ICC 2019
LAS VEGAS NEVADA

Welcome to the

2019 Annual Conference Educational Sessions

AHRI
AIR-CONDITIONING, HEATING, & REFRIGERATION INSTITUTE
we make life better™

International Green Construction Code (IgCC) and ASHRAE Standard 189.1

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Office of Environmental Initiatives, City of Scottsdale

Copyright Materials

Learning Objectives

1. Recognize the importance of developing a code-intended standard for design of high-performance green buildings and how these standards can be applied in practice
2. Differentiate *Ig*CC and ASHRAE/ICC/USGBC/IES Standard 189.1 from green building certification systems (e.g., LEED, Green Globes)
3. Describe key requirements contained in the *Ig*CC and ASHRAE/ICC/USGBC/IES Standard 189.1 on the important topics of sites, water, energy, IEQ, and materials
4. Distinguish between the two compliance path options (Prescriptive and Performance), their associated provisions in the *Ig*CC, and how to apply them in a design
5. Describe the requirements for construction and plans for operating the building

OUTLINE

- **Background and Overview**
- Chapter 1 - **Scope and Administration**
- Chapter 5 - **Site Sustainability**
- Chapter 6 - **Water Use Efficiency**
- Chapter 7 - **Energy Efficiency**
- Chapter 8 - **Indoor Environmental Quality (IEQ)**
- Chapter 9 - **Materials and Resources**
- Chapter 10 - **Construction and Plans for Operations**

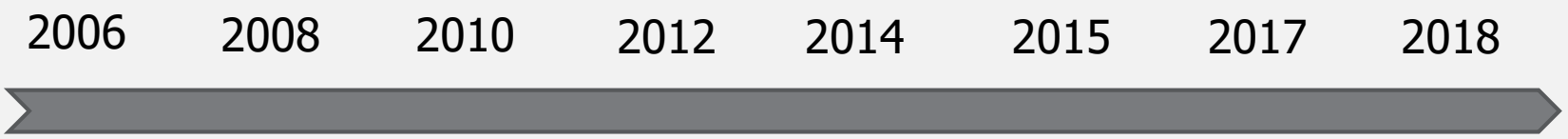
History and Convergence

Standard 189.1 for the Design of High-Performance Green Buildings

- 2006: work begun to create a standard that could be adopted into building codes.
- **2009: first edition released.**
- 2011: edition released.
- 2014: ASHRAE and ICC reached agreement for joint development.
- 2017: edition released and submitted to ICC for technical content of the 2018 *Ig*CC.

International Green Construction Code (IgCC)

- 2009: work begun to create a green building code developed by and for local building officials.
- **2012: first edition released.**
- 2014: ICC accepts 189.1 technical content for future edition.
- 2015: edition released.
- **2018 edition released with 189.1 technical content.**

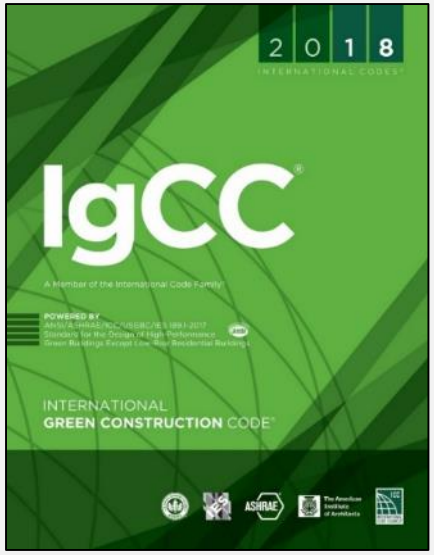


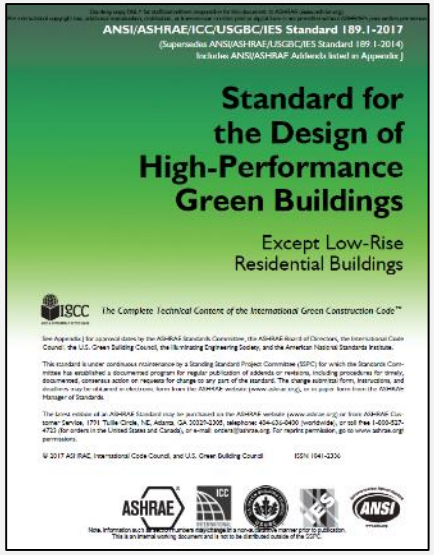
The New Arrangement

- According to the 2014 agreement between ICC and ASHRAE, the following is how the code and standard will be promulgated, effective 2018:
  - **U.S. and Canada**
    - ASHRAE will market the *Ig*CC with ICC
  - **Outside the U.S. and Canada**
    - ASHRAE will be allowed to publish and sell ASHRAE Standard 189.1. (Standard 189.1 is the technical basis of the *Ig*CC)

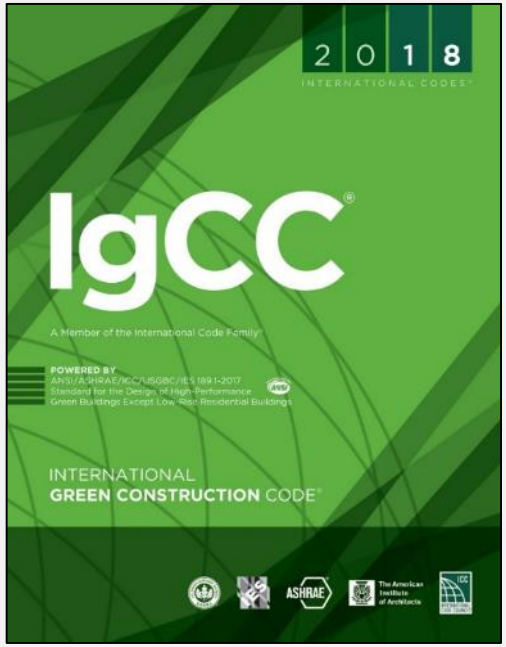
*Ig*CC and Standard 189.1

- Optional compliance path ("Jurisdictional Compliance Option") to the 2015 *International Green Construction Code* (*Ig*CC)
- Standard 189.1 is the technical basis for the 2018 *Ig*CC (merged together)
- This talk focuses primarily on the technical basis of the *Ig*CC (Standard 189.1)

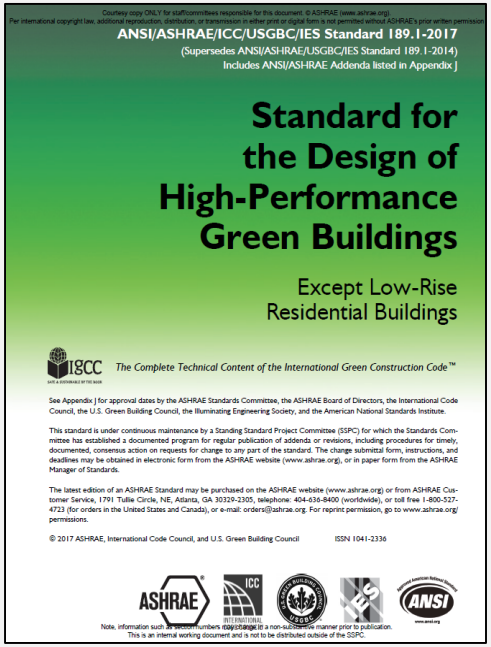




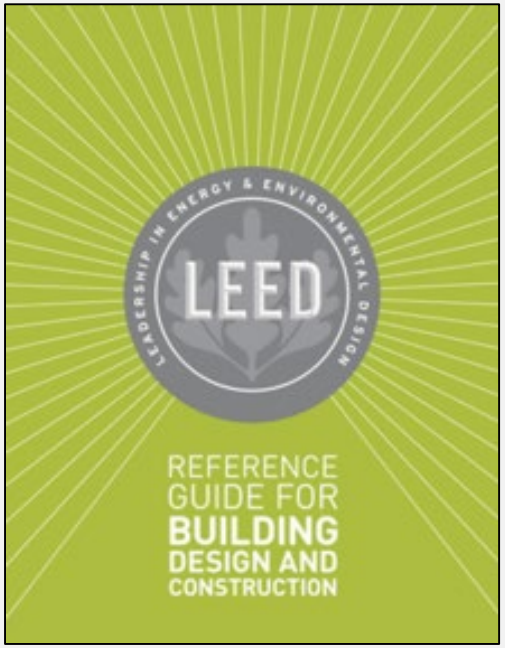
*Ig*CC/Standard 189.1 Versus LEED



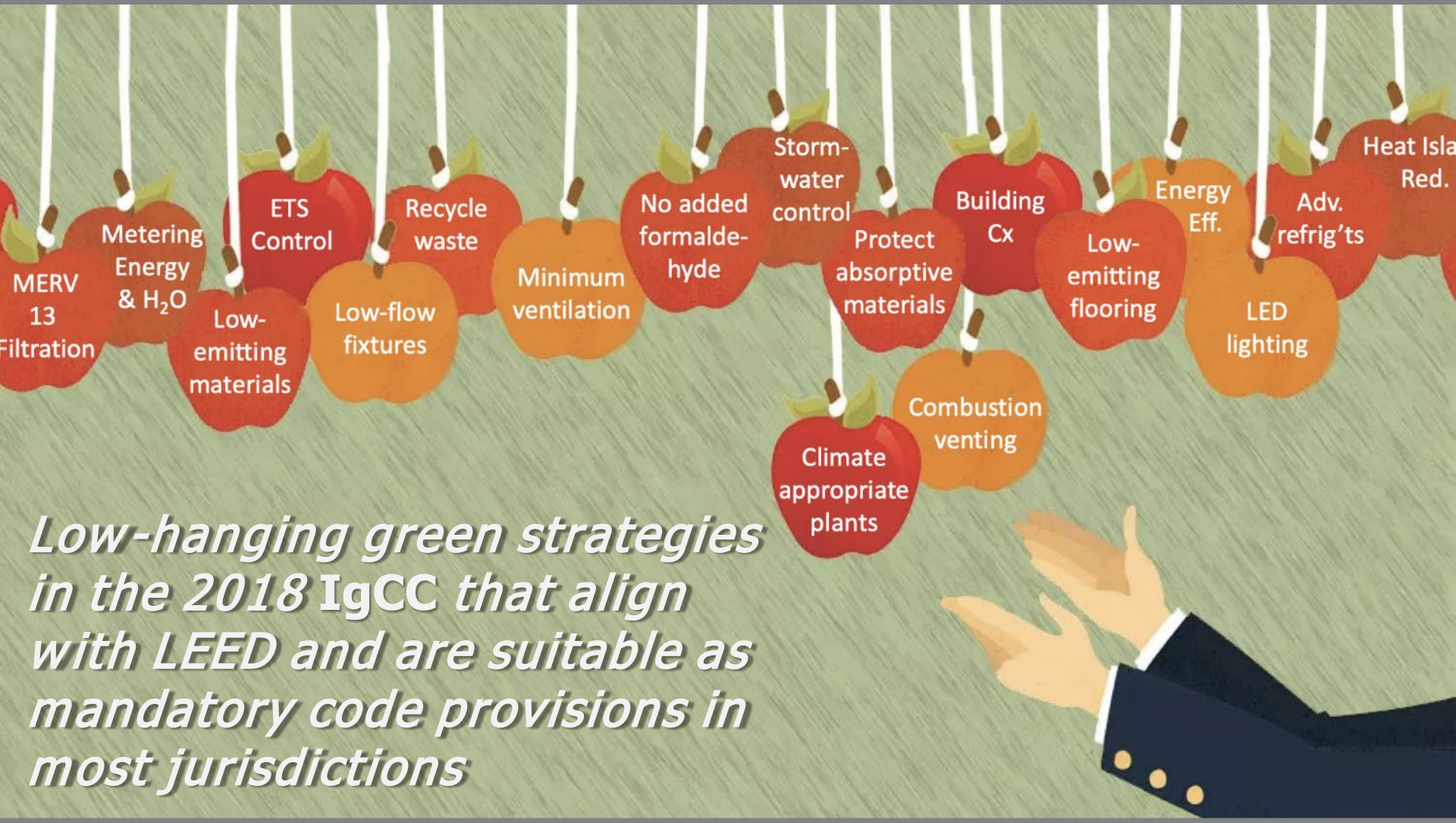
Mandatory code intended for adoption in North American jurisdictions



