Rebuilding Efficient Communities

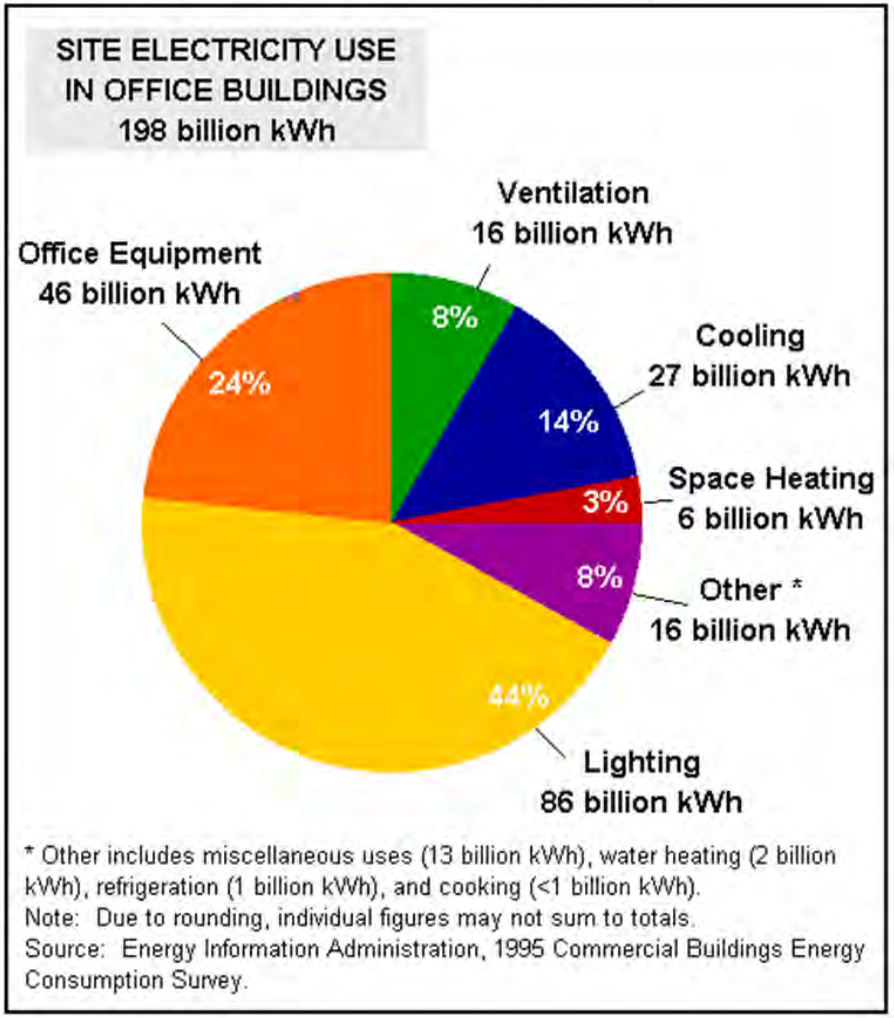
Bourke Reeve

LEED AP, BPI Building Analyst, MHP

Southface

Photo: Jonathan Hillyer, 2009

Energy Use in Commercial Buildings



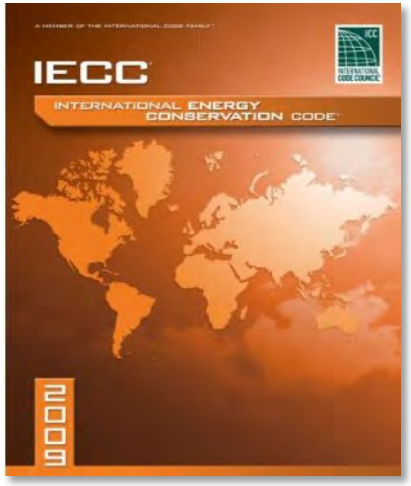
Source: U.S. Energy Information Administration, *2003 Commercial Building Energy Consumption Survey,* Table E1A (September 2008).

