adds mechanical)
- VAV with fixed supply temperature, capable for temperature reset by at least 5° F (3° C) during economizer operation
- Exceptions per Standard 90.1, Section 6.5.1 with slight modifications

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§7.4.3 HVAC

■ §7.4.3.4 Zone controls

- Have adapted Standard 90.1-2010 approach, but more restrictive
- General intent is to restrict the amount of air that is reheated, re-cooled, or other simultaneous heating/cooling operations in the same zone
- Exceptions allowed (from Standard 90.1 §6.5.2.1), with modifications [Exception (a) not allowed]

6.5.2 Simultaneous Heating and Cooling Limitation

6.5.2.1 Zone Controls. *Zone* thermostatic controls shall prevent

- a. reheating,
- b. recooling,
- c. mixing or simultaneously supplying air that has been previously mechanically heated and air that has been previously cooled, either by mechanical cooling or by economizer systems, and
- d. other simultaneous operation of heating and cooling systems to the same *zone*.

From 90.1-2010

§7.4.3 HVAC

- §7.4.3.5 Fan power limits, below Standard 90.1-2010



- 10%

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§7.4.3 HVAC

- §7.4.3.6 Expand energy recovery requirements from Standard 90.1-2010

TABLE 7.4.3.8 Energy Recovery Requirement (I-P)

Climate Zone	% Outside Air at Full Design Flow							
	≥10% and <20%	≥20% and <30%	≥30% and <40%	≥40% and <50%	≥50% and <60%	≥60% and <70%	≥70% and <80%	≥80%
	Design Supply Fan Flow, cfm							
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	NR	NR	≥5000	≥5000
1B, 2B, 5C	NR	NR	NR	NR	≥26,000	≥12,000	≥5000	≥4000
6B	NR	≥22,500	≥11,000	≥5500	≥4500	≥3500	≥2500	≥1500
1A, 2A, 3A, 4A, 5A, 6A	≥30,000	≥13,000	≥5500	≥4500	≥3500	≥2000	≥1000	≥0
7, 8	≥4000	≥3000	≥2500	≥1000	≥0	≥0	≥0	≥0

- Includes columns for between 10% and 30% outside air
- Energy recovery effectiveness of **60%** (instead of 50% in Standard 90.1)

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§7.4.3 HVAC

- §7.4.3.7 Kitchen hoods add variable speed, $\geq 50\%$ reduction in flow when not needed (*significant impact*)
- §7.4.3.8 Minimum duct insulation increased (Tables C-9 and 10)
- §7.4.3.12 Unoccupied hotel/motel >50 guest rooms
 - Lighting, outlets, TV off
 - HVAC setpoint raised/lowered by 5°F (3° C)



Highlights for Energy (Section 7)

Prescriptive Option (cont.)

- §7.4.5 Power
 - Peak load reduction:
 - *Reduce peak demand of the building through demand-limiting or load shifting measures (10%)*
 - *Standby generation does not count...*

Highlights for Energy (Section 7)

Prescriptive Option (Lighting)

- (§7.4.6.1) Interior lighting power allowance reduced from Table 9.5.1 in Standard 90.1-2010

TABLE 7.4.6.1B LPD Factors when Using the Space-by-Space Method

Common Space Type	LPD Factor
Classroom/Lecture/Training	0.85
Conference Meeting/Multipurpose	0.90
Corridor/Transition	0.85
Dining Area	0.90
Dining Area for Family Dining	0.85
Laboratory for Medical/Industrial Research	0.95
Lobby	0.95
Lobby for Elevator	0.85
Lobby for Motion Picture Theater	0.95
Lounge/Recreation	0.85
Office—Enclosed	0.95
Office—Open Plan	0.85
Sales Area	0.95
All Other Common Space Types	1.00



Example for Space-by-Space Method: LPD Factor is multiplier for 90.1-2010 values

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Highlights for Energy (Section 7)

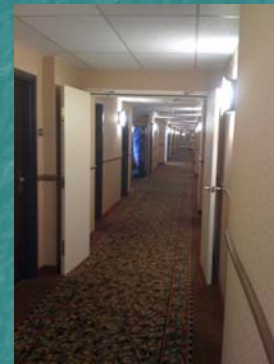
Prescriptive Option (Lighting)