International standard



Voluntary rating system

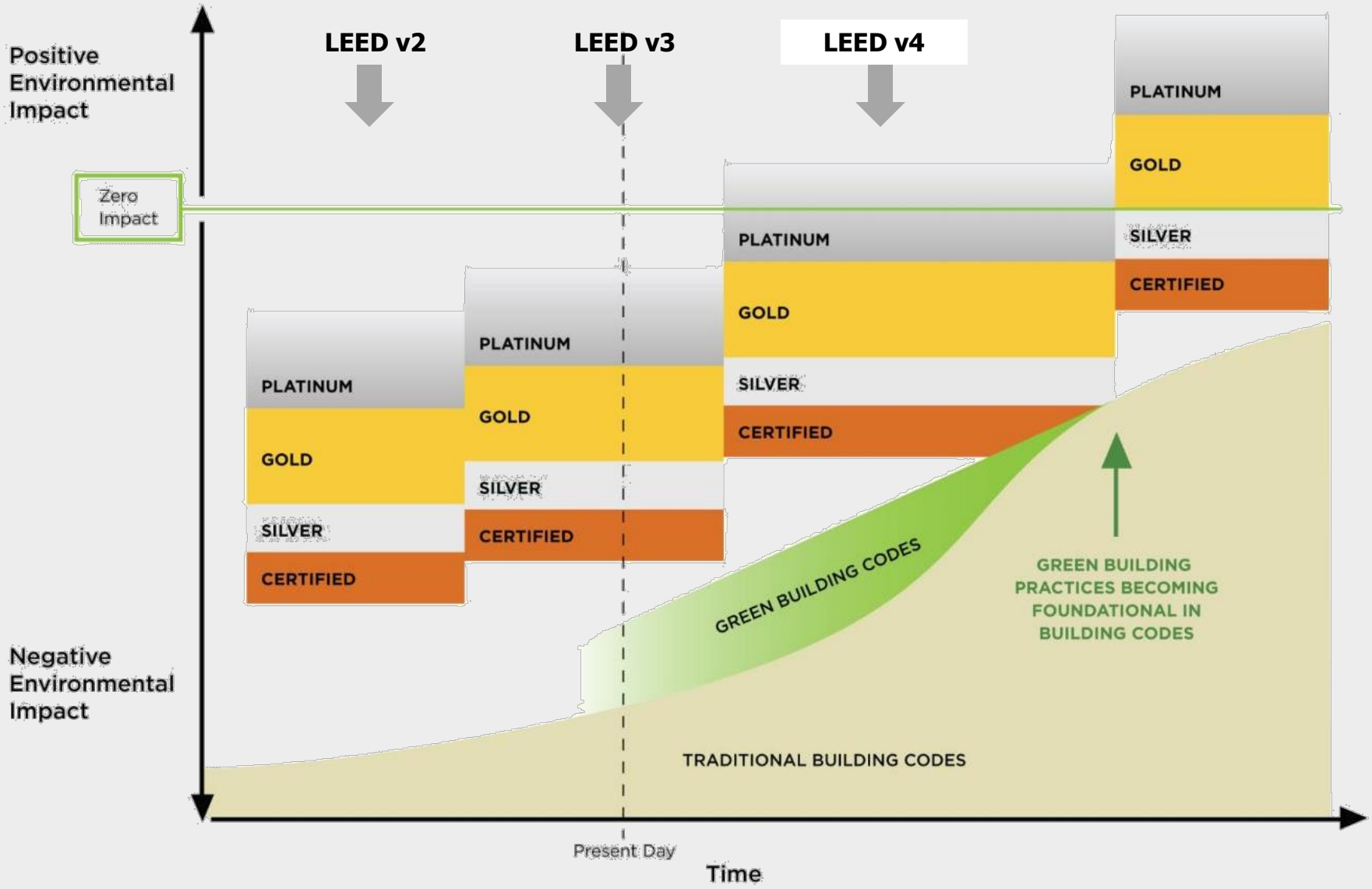

MERV 13 Filtration
Metering Energy & H_2O
Low-emitting materials
ETS Control
Low-flow fixtures
Recycle waste
Minimum ventilation
No added formalde-hyde
Storm-water control
Climate appropriate plants
Protect absorptive materials
Combustion venting
Building Cx
Low-emitting flooring
Energy Eff.
LED lighting
Adv. refrig'ts
Heat Isla
Red.
Low-hanging green strategies in the 2018 **IgCC** *that align with LEED and are suitable as mandatory code provisions in most jurisdictions*

Sample of IgCC Measures that Align with LEED

LEED Credit Category	LEED BD+C v4 Prerequisite or Credit	Corresponding 2018-IgCC Measure	Potential LEED Points	Achievement Rates
Energy & Atmosphere	Fundamental Commissioning and Verification	1001.3.1 Construction/10.3.1.1 Building Systems FPT	Prerequisite	100%
	Enhanced Commissioning (Option 1)	1001.3.1.1.1 FPT Requirements	3 Points	80%
		1001.3.1.2 Building Project Commissioning (Cx) Process		
		1001.3.1.3 Project Cx Documents		
	Minimum Energy Performance (Option 1, 5%)	701.3.1 General	Prerequisite	100%
	Optimize Energy Performance (14%)	701.4 Prescriptive Option	5 Points	90%
		701.5 Performance Option		
	Fundamental Refrigerant Management	901.3.3 Refrigerants	Prerequisite	100%
	Building Level Energy Metering	701.3.3 Energy Consumption Management	Prerequisite	100%

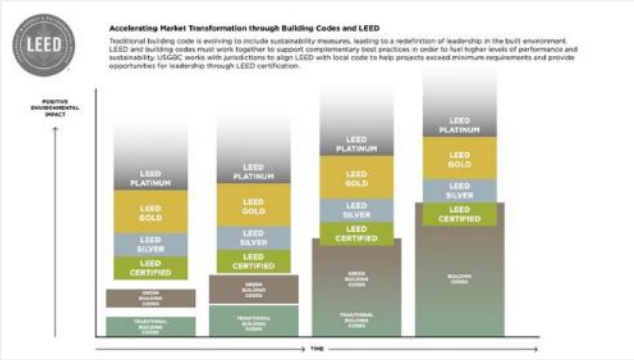
https://new.usgbc.org/green-codes

Evolution of LEED and Green Codes



USGBC Resources

- Articles
- Policy briefs
- LEED/*Ig*CC recommended alignment list with high achievement rates
- Coordinated *Ig*CC trainings with ASHRAE and ICC
- Sample *Ig*CC code compliance forms based on LEED forms (coming 2019)



https://new.usgbc.org/green-codes

CHAPTER/SECTION 1 - SCOPE AND ADMINISTRATION

IgCC Purpose (§101.2)

- **Provides minimum requirements for the design, construction, and plans for operation of high-performance green buildings that -**
  - Reduce emissions from buildings
  - Enhance building occupant health and comfort
  - Conserve water resources
  - Protect local biodiversity
  - Enhance resilience to natural and human-caused hazards
  - Support regenerative material cycles

Museum Square, Swaback Partners

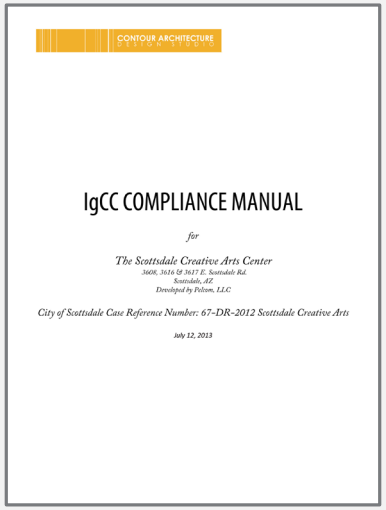
IgCC Scope (§101.3)

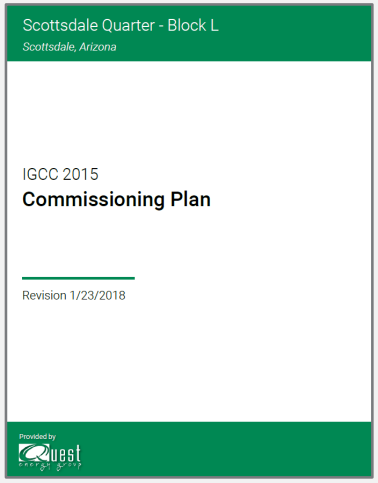
- **Applies only to the following projects:**
  - New buildings and their systems
  - New portions of buildings and their systems
  - New systems and equipment in existing buildings
  - Relocated existing buildings
- **Does not apply to the following:**
  - Single-family dwellings
  - Multifamily three stories or less
  - Buildings that use no electricity, fossil fuels, or water

Photo credit: Michael Dollin

Compliance and Approved Programs

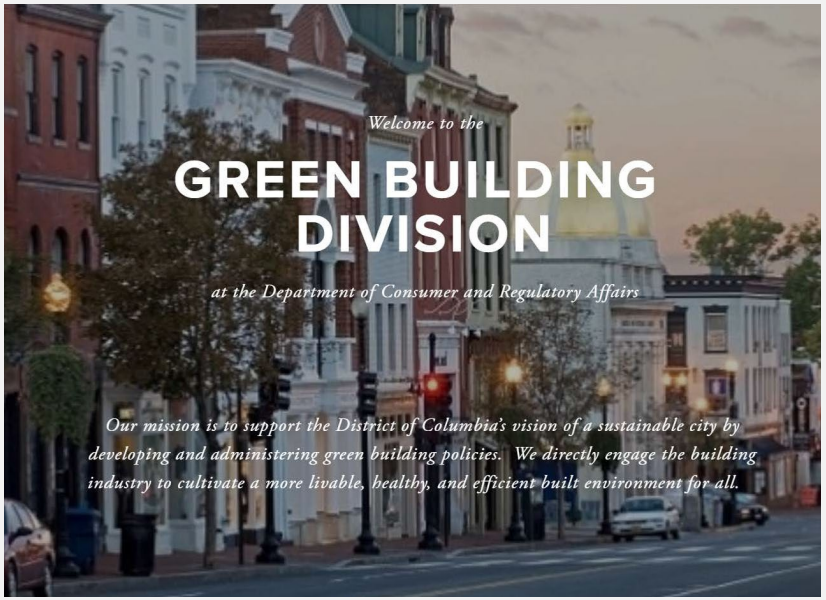
- **Compliance Materials and Tools** (§105.5)
  - Computer software
  - Worksheets
  - Compliance manuals
- **Approved Programs** (§105.6)
  - AHJ has authority to deem a national, state or local programs as meeting or exceeding this code





Approval and Inspections

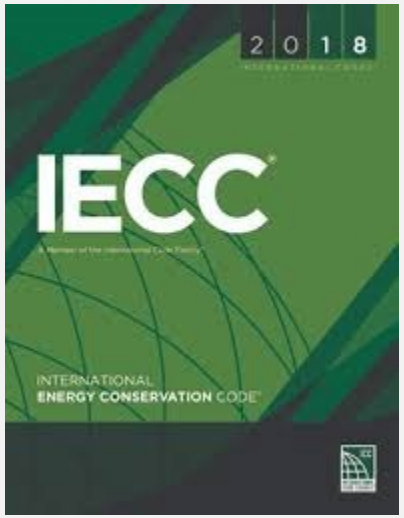
- **Construction Documents**
  - Information on construction documents
  - Content and format in compliance with IBC
- **Permits**
  - Separate permits shall not be issued under IgCC
- **Inspections**
  - Third-party plan review and inspection programs