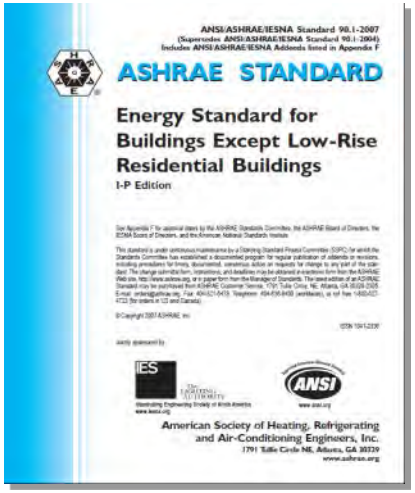
- Where do commercial Buildings use energy?
- Typically lighting is one of the largest energy users in commercial buildings
- Lighting also effects HVAC cooling loads
- Each building is unique
- Your results may vary
- **How do we control these costs?**

The Alabama Commercial Energy Code IECC 2009 & ASHRAE 90.1-2007

Photo: Jonathan Hillyer, 2009

IECC 2009 – Section 501





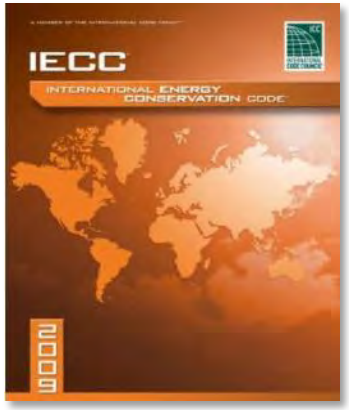
General

- Two Compliance Paths
  - IECC 2009 Chapter 5
  - ASHRAE 90.1-2007
- Downloads of each code
  - www.iccsafe.org/store/pages/doeregistration.aspx
  - www.ashrae.org/publications/page/2728
    (free downloads are gone but ASHRAE 90.1-2007 may be purchased for only $19)

Summary of the Commercial Codes

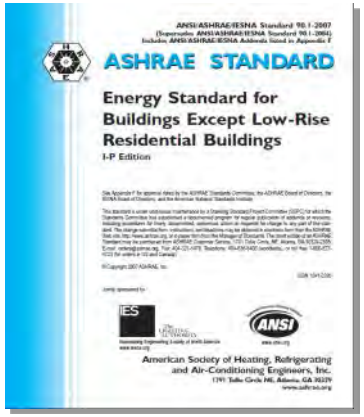
IECC 2009 Chapter 5

- 501 – General
- 502 – Building Envelope Requirements
- 503 – Building Mechanical Systems
- 504 – Service Water Heating
- 505 – Lighting
- 506 – Total Building Performance