- (§7.4.6.2) Occupancy sensor control to reduce power to <50% for:

- Hotel, motel hallways
- Storage stack aisles
- Library stacks

*Exception: HID lit areas
< 0.8 W/ft² or 8 W/m²*

- Egress lighting control (§7.4.6.3) < 0.1 W/ft² (1 W/m²)
Additional allowed if w/ auto shut-off



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Highlights for Energy (Section 7)

Prescriptive Option (Lighting)

- (§7.4.6.4) **Occupancy sensors:**
Manual on, auto off, except following where auto on is allowed
 - Areas per 7.4.6.2
 - Public corridors, stairwells
 - Restrooms
 - Entrance areas and lobbies

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Highlights for Energy (Section 7)

§7.5 Performance Based Option:



- Demonstrate equivalent performance in both *energy cost* and *CO₂ equivalent* compared to using the Prescriptive path for energy, plus relevant portions of Sections 5, 6 and 8

Proposed ≤ (Mandatory + Prescriptive Path)



Using Normative Appendix D
"Performance Option for Energy Efficiency"

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Highlights for Energy (Section 7)

Performance Based Option:

§7.5.4 Annual Load Factor/ Peak Electric Demand

- Same or less peak electric demand as if following the prescriptive path
- Minimum annual electrical load factor of 0.25

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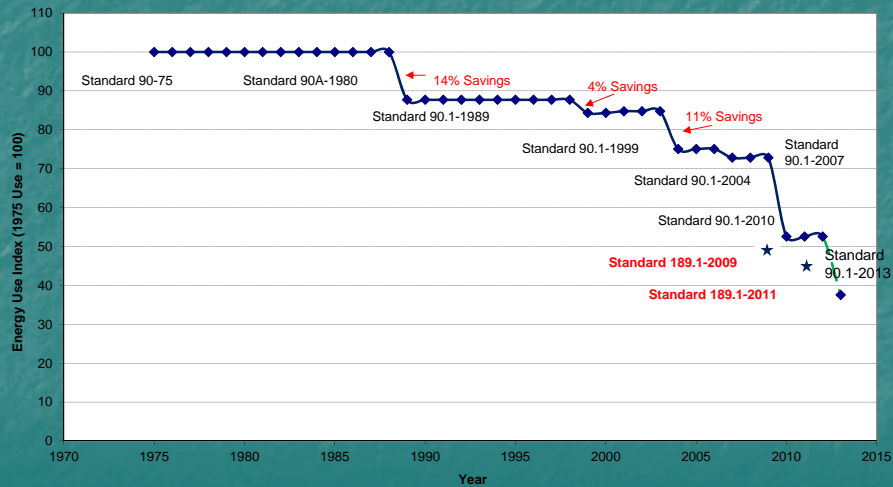
Standards 90.1-2010 and 189.1-2009 Energy Savings