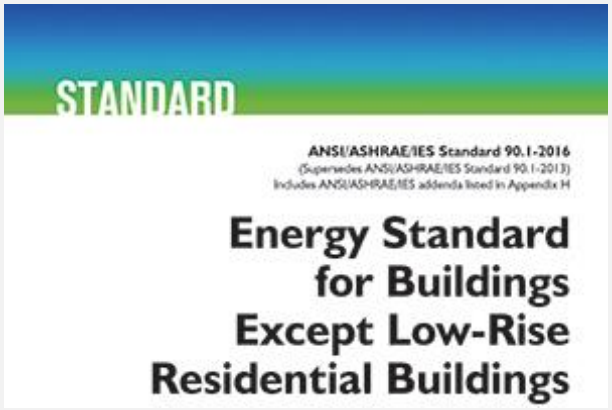
DC Green & Energy Third Party Program

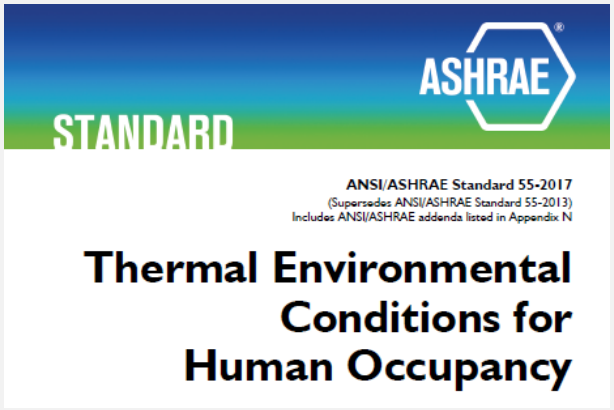
Referenced Codes and Standards

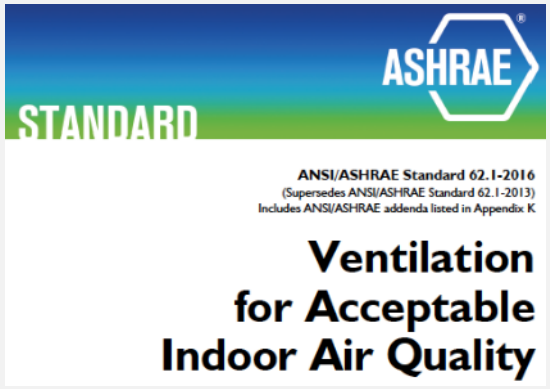
Usually adopted with modifications

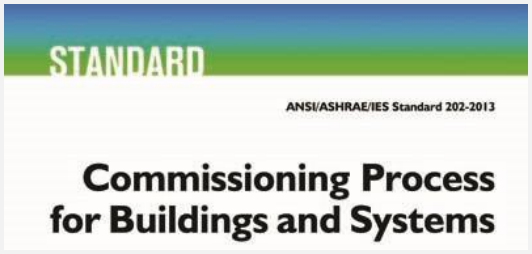


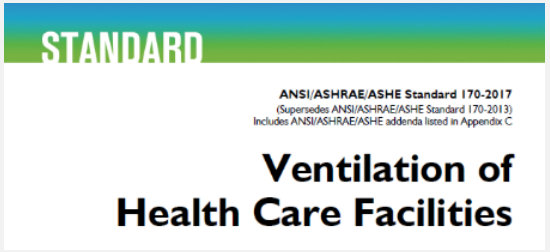
Reference to ASHRAE Standards



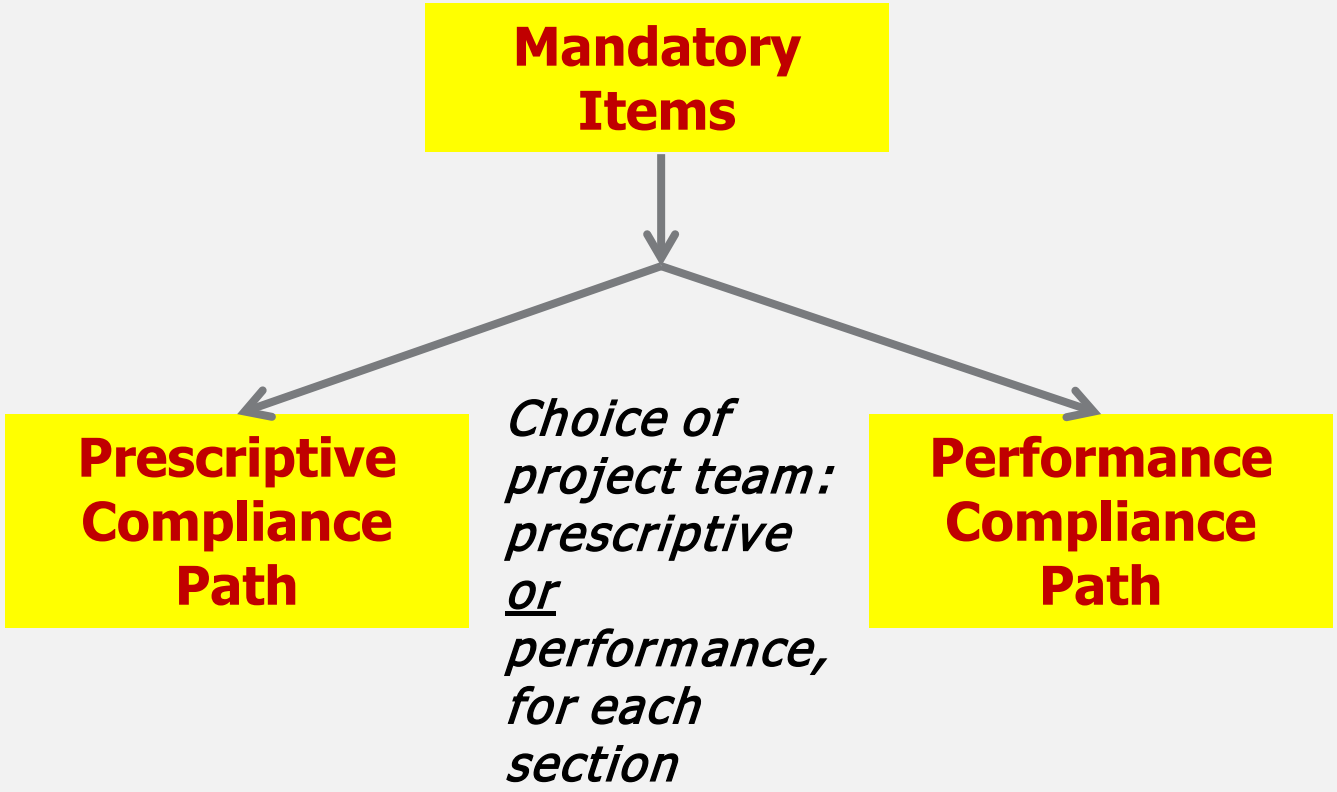








Compliance Paths



Note: Over time some sections have been simplified to make all provisions mandatory or to eliminate the performance option

Chapter/Section Organization

- **Chapter/Section 1**—Scope, Administration, and Enforcement
- **Chapter/Section 3**—Definitions
- **Chapter/Section 5**—Site Sustainability
- **Chapter/Section 6**—Water Efficiency
- **Chapter/Section 7**—Energy Efficiency
- **Chapter/Section 8**—Indoor Environmental Quality
- **Chapter/Section 9**—Materials and Resources
- **Chapter/Section 10**—Construction and Plans for Operation

Normative Appendices

- **Chapter/Section 11**—Normative References
- **Normative Appendix A**—Climate Zones and Prescriptive Building Envelope and Duct Insulation Tables
- **Normative Appendix B**—Prescriptive Equipment Efficiency Tables for the Alternative Reduced Renewables and Increased Equipment Efficiency Approach
- **Normative Appendix C**—Performance Option for Energy Efficiency
- **Normative Appendix D**—Building Concentrations

Informative Appendices

- **Informative Appendix E**—Building Envelope Tables
- **Informative Appendix F**—Integrated Design
- **Informative Appendix G**—Informative References
- **Informative Appendix H**—Option for Energy Efficiency Using the IECC Prescriptive Compliance Path
- **Informative Appendix I**—Additional Guidance for Functional and Performance Testing and Commissioning Process
- **Informative Appendix J**—Option for Residential Compliance using the National Green Building Standard

Adoption and Amendments

CITY COUNCIL REPORT

Meeting Date: November 28, 2016
General Plan Element: *Public Services & Facilities*
General Plan Goal: *Provide services to improve neighborhoods and the lives of Scottsdale residents*

ACTION

Subject statement. Every three years the Building and Fire Codes of the City of Scottsdale are updated to account for the latest building technologies, standards and construction practices. The Building Safety and Fire departments wish to update the Building and Fire Codes to the latest edition of the following codes with an effective date of January 1, 2017:

(1) Ordinance No. 4283, adopting the International Fire Code, 2015 Edition, including appendices B, C, D, E, F, G, H, I, J, K, and M, as published by the International Code Council, Inc., and as amended by the "2016 City of Scottsdale Amendments to the 2015 International Fire Code," declared public records by Resolution No. 10598 of the City of Scottsdale, are hereby referred to, adopted, and made a part hereof as if fully set out in this Ordinance.

(2) Ordinance No. 4284, adopting the Building Code of the City of Scottsdale, including the 2015 editions of the International Building Code, International Residential Code, International Mechanical Code, International Plumbing Code, International Fuel Gas Code, International Energy Conservation Code, International Existing Building Code, International Green Construction Code, 2014 edition of the National Electrical Code, "2012 ICC Standard for Bleachers, Folding And Telescopic Seating, and Grandstands," "ICC 117.1-2009 Americans With Disabilities Act Accessibility Guidelines For Buildings And Facilities," and the "2010 ADA Standards For Accessible Design".

a. the International Building Code, 2015 Edition, including appendices G, I and J, as published by the International Code Council, Inc., and as amended by the "2016 City of Scottsdale Building Codes and Amendments," declared public records by Resolution No. 10597 of the City of Scottsdale, are hereby referred to, adopted, and made a part hereof as if fully set out in this Ordinance.

b. The International Residential Code for One-and Two-Family Dwellings, 2015 Edition, including appendices A, B, C, H, J, K, R, S and U, as published by the International Code Council, Inc., and as amended by the "2016 City of Scottsdale Building Codes and Amendments," declared public records by Resolution No. 10599 of the City of Scottsdale, are hereby referred to, adopted, and made a part hereof as if fully set out in this Ordinance.

c. The International Plumbing Code, 2015 Edition, including B and E, as published by the International Code Council, Inc., declared a public record by Resolution No.

Action Taken_____

CITY OF SCOTTSDALE AMENDMENTS
TO THE
INTERNATIONAL GREEN CONSTRUCTION CODE
2015 EDITION

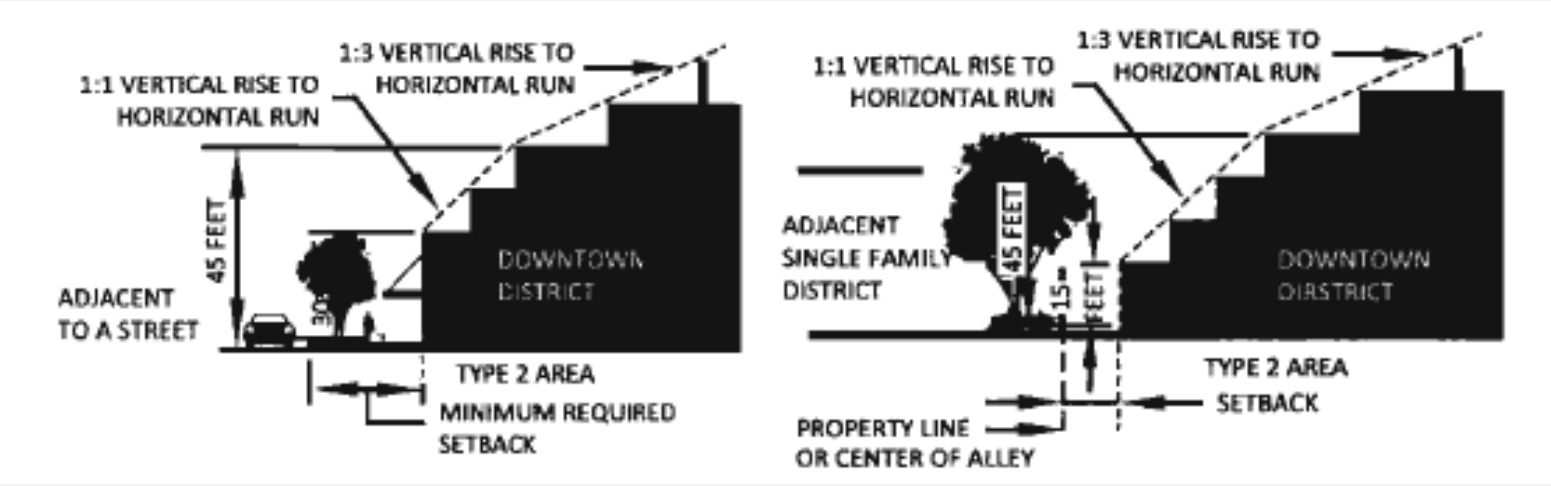
Ordinance No. 4284, Resolution No. 10604

14980375v4

Page 1 of 15
Exhibit A
Resolution 10604

City of Scottsdale
Zoning Incentives for the IgCC

- Area, Height and Density Bonuses
  - **Compliance with the IgCC**
  - Building step backs and shade study
  - Open space and vertically integrated mixed-use
  - Underground parking and integration of structured parking into building architecture



2015 International Green Construction Code (IgCC)

Scottsdale Green Building Program
Commercial Compliance Checklist for Plan Review

rev. 1/27/17

Use this checklist for tracking compliance requirements for the City of Scottsdale amended International Green Construction Code (IgCC). Please refer to the IgCC code document for further details and applicable requirements. Scottsdale's IgCC worksheets are available for determining compliance with Heat Island Mitigation (Sec. 408) and Material Selection (Sec. 505).

Project Name: _____ Date: _____ Plan Review # _____

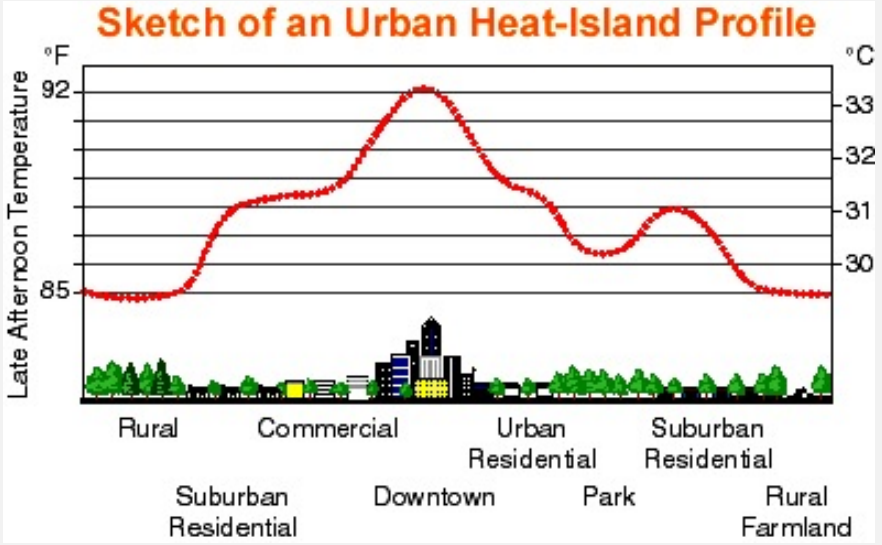
Chapter 4 – Site Development and Land Use		Verification	
√	**Section 404: Landscape Irrigation**	**Plan Review**	**Inspections**
☐	**404.1.1 Water for outdoor landscape irrigation.** Outdoor landscape irrigation systems shall be designed and installed to reduce potable water use by 50 percent from a calculated mid-summer baseline in accordance with Section 404.1.2 or the system shall be supplied with alternate onsite nonpotable water complying with Chapter 7 of the IgCC. Exceptions: Potable water is permitted to be used as follows: 1) During the establishment phase of newly planted landscaping; 2) To irrigate food production; 3) To supplement nonpotable water irrigation of shade trees for heat island mitigation (Sec. 408.2.3); 4) When approved in the development review and planning process.	Commissioning Agent	Commissioning Agent
☐	**404.1.2 Irrigation system design and installation.** Where in-ground irrigation systems are provided, the systems shall comply with all of the following: 1. The design and installation of outdoor irrigation systems shall be under the supervision of an irrigation professional accredited or certified by an appropriate local or national body. 2. Landscape irrigation systems shall not direct water onto building exterior surfaces, foundations, exterior paved surfaces or adjoining lots. Systems shall not generate runoff. 3. Where an irrigation control system is used, the system shall be one that regulates irrigation based on weather, climatological or soil moisture status data. The controller shall have integrated or separate sensors to suspend irrigation events during rainfall. 4. Irrigation zones shall be based on plant water needs with plants of similar need grouped together. Turfgrass shall not be grouped with other plantings on the same zone. 5. Micro-irrigation zones shall be equipped with pressure regulators that ensure zone pressure is not greater than 40 psi, filters, and flush end assemblies. 6. Refer to IgCC Sec. 404.1.2 for further details on sprinkler requirements.	Commissioning Agent	Commissioning Agent