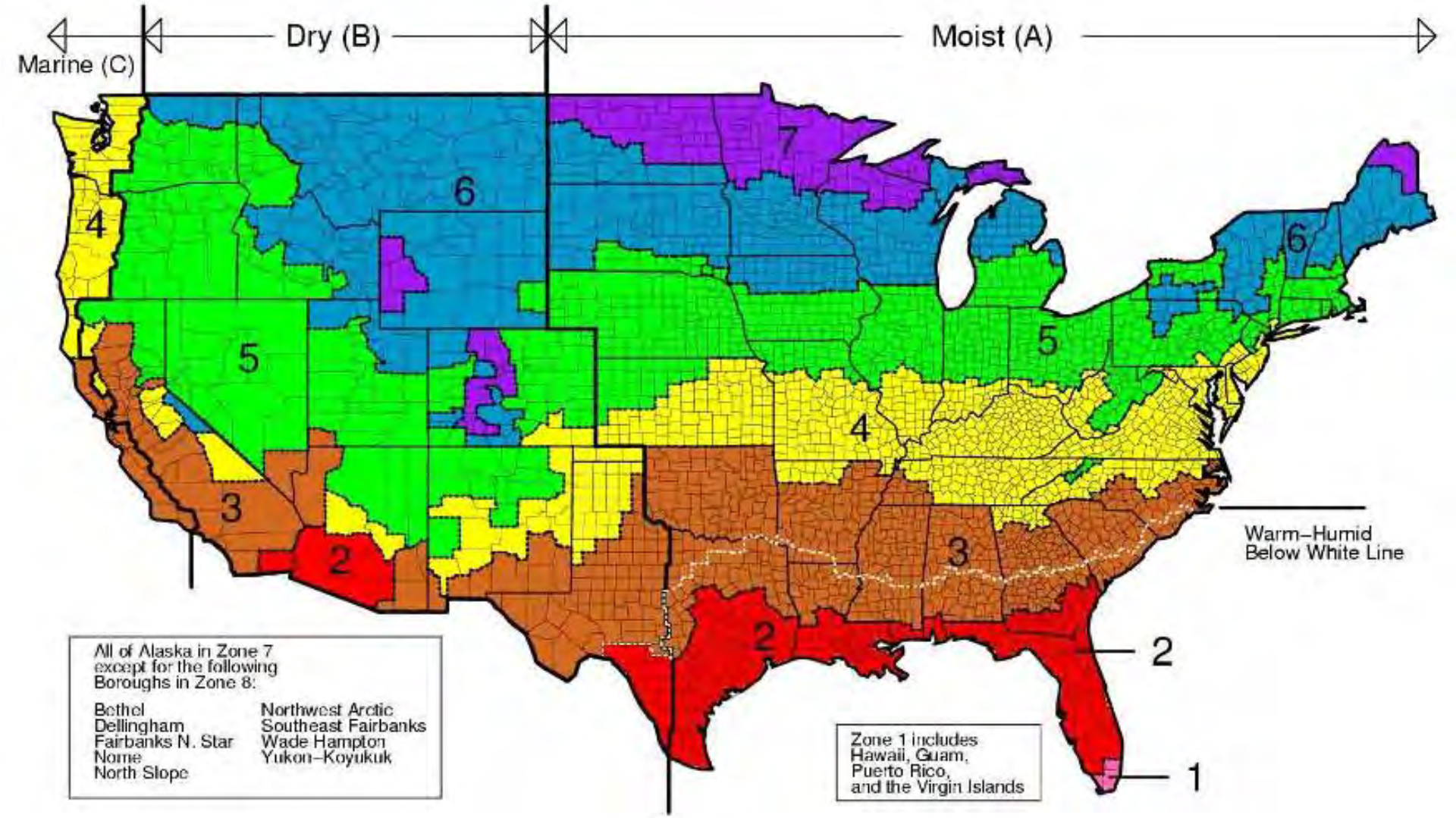


ASHRAE 90.1-2007

- Section 1-4 – General
- Section 5 – Building Envelope
- Section 6 – Heating, Ventilating, & Air Conditioning
- Section 7 – Water Heating
- Section 8-9 – Power & Lighting
- Section 10 – Other Equipment
- Section 11 – Energy Cost Budget Method