Building Type	Prototype	Site Energy (kBtu/ft ²)					Site Energy Savings Compared to 90.1-2004(%)				
		90.1-2004	90.1-2007	90.1-2010	189.1-2009	189.1-2009*	90.1-2007	90.1-2010	189.1-2009	189.1-2009*	
Office	Small office	41.3	39.3	32.8	31.9	27.9	4.5%	20.6%	22.8%	32.4%	
	Medium office	51.6	49.7	37.3	39.9	35.9	3.5%	27.7%	22.7%	30.4%	
	Large office	46.0	44.7	33.4	34.7	30.7	3.1%	27.5%	24.6%	33.3%	
Retail	Standalone retail	76.0	72.8	49.5	45.0	41.1	4.2%	34.8%	40.8%	45.9%	
	Strip mall	80.4	76.7	56.9	54.0	50.0	3.9%	29.2%	32.8%	37.8%	
Education	Primary school	73.4	68.9	50.2	53.4	49.4	4.3%	31.6%	27.2%	32.7%	
	Secondary school	66.2	62.1	41.2	41.1	37.2	4.1%	37.8%	37.9%	43.8%	
Health Care	Outpatient healthcare	163.3	164.7	123.6	133.8	129.8	4.8%	24.3%	18.1%	20.5%	
	Hospital	157.4	152.2	118.4	142.9	138.9	1.8%	24.8%	9.2%	11.8%	
Lodging	Small hotel	78.5	76.0	66.6	58.8	54.9	1.5%	15.2%	25.1%	30.1%	
	Large hotel	163.9	168.2	125.9	125.6	121.6	0.7%	23.2%	23.4%	25.8%	
Warehouse	Warehouse	26.3	26.2	19.0	15.6	11.6	1.2%	27.7%	40.7%	55.9%	
Food Service	Quick-service restaurant	570.1	566.7	519.9	512.0	508.1	0.6%	8.8%	10.2%	10.9%	
	Full-service restaurant	409.7	407.7	330.9	347.3	343.3	0.5%	19.2%	15.2%	16.2%	
Apartment	Mid-rise apartment	47.0	45.4	41.2	37.1	33.1	3.4%	12.3%	21.1%	29.6%	
	High-rise apartment	48.9	**	44.0	39.2	35.2	**	10.1%	19.8%	28.0%	
National Weighted Average		74.0	71.6	55.1	54.4	50.4	3.3%	25.6%	26.5%	31.9%	

http://www.energycodes.gov/commercial/901models/National_Average_Summary_STD2010_vs_STD2004.xls

Improvements in Stringency in Standards 90.1/189.1

Estimates from DOE BECP - Commercial Codes



Section 8 - Indoor Environmental Quality

■ Key Items

- Outdoor airflow
- Tobacco smoke control
- Outdoor air monitoring
- Filtration and air cleaning
- Daylighting
- Thermal comfort
- Acoustics



Indoor Environmental Quality

§8.3.1 IAQ

- Ventilation requirements from 62.1 Ventilation Rate Procedure

§8.3.1.1

- Outdoor air monitoring

§8.3.1.2

- Permanently mounted, direct outdoor airflow
 $\pm 15\%$ of *minimum outdoor airflow*
(Differs from LEED in that CO₂ monitoring for densely occupied spaces not specified)
- Exception for constant volume air supply, damper position feedback



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Indoor Environmental Quality

■ §8.3.1.3 Filtration

- (a) Particulates - Minimum **MERV 8** upstream of wetted surfaces or to reduce PM₁₀, **MERV 13** when designed to reduce PM_{2.5}
(Modifies and strengthens Std. 62.1 §6.2.1.1)
- (b) Ozone cleaners for outdoor air in building projects located in high ozone areas. *(Ozone removal efficiency = 40%, per Std. 62.1 §6.2.1.2)*
- (c) Filter frames, air cleaner racks, access doors sealed to eliminate bypass pathways

6.2.1.3 Ozone. Air-cleaning devices for ozone shall be provided when the most recent three-year average annual fourth-highest daily maximum eight-hour average ozone concentration exceeds 0.107 ppm (209 µg/m³).

From Std. 62.1-2010

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Indoor Environmental Quality

■ §8.3.1.4

Environmental Tobacco Smoke Control



- *No smoking inside, with signage*
- *No smoking within 25 feet (7.5 m) of entrance, outdoor air intakes or operable windows*

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Indoor Environmental Quality

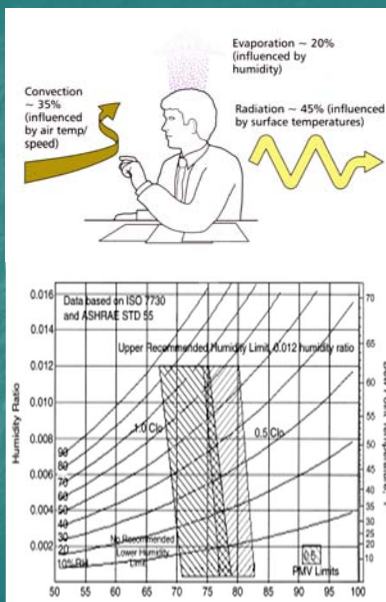
Other Mandatory:

■ Thermal Comfort

- Comply with Std. 55 Sections 6.1 and 6.2 (Design and Documentation)

■ Mat systems at building entrances

■ Envelop acoustical design (sound transmission rating criteria)



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Indoor Environmental Quality

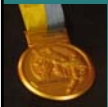


Prescriptive Option (§8.4):

- Daylighting by sidelighting
- Materials

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Indoor Environmental Quality



Performance Option (§8.5):

- Daylighting simulation
 - Office space and classrooms
 - Minimum illuminance target:
300 lux (30 fc) on plane 2.5 ft (0.8 m) above floor in 75% of daylight zone, at noon equinox
- Direct sun limitation on office worksurface
 - Direct sunlight on worksurface <20% of occupied hours on equinox day (worksurface = 2.5 feet above floor)

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Section 9 - Building's Impact on Atmosphere, Materials and Resources

Mandatory:

- Construction waste management
- No CFC based refrigerants
- Recyclables storage areas

Prescriptive Option:

- Reduced impact materials (recycled, regional, biobased)

Performance Option:

- Life Cycle Assessment



Section 10 - Construction and Plans for Operation

Only Mandatory Provisions:

- **§10.3.1 Construction**
- **§10.3.2 Plans for Operation**

Construction and Operation

§10.3.1 Construction

- Building acceptance testing
- Commissioning
- Erosion and sediment control
- Indoor air quality
- Moisture control
- Construction vehicles



Construction Requirements (*cont.*)

§10.3.1.2 Building Project Commissioning

- Full commissioning for $>500 \text{ m}^2$ (5,000 ft^2)
 - HVAC, building envelope, lighting, irrigation, plumbing, domestic water, renewable energy
- Designate CxA
- Develop OPR and Basis of Design
- Design reviews at 50% and 'final' construction documents



Doing full Cx process also satisfies the Building Acceptance Test requirements

Addendum in process

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Construction Requirements (*cont.*)

§10.3.1.4 IAQ Construction Mgmt

- Develop and implement an IAQ Construction Management Plan, to include:
 - Air conveyance materials
 - Permanent HVAC not used during construction, except for startup, balancing, commissioning
 - Flush-out or baseline IAQ monitoring



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Construction Requirements (*cont.*)

IAQ Construction Management

- Post-construction, pre-occupancy
 1. Flush-out: Temp >60 °F (15 C), RH ≤60%

Equation 10.3.1.4:

$$\text{TAC} = V_{or} \times 1/A \times 1/H \times 60 \text{ min/h} \times 24 \text{ h/day} \times 14 \text{ days (I-P)}$$

$$\text{TAC} = V_{or} \times 1 \text{ m}^3/1000 \text{ L} \times 1/A \times 1/H \times 3600 \text{ s/h} \times 24 \text{ h/day} \times 14 \text{ days (SI)}$$

where

TAC = total air changes

V_{or} = system design *outdoor air* intake flow cfm (L/s) (according to Equation 6-8 of ANSI/ASHRAE Standard 62.1)

A = floor area ft² (m²)

H = ceiling height, ft (m)

2. Baseline IAQ Testing for 34 contaminants

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§10.3.2 Plans for Operation

1. High Performance Building Operation
 - Site Sustainability
 - Water Use Efficiency
 - Energy Efficiency
 - Indoor Environmental Quality
2. Maintenance
3. Service Life
4. Transportation Management

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What's Next

Standards 62.1 and 90.1-2013

Then 189.1-2014

Then IgCC 2015

Updated Users Manual for 189.1-2014

189.3 Healthcare Facilities: 1st public review complete

189.2 Low-Rise Residential: Title, Purpose and Scope of proposed new standard out for public review

How to Get Involved

Join the committee listserv

www.ashrae.org/resources--publications/free-resources/

Attend a meeting as an observer
ASHRAE Winter and Annual meetings

Submit a public review comment
www.ashrae.org/public-review-drafts

Submit a change proposal
www.ashrae.org/standards-research--technology/standards-guidelines/continuous-maintenance

Join the committee
www.ashrae.org/standards-research--technology/standards-forms--procedures

Thank you!

Questions?

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