CHAPTER/SECTION 5 - SITE SUSTAINABILITY

Chapter 5 - Sustainable Sites

All Site Provisions are Mandatory

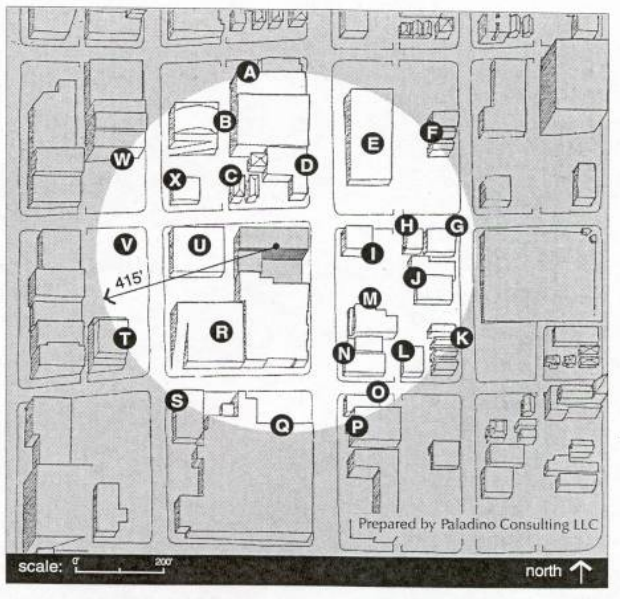
- **Planning and zoning considerations**
- **Key areas addressed:**
  - Protection of greenfields
  - Stormwater management
  - Urban heat island
  - Light "pollution" limitations
  - Transportation impacts
  - Electric vehicle charging stations
  - Building site construction waste management



Chapter 5 - Sustainable Sites

Site Selection (Mandatory)

- Allowable sites
  - Limit development on greenfield sites to areas that are in close proximity to existing development
  - Usually dictated by local planning and zoning laws
- Prohibited development activity
  - Prohibits development in flood zones, wetlands & conservation areas
- Predesign and site inventory
- Invasive plants
- Greenfield site development
  - Retention of native or adapted plants and biodiverse plantings



Chapter 5 - Sustainable Sites

Stormwater Management (Mandatory)

- Greenfield shall retain no less than 95th percentile precipitation event during a single 24-hour period
- Greyfield shall retain no less than 60th percentile precipitation event during 24 hour
- Brownfield shall not use use infiltration practices that will result in pollutant discharges to groundwater

Bioswale stormwater capture

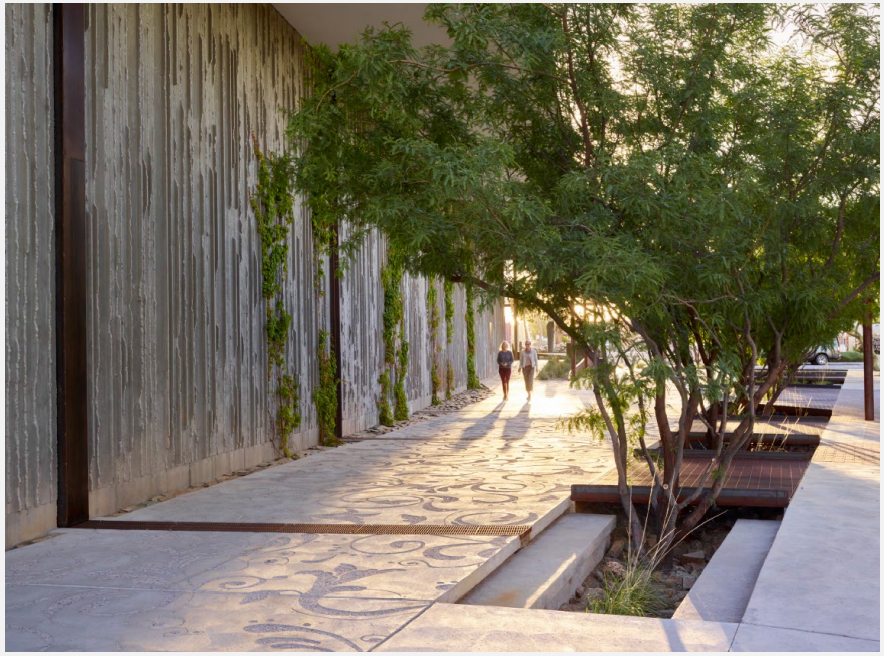
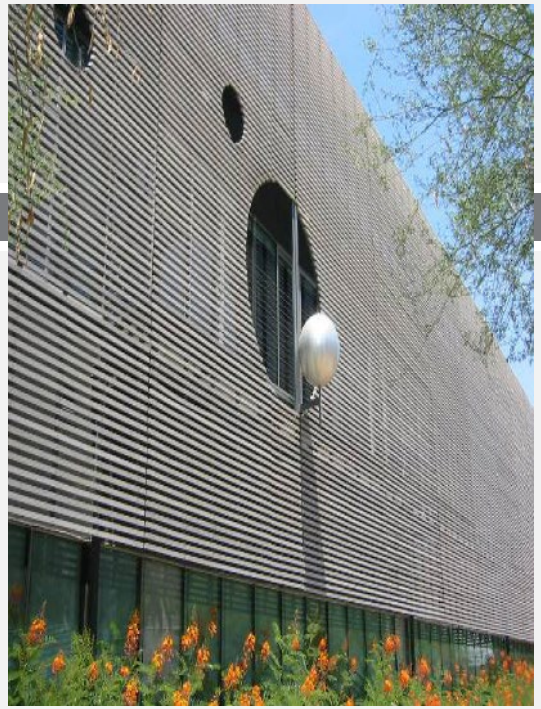


Photo credit: Marion Brenner

Colwell Shelor, Landscape Architects

Chp 5 - Sustainable Sites



Heat Island Mitigation (Mandatory)

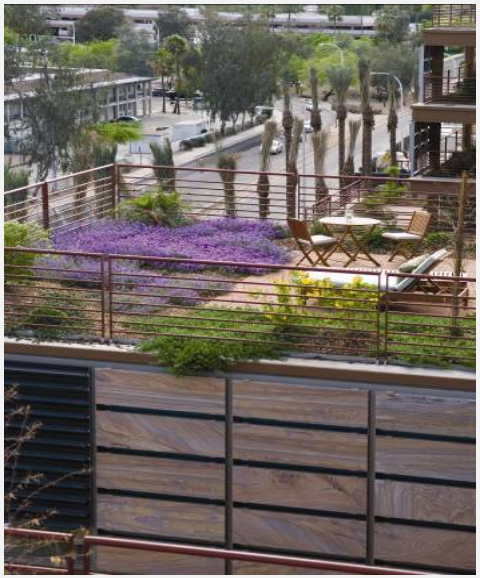
- **Site hardscape:** **Except CZ 6, 7, and 8**
  50% to be either shaded, minimum SRI of 29, or water-permeable hardscape
- **Wall:** **CZ 1–4 east walls, 1–6 west walls**
  30% to be shaded up to 20 feet above grade (or minimum SRI 29 level)

Shade by Trees and/or Architectural Elements

Chapter 5 - Sustainable Sites

Heat Island Mitigation (Mandatory)

- **Roofs:** **Applies CZ 0, 1, 2, and 3** minimum **three-year aged** SRI: min. 64 (low-slope) or 29 (steep-slope)
- Applies to areas not covered by mechanical equipment, renewable energy, rooftop walkways or vegetated roofs



Chapter 5 - Sustainable Sites

Transportation Impact Mitigation (Mandatory)

- Pedestrian walkways
- Bicycle paths and parking
- Preferred parking for low-emission vehicles or electric vehicle charging infrastructure

Image source: ChargePoint.com

City of Scottsdale

Planning, Neighborhoods and Transportation

IGCC Worksheet - Site Heat Island Mitigation

International Green Construction Code (IgCC)

Project Name _____ Date _____

Completed by _____ Firm Name _____

1. Site Hardscape. In accordance with Section 408.2 of the IgCC, not less than 50 percent of site hardscape shall be provided with one or any combination of options in the table below. Where trees are used to provide shade, shade coverage shall include only those hardscape areas directly beneath the trees based on a ten year growth canopy. Shade coverage can also be determined by using the arithmetic mean of the shade coverage calculated at 10 am, noon, and 3 pm on summer solstice. Shaded areas shall be shown on the construction documents demonstrating compliance with this section.

	Site Hardscape Location	Site Mitigation Options (check √ where applicable)				Hardscape Area (sq. ft.)	% of Total Site Hardscape Area
		Paving Material with an initial Solar Reflectance Value of not less than 0.30 (see Table 1 next page)	Paving Areas shaded by Structures	Paving Areas shaded by Trees	Pervious Paving including open-grid pavers and stablilized decomposed granite		
1							
2							
3							
4							
5							
6							
Qualifying Site Hardscape area (1 thru 6 above)							
Non-Qualifying Site Area (Other areas not included above)							
Total Site Harscape Area (Qualifying and Non-Qualifying)							
Total Percentage of Qualifying Site Hardscape Area (Qualifying Area ÷ Total Area)							

Table 1 - Solar Reflectance for Standard Paving materials

Paving Material	SRI	Reflectance	Emissivity
Typical new gray concrete	35	0.35	0.9
Typical weathered* gray concrete	19	0.20	0.9
Typical new white concrete	86	0.7	0.9
Typical weathered* white concrete	45	0.4	0.9
New asphalt	0	0.05	0.9
Weathered asphalt	6	0.10	0.9
* Reflectance of surfaces can be maintained with cleaning. Typical pressure washing of cementitious materials can restore reflectance close to original value. Weathered values are based on no cleaning.			

2. Roof Coverings. In accordance with Section 408.3 of the IgCC, not less than 75 percent of roof surfaces of buildings shall be provided with one or any combina-tion of the following options in the table below.

Exception: Portions of roof surfaces where solar thermal collectors, solar photovoltaic systems, roof penetrations and associated equipment, roof-top decks and walkways are provided shall be permitted to be deducted from the roof surface required to comply with this section.

Roof Location		Roof Mitigation Options		Roof Area (sq.ft.)	% of Total Roof Area
		Roof surface with min. aged solar reflectance, thermal emittance or SRI per **Table 2 below** (indicate value)	Vegetated Roof and/or Terraces		
1					
2					
3					
4					
Qualifying Roof Area (1 thru 4 above)					
Non-Qulaifying Roof Area (Other areas not included above)					
Total Roof Area (Qualifying and Non-Qualifying)					
Total Percentage of Qualifying Roof Area (Qualifying Area ÷ Total Area)					

Table 2 - Reflectance and Emittance for Roof Surfaces

Roof Slope	Minimum Aged Solar Reflectance	Minimum Aged Thermal Emittance	Minimum Aged SRI
Less than 2:12	0.55	0.75	60
2:12 or greater	0.30	0.75	25

CHAPTER/SECTION 6 - WATER USE EFFICIENCY

Chapter 6 - Water Use Efficiency

All Water Provisions are Mandatory

- Site water use (§6.3.1)
  - ***Irrigation:*** No more than one-third of improved landscape area shall be irrigated with potable water
  - ***Irrigation System Design:*** *Hydrozoning*
  - ***Controls:*** Smart irrigation controllers

Chapter 6 - Water Use Efficiency

Mandatory Provisions

- **Building water use (§6.3.2)**
  - Efficient plumbing fixtures per U.S. EPA WaterSense or ASME standards, with specific limit on flow amount or rate (*table next page*)
  - Appliances per U.S. EPA ENERGY STAR®, with water use factor for dwelling unit or public access

Plumbing Fixture Requirements

Table 6.3.2.1 Plumbing Fixtures and Fittings Requirements

Plumbing Fixture	Maximum
Water closets (toilets)—flushometer single-flush valve type	Single-flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—flushometer dual-flush valve type	Full-flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—single-flush tank-type	Single-flush volume of 1.28 gal (4.8 L)
Water closets (toilets)—dual-flush tank-type	Full-flush volume of 1.28 gal (4.8 L)
Urinals	Flush volume 0.5 gal (1.9 L)
Public lavatory faucets	Flow rate—0.5 gpm (1.9 L/min)
Public metering self-closing faucet	0.25 gal (1.0 L) per metering cycle
Residential bathroom lavatory sink faucets	Flow rate—1.5 gpm (5.7 L/min)
Residential kitchen faucets	Flow rate—1.8 gpm (6.8 L/min) [a]
Residential showerheads	Flow rate—2.0 gpm (7.6 L/min)
Residential shower compartment (stall) in *dwelling units* and guest rooms	Flow rate from all shower outlets total of 2.0 gpm (7.6 L/min)

a. With provision for a temporary override to 2.2 gpm (8.3 L/min) as specified in Section 6.3.2.1(g).