2009 IECC / ASHRAE 90.1 Climate Zones



Note: AL is in Climate Zone (CZ) 2A & 3A

Section 5.5-3: Prescriptive Chart – CZ3

TABLE 5.5-3 Building Envelope Requirements For Climate Zone 3 (A, B, C)*

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.048	R-20.0 c.i.	U-0.048	R-20.0 c.i.	U-0.173	R-5.0 c.i.
Metal Building	U-0.065	R-19.0	U-0.065	R-19.0	U-0.097	R-10.0
Attic and Other	U-0.027	R-38.0	U-0.027	R-38.0	U-0.053	R-19.0
Walls, Above-Grade						
Mass	U-0.123	R-7.6 c.i.	U-0.104	R-9.5 c.i.	U-0.580	NR
Metal Building	U-0.113	R-13.0	U-0.113	R-13.0	U-0.184	R-6.0
Steel-Framed	U-0.084	R-13.0 + R-3.8 c.i.	U-0.064	R-13.0 + R-7.5 c.i.	U-0.124	R-13.0
Wood-Framed and Other	U-0.089	R-13.0	U-0.089	R-13.0	U-0.089	R-13.0
Walls, Below-Grade						
Below-Grade Wall	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.107	R-6.3 c.i.	U-0.087	R-8.3 c.i.	U-0.322	NR
Steel-Joist	U-0.052	R-19.0	U-0.052	R-19.0	U-0.069	R-13.0
Wood-Framed and Other	U-0.051	R-19.0	U-0.033	R-30.0	U-0.066	R-13.0
Slab-On-Grade Floors						
Unheated	F-0.730	NR	F-0.730	NR	F-0.730	NR
Heated	F-0.900	R-10 for 24 in.	F-0.900	R-10 for 24 in.	F-1.020	R-7.5 for 12 in.
Opaque Doors						
Swinging	U-0.700		U-0.700		U-0.700	
Nonswinging	U-1.450		U-0.500		U-1.450	

Section 5.5.3: Fenestration – CZ3

TABLE 5.5-3 Building Envelope Requirements For Climate Zone 3 (A, B, C)*

Fenestration	Nonresidential		Residential		Semiheated	
	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC
Vertical Glazing, 0%–40% of Wall						
Nonmetal framing (all)[b]	U-0.65	SHGC-0.25 all	U-0.65	SHGC-0.25 all	U-1.20	SHGC-NR all
Metal framing (curtainwall/storefront)[c]	U-0.60		U-0.60		U-1.20	
Metal framing (entrance door)[c]	U-0.90		U-0.90		U-1.20	
Metal framing (all other)[c]	U-0.65		U-0.65		U-1.20	
Skylight with Curb, Glass, % of Roof						
0%–2.0%	U_{all}-1.17	$SHGC_{all}$-0.39	U_{all}-1.17	$SHGC_{all}$-0.36	U_{all}-1.98	$SHGC_{all}$-NR
2.1%–5.0%	U_{all}-1.17	$SHGC_{all}$-0.19	U_{all}-1.17	$SHGC_{all}$-0.19	U_{all}-1.98	$SHGC_{all}$-NR
Skylight with Curb, Plastic, % of Roof						
0%–2.0%	U_{all}-1.30	$SHGC_{all}$-0.65	U_{all}-1.30	$SHGC_{all}$-0.27	U_{all}-1.90	$SHGC_{all}$-NR
2.1%–5.0%	U_{all}-1.30	$SHGC_{all}$-0.34	U_{all}-1.30	$SHGC_{all}$-0.27	U_{all}-1.90	$SHGC_{all}$-NR
Skylight without Curb, All, % of Roof						
0%–2.0%	U_{all}-0.69	$SHGC_{all}$-0.39	U_{all}-0.69	$SHGC_{all}$-0.36	U_{all}-1.36	$SHGC_{all}$-NR
2.1%–5.0%	U_{all}-0.69	$SHGC_{all}$-0.19	U_{all}-0.69	$SHGC_{all}$-0.19	U_{all}-1.36	$SHGC_{all}$-NR