Chapter 6 - Water Use Efficiency

Mandatory Provisions

- **HVAC Systems, Equipment (§6.3.2.3):**
  - Once-through cooling with potable water is prohibited
  - Cooling towers and evaporative coolers shall be equipped with makeup and blowdown meters (threshold listings)
  - Cooling towers shall be equipped with efficient drift eliminators to achieve drift reduction
  - Condensate collection for reuse from AC units > 65,000 Btu/h in areas with ambient mean coincident wet bulb >72°F at 1% design cooling condition

Chapter 6 - Water Use Efficiency

Mandatory Provisions

- Commercial Food Service (§6.3.2.5):
  - Use **ENERGY STAR** or equivalent rated equipment
    - for items such as spray valves, dishwashers
  - Medical and laboratory facilities
    - specific criteria (beyond scope of this talk)

Commercial Dishwashers

ENERGY STAR

Efficiency Requirements for Dishwashers				
Machine Type	**High Temp Requirements**		**Low Temp Requirements**	
	Idle Energy Rate	Water Consumption	Idle Energy Rate	Water Consumption
Under Counter	<= 0.9 kW	<= 1.00 gal/rack	<= 0.5 kW	<= 1.70 gal/rack
Stationary Single Tank Door	<= 1.0 kW	<= 0.95 gal/rack	<= 0.6 kW	<= 1.18 gal/rack
Single Tank Conveyor	<= 2.0 kW	<= 0.70 gal/rack	<= 1.6 kW	<= 0.79 gal/rack
Multiple Tank Conveyor	<= 2.6 kW	<= 0.54 gal/rack	<= 2.0 kW	<= 0.54 gal/rack

Specification effective 2007

ENERGY STAR qualified include: High and low undercounter temp, single tank door type, single tank conveyor, and multiple tank conveyor machines

NOT Eligible to QUALIFY include: flight type dishwashers; dishwashers that include an optional manual rinse after the final sanitizing rinse

EPA

Water Measurement Thresholds

TABLE 601.3.4.1A (TABLE 6.3.4.1A)
WATER SUPPLY SOURCE MEASUREMENT THRESHOLDS

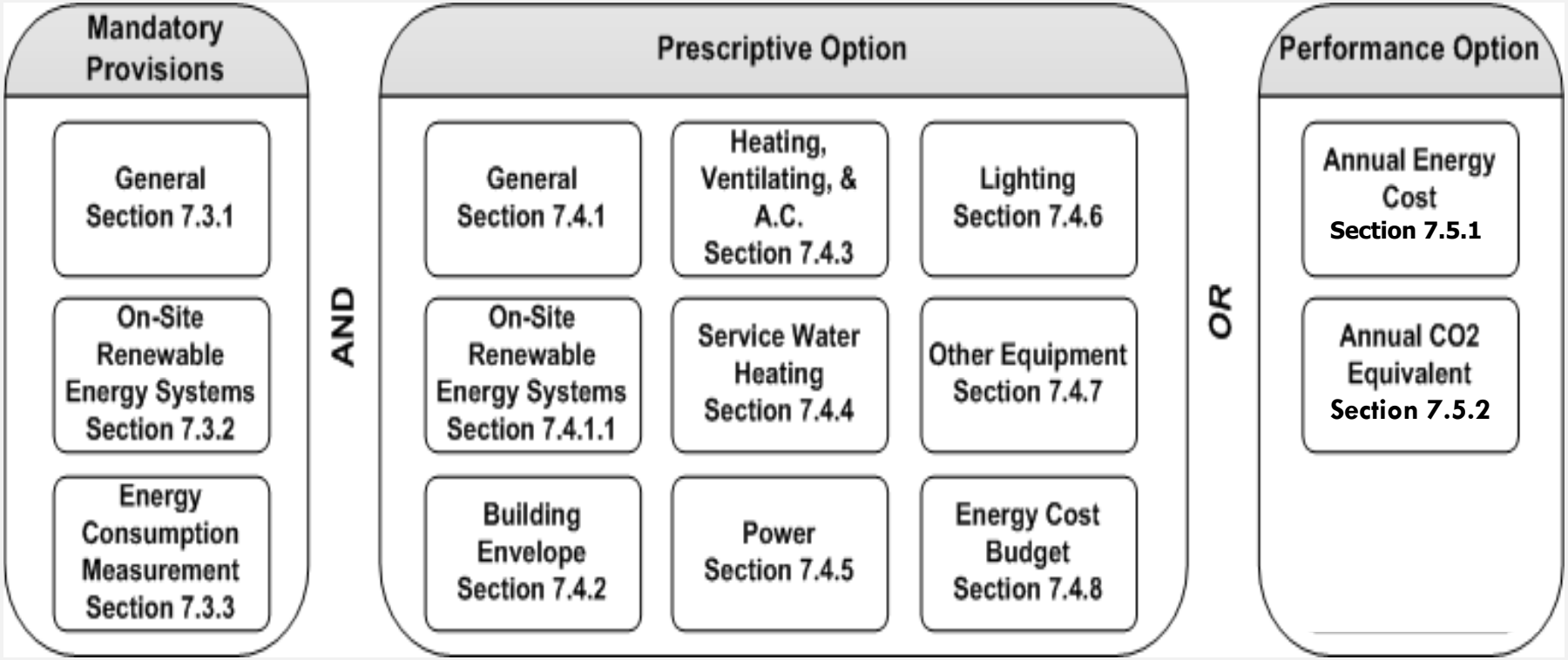
WATER SOURCE	MAIN MEASUREMENT THRESHOLD
Potable water	1000 gal/day (3800 L/day)
Municipally *reclaimed water*	1000 gal/day (3800 L/day)
Alternate sources of water	500 gal/day (1900 L/day)

TABLE 601.3.4.1B (TABLE 6.3.4.1B)
SUBSYSTEM WATER MEASUREMENT THRESHOLDS

SUBSYSTEM	SUBMETERING THRESHOLD
Cooling towers (meter on makeup water and blowdown)	Cooling tower flow through tower > 500 gpm (30 L/s)
Evaporative coolers	Makeup water > 0.6 gpm (0.04 L/s)
Steam and hot-water boilers	> 500,000 Btu/h (150 kW) input
Total irrigated landscape area with controllers	> 25,000 ft^2 (2500 m^2)
Separate campus or project buildings	Consumption > 1000 gal/day (3800 L/day)
Separately leased or rental *space*	Consumption > 1000 gal/day (3800 L/day)
Any large water-using process	Consumption > 1000 gal/day (3800 L/day)

CHAPTER/SECTION 7 - ENERGY

General Compliance Paths - Energy



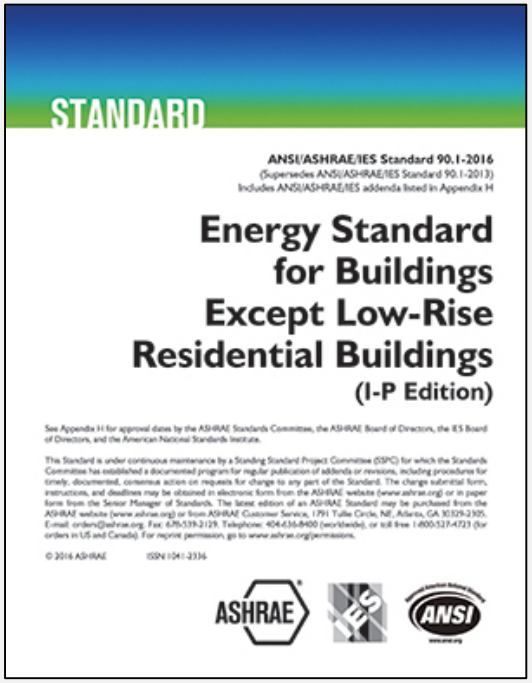
Automated Demand Response 7.3.4

OR

Informative Appendix H –
Option for Energy Efficiency using the
IECC Prescriptive Compliance Path

Mandatory: ASHRAE 90.1 (§7.3.1)

- Building projects shall be designed to comply with the mandatory provisions of ASHRAE Standard 90.1
  - Continuous air barrier exceptions in ASHRAE 90.1 does not apply unless Appendix H is adopted for IECC prescriptive compliance path



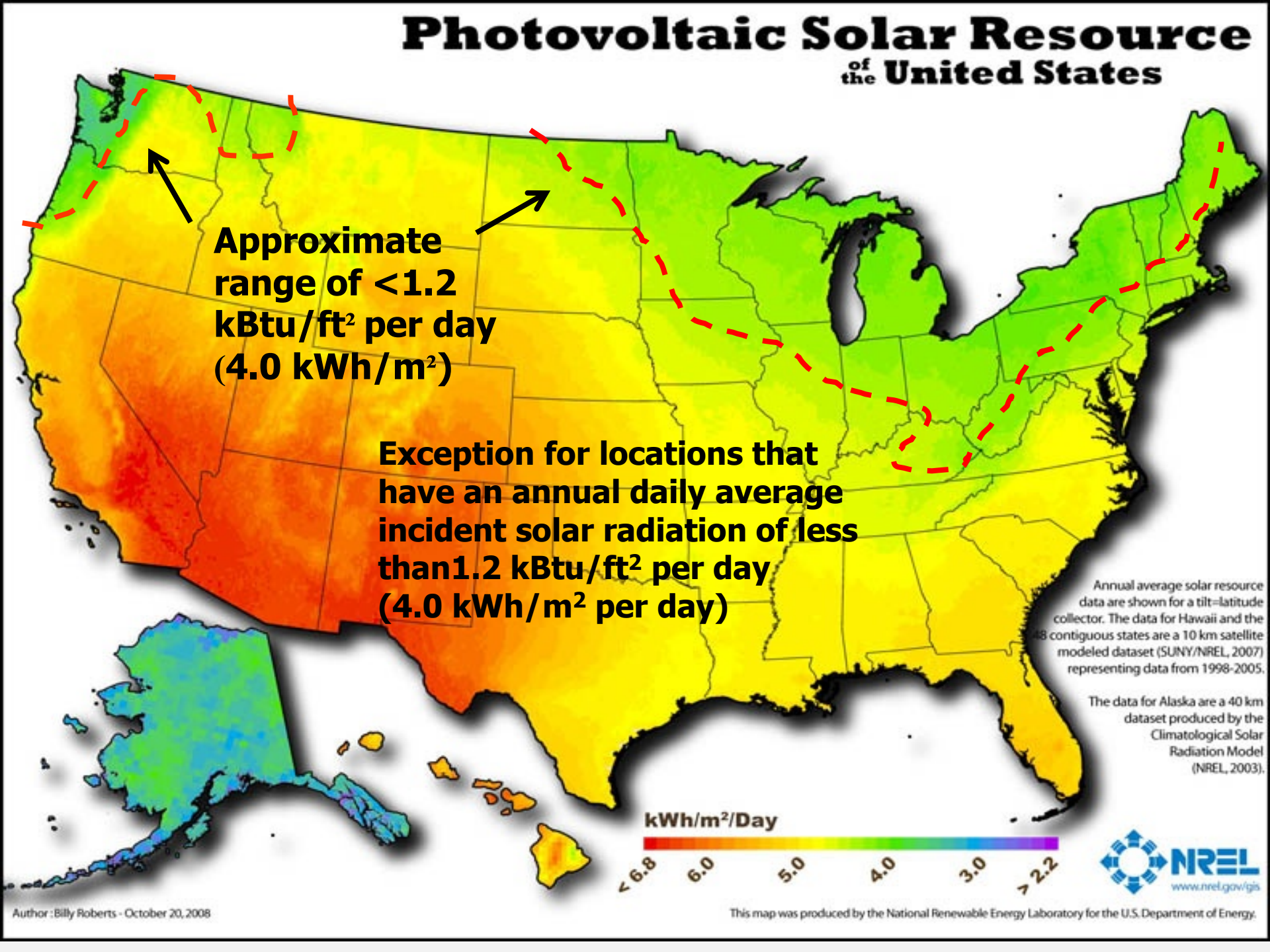
ASHRAE provides free online access to read-only versions of standards -

https://www.ashrae.org/standards-research--technology/standards--guidelines/otherashrae-standards-referenced-in-code

Mandatory: Renewable Ready

- On-site renewable power (§7.3.2)
  Allocated space and pathways for future installation of on-site renewable energy production
  - ≥6.0 kBtu/ft² (20 kWh/m²) for single-story buildings
  - ≥10.0 kBtu/ft² (32 kWh/m²) for multistory buildings

Photovoltaic Solar Resource of the United States



Mandatory: Energy Data Collection

- **Energy Consumption Management** (§7.3.3)
  - Collect energy consumption data for each energy supply source to the building including gas, electricity and district energy
  - Meters communicate to central recording system
  - Data storage for minimum 36 months showing hourly, daily, monthly, and annual energy consumption

Exception: Residential portions of buildings

Mandatory: 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)
Geothermal energy	>1,000,000 Btu/h (300 kW) heating
On-site renewable thermal energy	>100,000 Btu/h (30 kW)

Mandatory: Metering Thresholds

Table 7.3.3.1B System Energy Use Thresholds

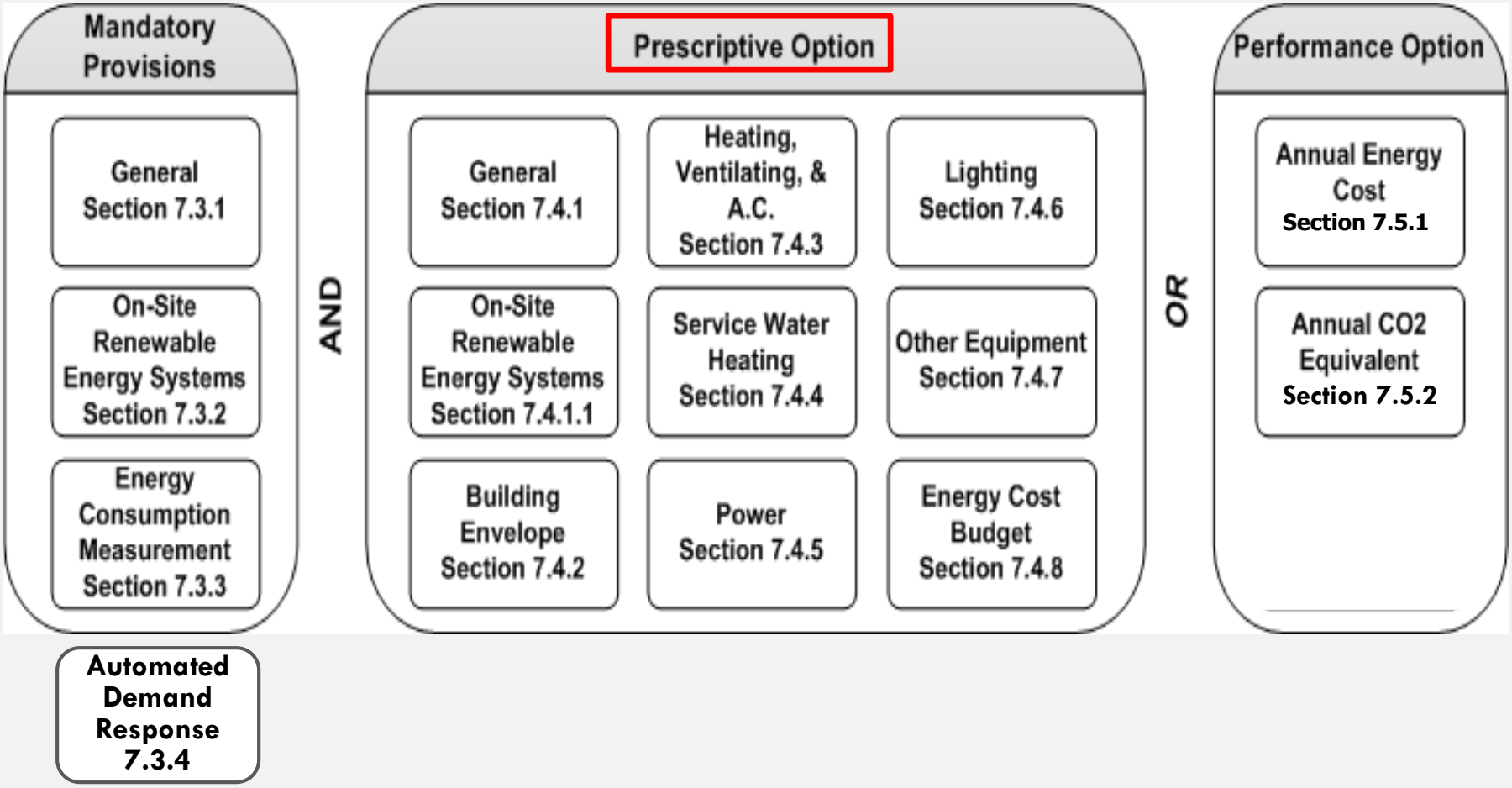
Use (Total of All Loads)	Subsystem Threshold
HVAC system	Connected electric load > 100kVA
	Connected gas or district services load > 500,000 Btu/h (150 kW)
People moving	Sum of all feeders > 50 kVA
Lighting	Connected load > 50 kVA
Process and plug process	Connected load > 50 kVA
	Connected gas or district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

Mandatory: Automated Demand Response

(where local utility infrastructure is available)

- **Buildings shall contain automatic control systems** (§7.3.4)
  - capability to reduce building equipment loads to lower electric peak demand of the building
  - communication with utility to receive demand response signals and implement load adjustments
- **During automated demand response (DR)**
  - HVAC setpoints adjusted by minimum of 3°F (1.7°C)
  - Variable-Speed control to max. speed of 90% of design speed
  - Lighting reduction by not less15% and not more than 50% of the baseline power level

General Compliance Paths - Energy



Prescriptive Option (§7.4)

- **General Prescriptive Requirements (§7.4.1)**
  - Where a requirement is provided, it supersedes the requirement in Standard 90.1, unless Appendix H is adopted by the jurisdiction for IECC prescriptive option.

- OR -

INFORMATIVE APPENDIX H

OPTION FOR ENERGY EFFICIENCY USING THE IECC PRESCRIPTIVE COMPLIANCE PATH

The purpose of this appendix is to provide users of the IECC, a correlated path, that facilitates the use of the prescriptive provisions of the IECC without directly relying on ASHRAE Standard 90.1.

Prescriptive: On-Site Renewable Energy

- **Two options for demonstrating compliance:**

1. **<u>Standard Approach (Baseline Renewable)</u>:** Provide on-site renewable energy systems that provide the annual energy production equivalent of not less than –
   - 6 kBtu/ft² of gross roof area for <u>single story</u>;
   - 10 kBtu/ft² of gross roof area for <u>multistory</u>

<u>Exception (must demonstrate compliance with both of these):</u>

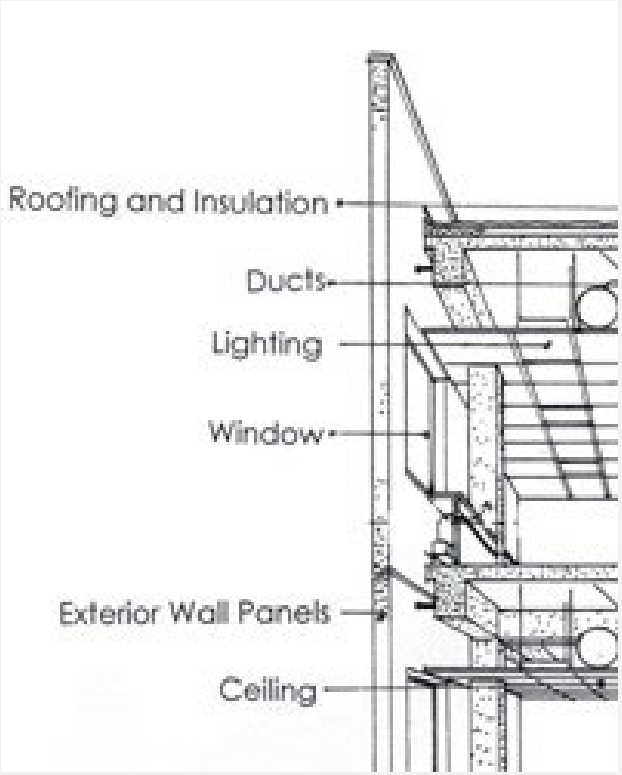
- Low incident solar radiation (<4.0 kWh/m²/day)
- Purchase of green power in terms of 7 kWh/ft²•yr annually until cumulative purchase of 70 kWh/ft²•yr

Prescriptive: On-Site Renewable Energy

- **Second option for demonstrating compliance:**
  2. **Alternate Renewable Approach:** Reduced On-Site Renewable Energy and Higher-Efficiency Equipment (Normative App. B)
     - Not less than 4 kBtu/ft² of gross roof area for single story;
     - Not less than 7 kBtu/ft² of gross roof area for multistory

Prescriptive: Building Envelope (§7.4.2)

- **Comply with building envelope prescriptive requirements in Std 90.1, as modified in this section:**
  - Opaque elements and fenestration reduction U-factors reduced by **5%**
  - Solar heat gain coefficient (SHGC) for skylights and east/west oriented fenestration reduced by **5%**
  - SHGC reduction for skylights are not required in spaces meeting day-lighting area requirements in §8.4.1



Source: Whole Building Design Guide

Prescriptive: Building Envelope

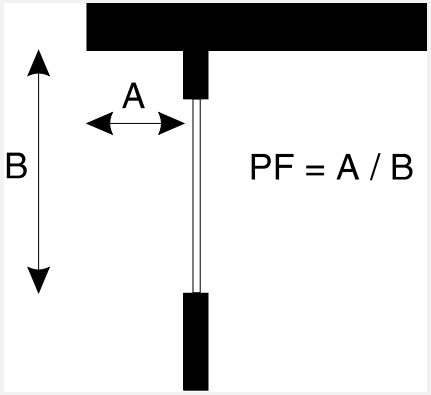
- Vertical fenestration shall be less than 40% of gross wall area (§7.4.2.5)
- Supersedes ASHRAE 90.1 vertical fenestration requirements of not more than 40% (0 to 40%)

Note: Appendix H IECC option requires compliance with the fenestration limit of 30% or 40% based on daylighting and responsive controls.

Prescriptive: Building Envelope

Permanent Projections

- Overhang: PF of not less than 0.5 for first story and 0.25 for other stories **(§7.4.2.6)**
- East, west & south orientations
- Climate zones 0–3, plus 4B & 4C



<u>Exceptions</u>: 18" of lot line, shade from adjacent structures, exterior shading devices, automated controlled shading in response to daylight levels or dynamic glazing

Prescriptive: Building Envelope

- **Orientation:** These requirements push toward "optimal" window placement and selection **(§7.4.2.9)**
- Vertical fenestration shall comply with either (a) or (b):

a. $A_W \leq (A_N + A_S)/4$ and $A_E \leq (A_N + A_S)/4$

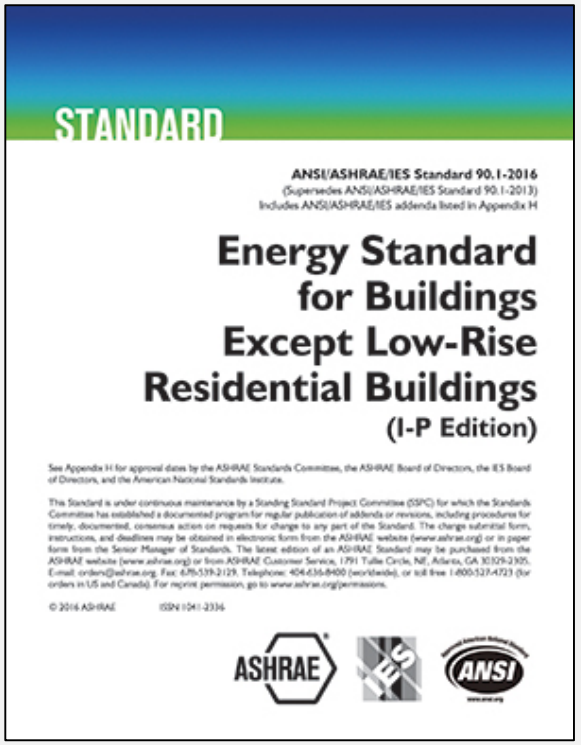
b. $A_W \times SHGC_W \leq (A_N \times SHGC_C + A_S \times SHGC_C)/6$ and $A_E \times SHGC_E \leq (A_N \times SHGC_C + A_S \times SHGC_C)/6$

Exceptions: 1) Buildings where the west- and east-oriented vertical fenestration areas do not exceed 20% of the gross wall area for each of those facades; 2) Buildings with shade on 75% of the west- and east-oriented vertical fenestration areas from permanent projections, existing buildings or structures

Prescriptive: HVAC (§7.4.3)

- **Based on Std 90.1 but modifications for improved energy performance over code minimum standards**
- Minimum Equipment Efficiencies
  - Projects complying with the Alternate Renewables Approach must comply with Higher Equipment Efficiencies requirements in Normative Appendix B and applicable ENERGY STAR requirements

Note: Appendix H option requires compliance with IECC mechanical provisions and IgCC modifications.



Prescriptive: Ventilation Controls for Densely Occupied Spaces (§7.4.3.2)

- Supersedes Std 90.1 DCV Requirements
- DCV shall be provided for *densely occupied spaces* served by systems with one or more of the following:
  - Air-side economizer
  - Automated modulating control of OA dampers
  - Design OA flow >1000 cfm

Note: Type of DCV control is not specified

Exceptions:
- design outdoor airflow <750 cfm
- Exhaust energy recovery
- ≥75% space outdoor airflow used as makeup or transfer air for other spaces
- Prison cells, daycare sickrooms, science lab, barber, beauty salon, bowling alleys

Prescriptive: Automatic Control of HVAC in Hotel/Motel Guest Rooms (§7.4.3.10)

- Within 30 minutes of occupants leaving the guest room, in hotels/motels (>50 guest rooms) power for lighting, switched outlets, TV control, and HVAC (setback), shall be automatically turned off

- Reset thermostat for unrented or unoccupied rooms
- Captive keycard systems are not acceptable

Prescriptive: Lighting Power Allowance (§7.4.6)