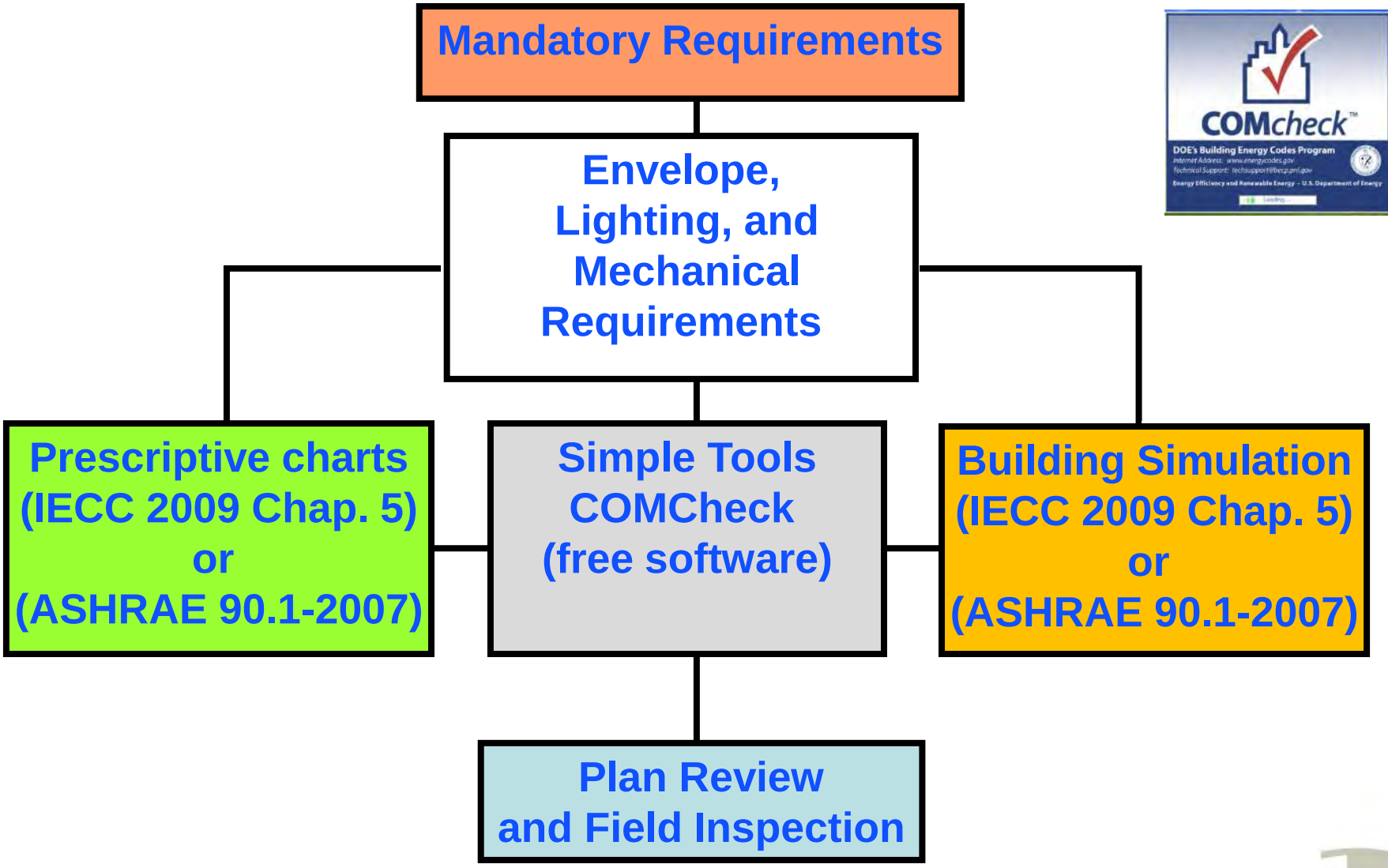
Section 9.5: Interior Lighting Budget

TABLE 9.5.1 Lighting Power Densities Using the Building Area Method

Building Area Type[a]	*LPD* (W/ft^2)
Automotive facility	0.9
Convention center	1.2
Courthouse	1.2
Dining: bar lounge/leisure	1.3
Dining: cafeteria/fast food	1.4
Dining: family	1.6
Dormitory	1.0
Exercise center	1.0
Gymnasium	1.1
Health-care clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing facility	1.3
Motel	1.0
Motion picture theater	1.2
Multifamily	0.7
Museum	1.1
Office	1.0
Parking garage	0.3
Penitentiary	1.0
Performing arts theater	1.6
Police/fire station	1.0
Post office	1.1
Religious building	1.3
Retail	1.5
School/university	1.2
Sports arena	1.1
Town hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

[a] In cases where both a general building area type and a specific building area type are listed, the specific building area type shall apply.