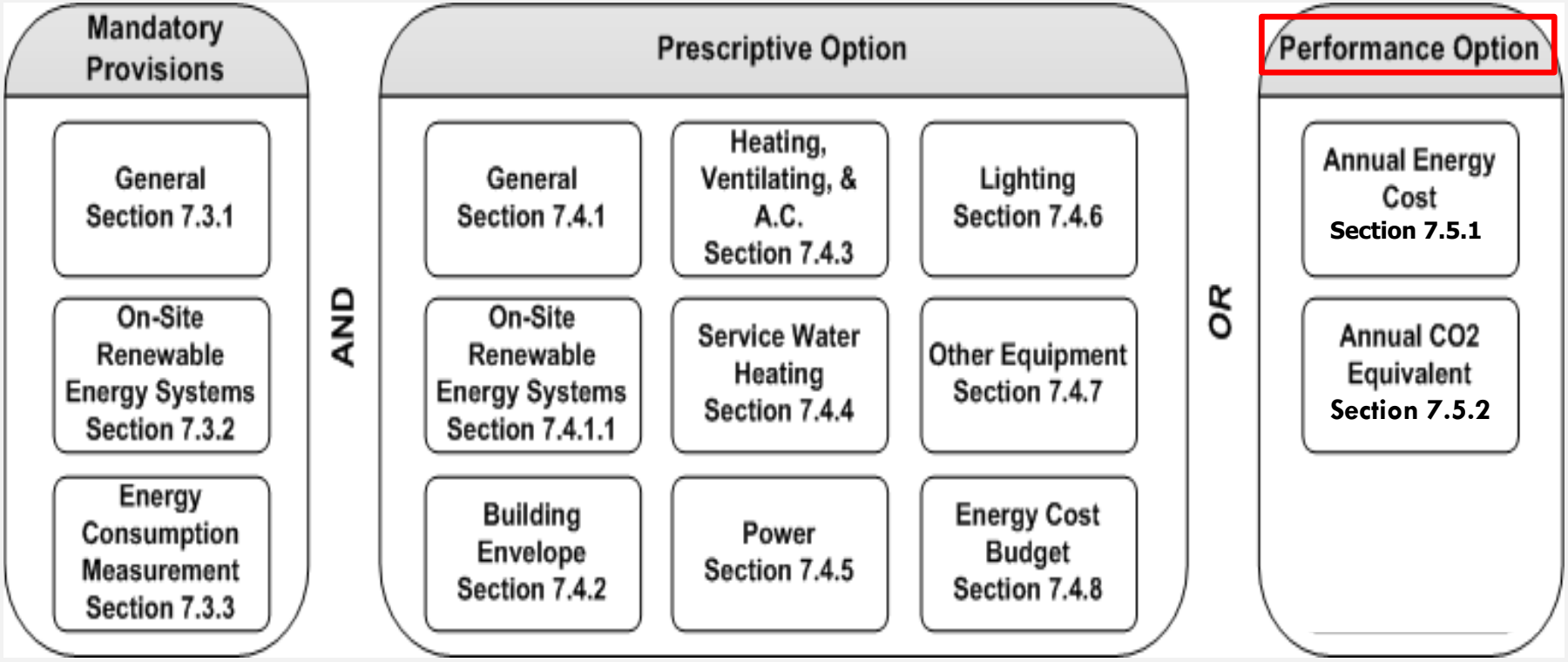
- Interior and exterior lighting power allowance reduced from Tables 9.5.1(Building Area) or 9.6.1(Space-by-Space) in ASHRAE Std 90.1
  - Updated values

Note: Appendix H option requires compliance with IECC lighting provisions along with IgCC modifications.

TABLE 701.4.6.1A (TABLE 7.4.6.1A)
LIGHTING POWER DENSITIES USING THE BUILDING AREA METHOD

BUILDING AREA TYPE*	LPD, W/ft²	LPD, W/m²
Automotive facility	0.64	6.9
Convention center	0.51	5.5
Courthouse	0.74	8.0
Dining: Bar lounge/leisure	0.69	7.4
Dining: Cafeteria/fast food	0.66	7.1
Dining: Family	0.61	6.6
Dormitory	0.52	5.6
Exercise center	0.61	6.6
Fire station	0.50	5.4
Gymnasium	0.67	7.2
Health care clinic	0.68	7.3
Hospital	0.86	9.3
Hotel/Motel	0.70	7.5
Library	0.72	7.8
Manufacturing facility	0.60	6.5

General Compliance Paths - Energy



Energy Performance-Based Option

Annual Energy Cost (§7.5.1)

- The proposed building performance cost index (PCI) shall be calculated in accordance with ASHRAE Std 90.1, Appendix G and be equal to or less the PCI Target

Annual Carbon Dioxide Equivalent

- The proposed design shall have an annual CO_2e equal to or less than the annual CO_2e of the baseline building design multiplied by the building performance factor (BPF) target (90.1, Appendix G)

CHAPTER/SECTION 8 - INDOOR ENVIRONMENTAL QUALITY

Areas of Concern with Indoor Environmental Quality

- Ventilation requirements
- Outdoor air delivery monitoring
- Contaminant source control
- Environmental tobacco smoke
- Building entry systems
- Thermal comfort
- Acoustics
- Lighting (daylighting, light quality, glare)
- Pressurization and humidity control
- Occupant IEQ surveys

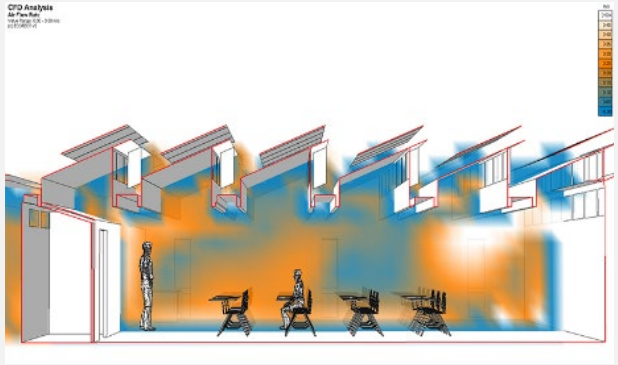
IEQ - Mandatory: Ventilation Rate and Monitoring

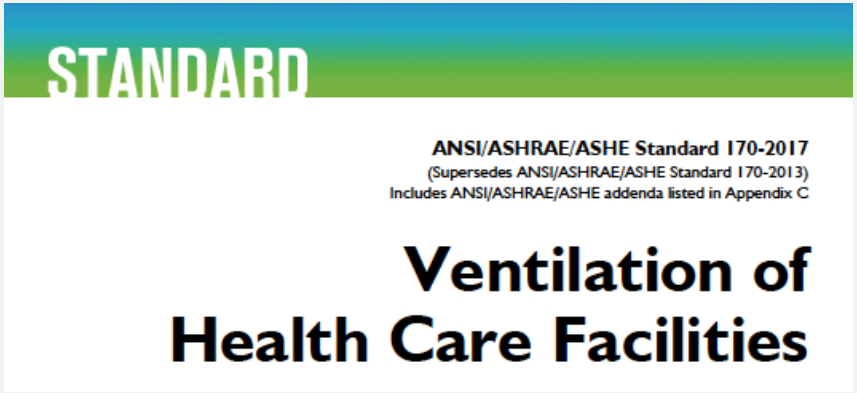
§8.3.1 IAQ

- Rate per Standard 62.1, using ventilation rate procedure (Healthcare use Std. 170)

§8.3.1.2 Outdoor Air Monitoring

- Permanently installed outdoor airflow measurement device
  ±**10**% of ***minimum outdoor airflow***
  (Differs from LEED in that CO_2 monitoring for densely occupied spaces is not specified)



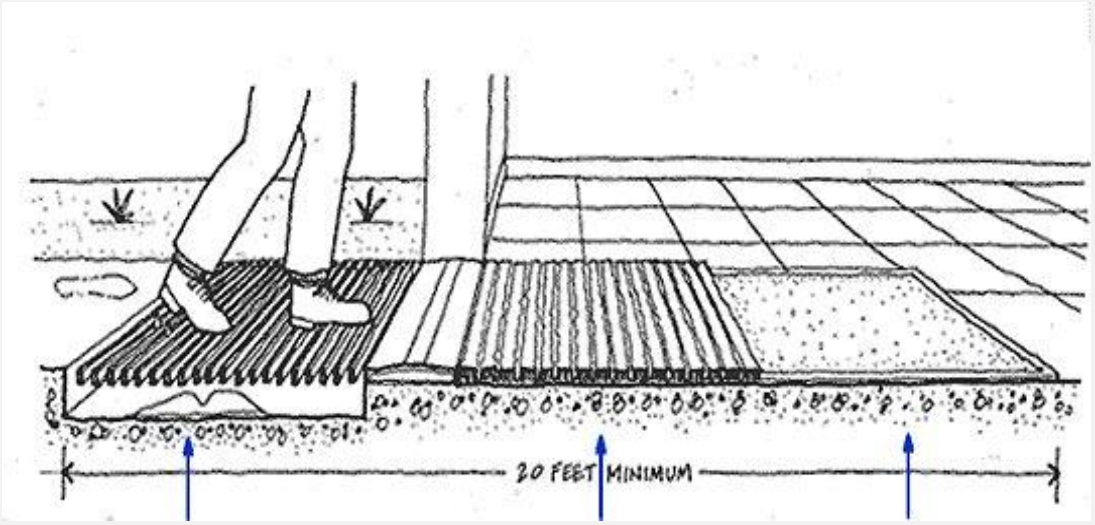


IEQ—Mandatory: Smoking and Building Entrances

- §8.3.1.7

  Environmental Tobacco Smoke Control

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



Source: EPA

- §8.3.1.8

  Entryway floor system

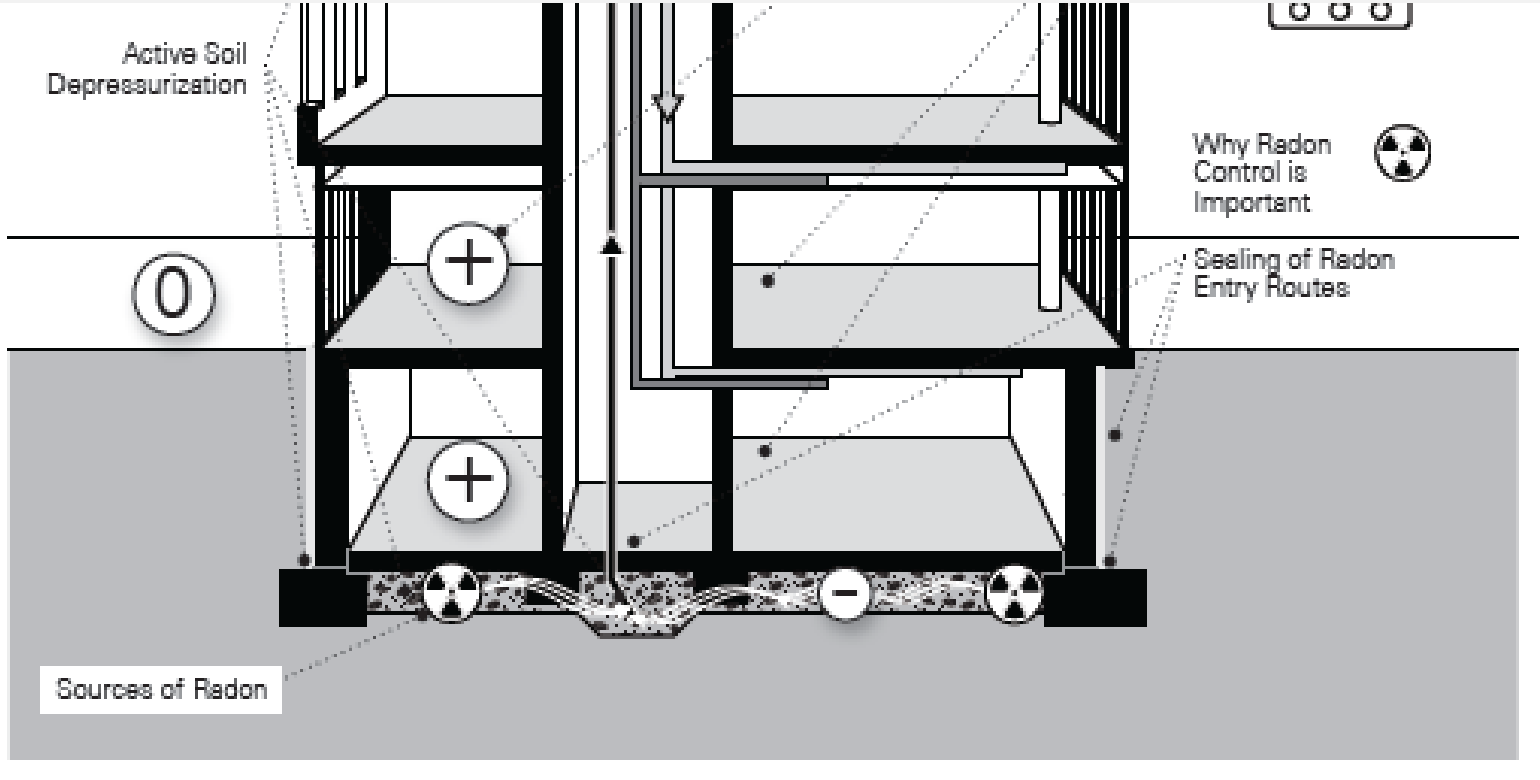
  - *Scraper Surface*
  - *Absorption surface*
  - *Finishing Surface*

Pre-Occupancy Purge and Ventilation

- **Guest Room Preoccupancy Outdoor Air Purge Cycle §8.3.1.9**
  - Automatic purge cycle that provide outdoor air ventilation at the design ventilation rate for 60 minutes or at a rate and duration equivalent to one air change
  - Purge cycle shall be completed within 60 minutes prior to the time the room is scheduled for occupancy
- **Preoccupancy Ventilation Control for zones not continuously occupied for 24 hours §8.3.1.10**
  - continuously at the system design minimum outdoor airflow for a period of one hour prior to expected occupancy

IEQ - Mandatory: Isolation from Soil Pollutants §8.3.4

- Soil gas retarder for spaces immediately <u>above crawlspaces, slab on grade, or basement slabs</u>



IEQ—Mandatory: Lighting Quality

§8.3.5

- **Enclosed office spaces:** Provide at least one of the following for 90% of offices with less than 250 ft²
  - Multilevel lighting control or
  - Bi-level lighting control with separate task lighting
- **Multi-occupant spaces**
  - Multilevel lighting control required for conference rooms, meeting rooms, multipurpose rooms, classrooms
  - At least two separate controlled groups of luminaires required for gymnasiums, auditoriums, ballrooms, and cafeterias

Prescriptive Option (§8.4)

Daylighting

Office space shading

Low-emitting materials

IEQ - Prescriptive: Daylighting

Daylighting in large spaces directly under roof and high ceilings

- Required for spaces under three stories, greater than 2,500 ft², and with a ceiling height greater than 15 ft
  - Not less than 50% of the floor area shall be in the daylight area with adjustments for partitions, etc.
  - More flexibility and clarified definitions

With exceptions for Climate Zones 7 and 8, and certain building types (auditorium, etc)

IEQ - Materials (for IAQ)

§8.4.2

- Sets requirements for materials that emit volatile organic compounds (VOCs) as a total VOC or individual compounds such as formaldehyde
  - Adhesives and sealants
  - Paints and coatings
  - Floor coverings
  - Composite wood, wood structural, and agrifibers

IEQ—Performance Option

Daylighting Simulation

Materials Emissions

Lighting for Presentations

IEQ—Performance Option: Daylighting simulation

- Computer models shall use an hourly simulation and adhere to modeling protocols in IES LM83 for spatial daylight autonomy (sDA) and annual sunlight exposure (ASE) calculations
  - Daylight simulation must include areas that are required under the prescriptive provisions in Section 8.4.1
  - Sets minimum daylit levels
  - Minimize direct sun limitation on office worksurface

IEQ—Performance Option: Materials

- Modeling for individual VOC concentrations for each material used, sum total to show compliance with CDPH/EHLB/Standard Method V1.1 (CA Section 1350)

Source: Scott Credit Union Home Office.

CHAPTER/SECTION 9 - BUILDINGS IMPACT ON ATMOSPHERE, MATERIALS, AND RESOURCES

Materials and Resources

Mandatory

- Construction waste management, materials extraction and harvesting, no CFC-based refrigerants, low-mercury lamps, storage for recyclable and discarded goods

Prescriptive Option

- Reduced impact materials (recycled or salvaged, regional, bio-based)

Performance Option

- Life-cycle assessment

Mandatory: Construction Waste Management (§9.3.1)

- **Construction Waste Management**
  - Divert 50% of non-hazardous waste, demolition debris
  - Total waste limit of 42 yd^3 or 12,000 lb per 10,000 ft^2
  - Construction waste management plan
  - Reuse includes donations to charitable organizations, salvage use, reclamation by manufacturers, return of packaging materials

Mandatory: Refrigerants, Recyclable and Reusable Materials (§9.3.3, §9.3.4)

- No CFCs; fire suppression systems contain no ozone-depleting substances (CFCs, HCFCs , halons)

Source: Steelcase

- Areas for storage and collection of recyclable materials, reusable materials, discarded fluorescent lamps and ballasts, electronics and batteries

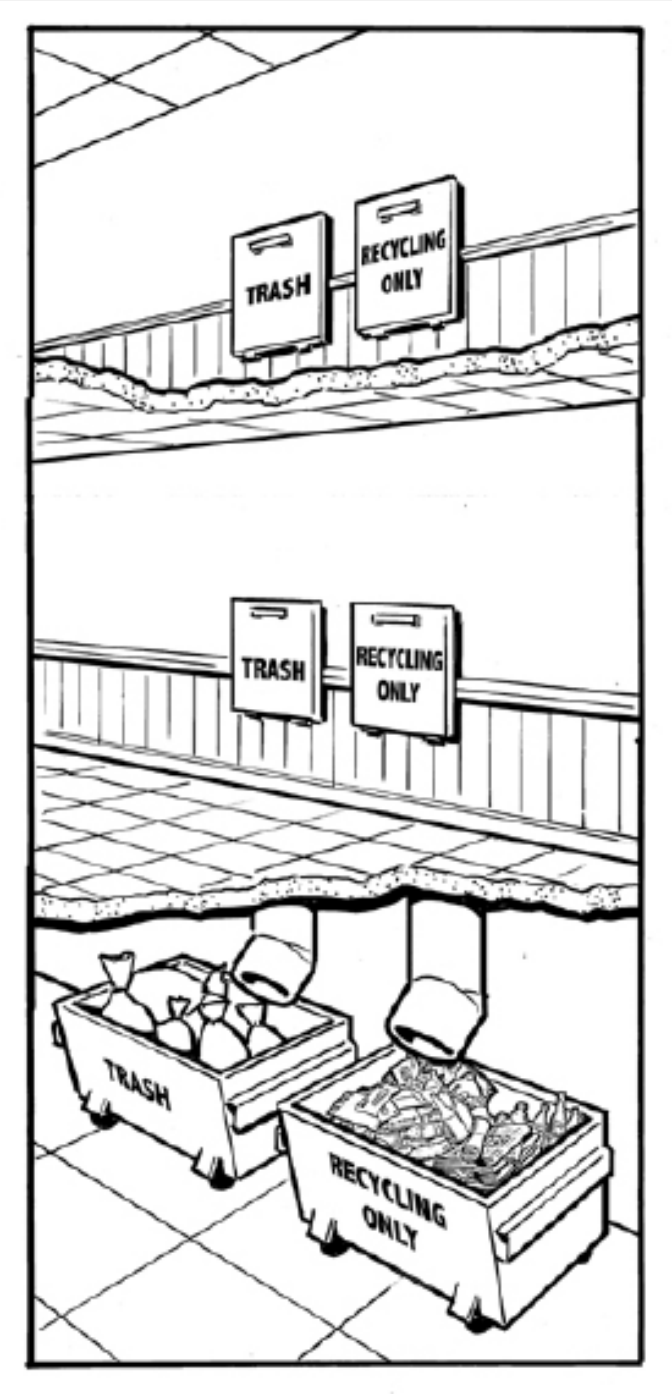
Accommodation for Trash and Recycling Collection

Pull out bins in kitchen

Recycling in Dwellings

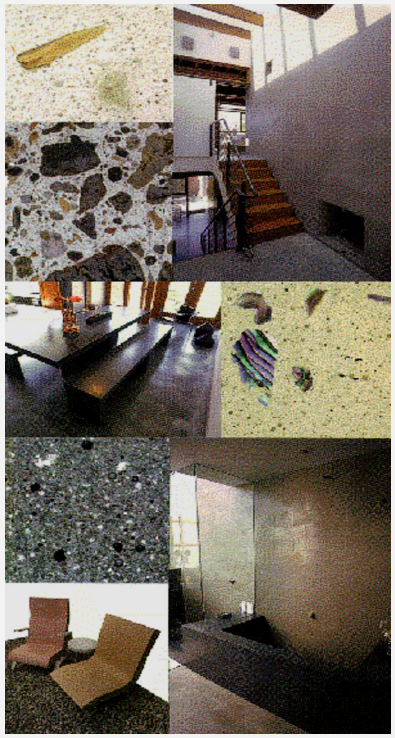
Trash and Recycling in Multistory Buildings

Trash and Recycling Chutes



Prescriptive: Reduced Impact Materials (§9.4.1)

- **Reduced impact materials**
  Comply with two of the items listed:
  - Min. 10% by cost recycled, salvaged
  - Min. 15% by cost regionally (500-mile radius) extracted, processed, manufactured
  - Min. 5% by cost biobased products (wood, bamboo, wool, etc.) and wood building component - not less than 60% certified content
  - Multiple-attribute product declaration or certification
    - min. of 10 different products



Performance Option (§9.5)

- ***Life-cycle assessment (LCA)*** per ASTM E2921 & ISO 14044
- LCA shall demonstrate that the proposed building design achieves improvements over the reference building design
  - LCA to show 10% improvement in two impact categories, one of which must be global warming - or –
  - LCA to show 5% improvement in three impact categories, one of which must be global warming:

Impact categories include - land use, resource use, global warming, zone layer depletion, human health effects, ecotoxicity, smog, acidification, and eutrophication

CHAPTER/SECTION 10 – CONSTRUCTION AND PLANS FOR OPERATION

Construction and Plans for Operation

All Mandatory Provisions:

- **Construction** (§10.3.1)
  - **Functional Performance Testing**
    - HVAC systems over 180,000 Btu/h for cooling and 300,00 Btu/h for heating
    - Lighting systems over 5kW
    - Domestic water-heating systems over 50,000 Btu/hr
    - Water pumping and mixing systems over 5 hp
    - Irrigation systems that use more than 1000 gal

Building Commissioning Process

- Full Cx process for buildings greater than 10,000 ft^2 in accordance with ASHRAE Std. 202 and shall include the following:
  - HVAC
  - Air-curtain systems
  - Lighting systems
  - Domestic hot-water systems
  - Water pumping and mixing systems
  - Irrigation system performance
  - Renewable energy and energy storage systems

Plans for Operation (§10.3.2)

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

CITY OF SCOTTSDALE
PLANNING, NEIGHBORHOODS AND TRANSPORTATION DIVISION
BUILDING COMMISSIONING CERTIFICATE
2015 International Green Construction Code (IgCC)

Project Name :_____ Date:_____

Address :_____ Plan Check No.:_____ Permit No.:_____

OWNER'S NOTIFICATION OF COMMISSIONING AGENCY
To be filled in and signed by Owner before a building permit is issued.

The International Green Construction Code requires an approved commissioning agency to ensure buildings are constructed and commissioned in accordance with the approved plans and specifications. The registered design professional or designated consultant involved in the design of the project is permitted to act as the commissioning agency.

I, as owner/legal agent, do hereby certify that I have retained _____ to be responsible for building commissioning services in accordance with this certificate.

Signed : _____ Print name: _____
(signature of owner or legal representative)

Relation to Project (owner/legal agent): _____ Date: _____

CERTIFICATE OF RESPONSIBILITY - COMMISSIONING AGENCY
To be filled in and signed by the commissioning agency before a building permit is issued.

As the commissioning agency for the above named project, I certify that I am familiar with the design of the project and hereby assume full responsibility for carrying out the required verification and commissioning responsibilities in accordance with this certificate.

Signed : _____ Print name: _____
(signature of commissioning agency representative)

Name of Commissioning Agent: _____ Date: _____
(commissioning agency must be independent from the contractor responsible for the work being inspected)

VERIFICATION AND COMMISSIONING RESPONSIBILITIES

✔	IGCC Section No.	Construction or System requiring Verification and Commissioning	Pre-C of O	Post-C of O	Responsible Party
		Chapter 4 – Site Development			
	404.1	Landscape irrigation systems	X		
	407.3	Bicycle parking and storage	X		
	407.4	Preferred vehicle parking	X		
	408.2	Hardscape and shading	X		
	408.3.1	Roof coverings	X		
	408.3.2	Vegetative roofs	X	X	
		Chapter 5 – Material Resource Conservation and Efficiency			
	503	Construction waste management	X		
	504	Waste management/recycling for occupants	X		
	505	Material selection	X		

Chapter 6 – Energy Conservation and Efficiency					
	603	Energy metering, monitoring and reporting	X		
	605	Building envelope systems	X		
	606	Building mechanical systems	X		
	607	Building service water heating systems	X		
	608	Building electrical power and lighting systems	X		
	609	Specific appliances and equipment	X		
	610	Building renewable energy systems	X		
	611	Energy systems commissioning	X	X	
Chapter 7 – Water Resource Conservation and Efficiency					
	701.2	Water usage metering	X	X	
	702	Fixtures, fittings, equipment and appliances	X		
	703	HVAC water systems and equipment	X	X	
	704	Water treatment devices and equipment	X	X	
Chapter 8 – Indoor Environmental Quality and Comfort					
	802	Air-handing system access and filters	X		
	803	HVAC systems	X	X	
	805	Prohibited materials	X		
	806	Material emissions and pollutant control	X		
	808	Daylighting	X		
Chapter 9 – Commissioning, Operation and Maintenance					
	903	Building operation & maintenance documentation	X	X	

Processed by Anthony Floyd, FAIA, LEED AP, Green Building Manager

City Plans Examiner / IgCC Evaluation Date

CERTIFICATE OF COMPLIANCE - COMMISSIONING AGENCY

To be signed by commissioning agency after completion of project and prior to Certificate of Occupancy being issued.

I certify that, to the best of my knowledge, the requirements of the International Green Construction Code and the approved plans and specifications have been complied with, insofar as the portion of the work requiring verification and commissioning in accordance with the responsibilities listed on this certificate. A pre-occupancy commissioning report has been provided to the building owner indicating that the work was or was not completed in conformance with the approved construction documents and discrepancies have been brought to the attention of the contractor for correction.

Within 12 months after issuance of the Certificate of Occupancy, a final commissioning report shall be provided to the owner in accordance with the commissioning responsibilities listed on this certificate. The report shall identify performance deficiencies and necessary remedies. Contractor's responsibilities shall be in accordance with the performance obligations set by the Arizona Registrar of Contractors.

Signed : _____ Print name: _____

(signature of approved commissioning agency representative)

Name of Commissioning Agency: _____ Date: _____

(commissioning agency must be independent from the contractor responsible for the work being inspected)

Copy – to be maintained in plan review records after the Certificate of Responsibility box (page 1) is signed.
Original – to be retained by commissioning agency until completion of project and Certificate of Compliance (page 2) is signed; then returned to Building Inspections prior to issuance of Certificate of Occupancy.

In summary …

- IgCC is a joint document between ASHRAE and ICC
- In the U.S. and Canada, the IgCC serves as a model code providing a minimum set of requirements for high performance green buildings
- IgCC does not become law unless adopted by a governing jurisdiction (city, county, state)
- IgCC can be amended by local jurisdictions
- As the building industry evolves, IgCC provisions will merge into other construction codes

Thank you!

- Comments, questions, concerns, advice …

Anthony Floyd, Fellow AIA, BEAP, CEM, LEED BD+C
Office of Environmental Initiatives, City of Scottsdale

ICC 2019
LAS VEGAS NEVADA

Thank You For Attending

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