Road map of Compliance Pathways

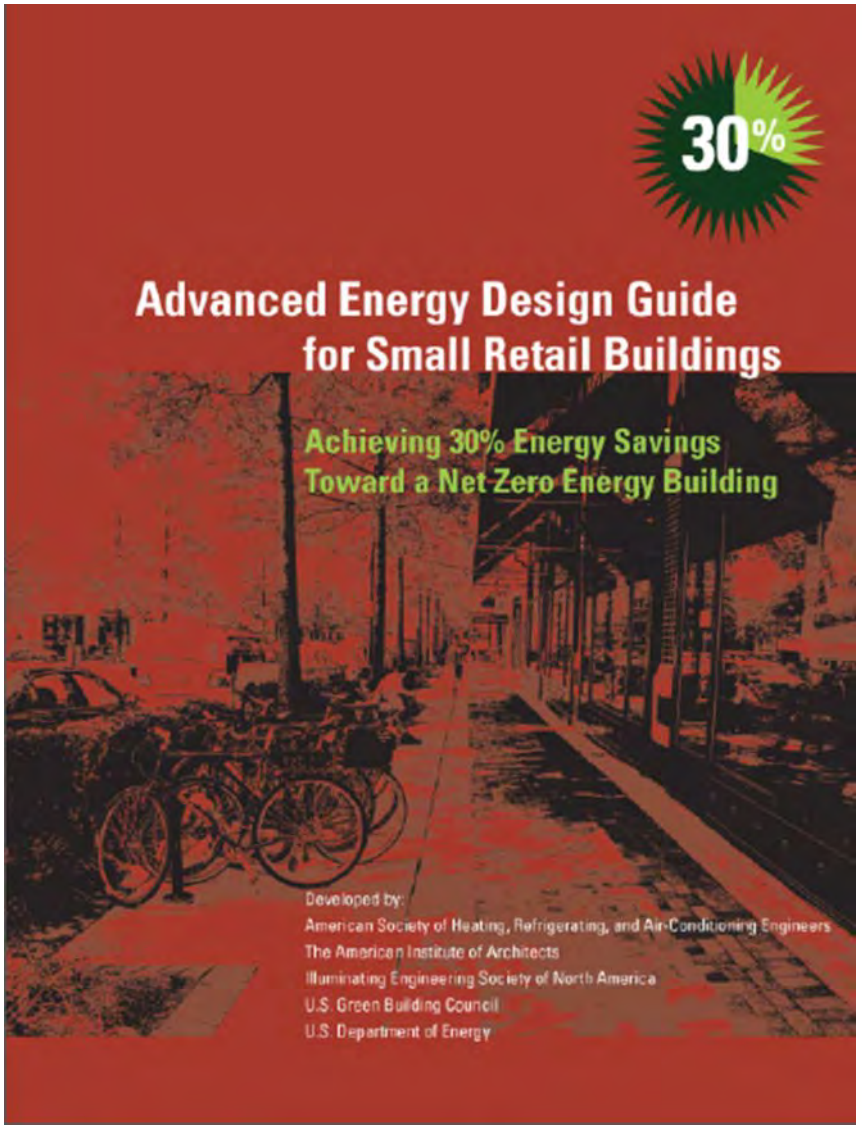


Above Code Programs & Incentives

- ASHRAE AEDG
- LEED
- EarthCraft
- Incentives for Energy Efficiency

ASHRAE Advanced Energy Design Guides

- Free to Download
- Targets 30% Energy Improvement Over Code - 6 Guides
- New AEDGS Targeting 50% - 2 Guides Available Now
- Prescriptive



ASHRAE Advanced Energy Design Guides

- Small Healthcare
- Highway Lodging
- Small Warehouse
- K-12 Schools
- Small Retail
- Small Office

For these categories of buildings:

Small Hospitals and Healthcare Facilities

For small hospitals and healthcare facilities up to 90,000 ft² in size, which require a wide variety of heating and air-conditioning equipment. Options for daylighting, an important cost-saving measure, are included.
I-P units.
Errata incorporated 06/22/10

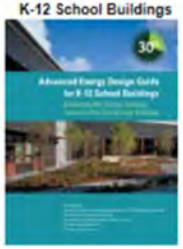
Highway Lodging

For typical hotels found along highways having up to 80 rooms, generally four stories or less, that use unitary heating and air-conditioning equipment, which represent a significant amount of commercial hotel space in the U.S.
I-P units.
Errata incorporated 01/04/10

Small Warehouses and Self-Storage Buildings

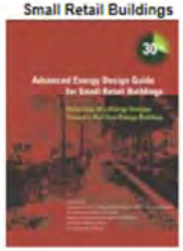
For warehouses up to 50,000 ft² and self-storage buildings that use unitary heating and air-conditioning equipment, which represent a significant amount of commercial warehouse space in the U.S.
I-P units.
Errata incorporated 01/04/10

K-12 School Buildings



For elementary, middle, and high school buildings, which have a wide variety of heating and air-conditioning requirements. Options for daylighting, an important component in schools, are included.
I-P units.
Errata incorporated 01/05/10

Small Retail Buildings



For retail buildings up to 20,000 ft², the bulk of retail space in the U.S. Addresses typical uses: retail (other than shopping malls); strip shopping centers; automobile dealers; building material, garden supply, and hardware stores; department stores; drugstores; equipment and home furnishing stores; liquor stores; and wholesale goods (except food).
I-P units.
Errata incorporated 06/12/07.

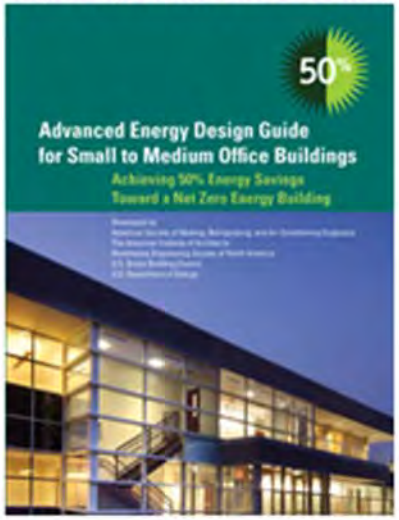
Small Office Buildings

For office buildings up to 20,000 ft² the bulk of office space in the U.S.; and provides benefits and savings for the building owner while maintaining quality and functionality of the office space. Awards: USGBC 2005 Leadership Award; Stars of Energy Efficiency Award, Honorable Mention (Alliance to Save Energy); and Best Sustainable Practice Award, Honorable Mention (SBIC).
I-P units.
Errata incorporated 12/31/08.

AEDG 50% Targets

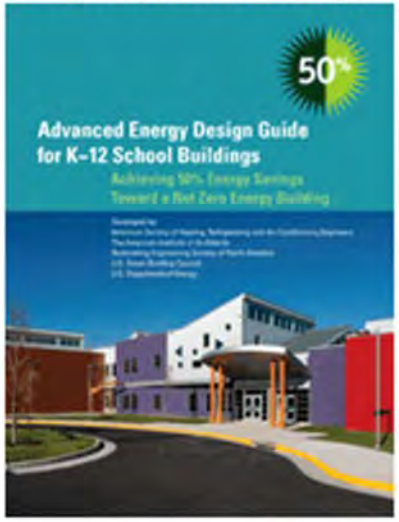
For these categories of buildings:

Small to Medium Office Buildings



For small to medium office buildings up to 100,000 ft^2, including a wide range of office types and related activities such as administrative, professional, government, bank or other financial services, and medical offices without medical diagnostic equipment. Also provides a greater emphasis on integrated design as a necessary component in achieving 50% energy savings.

K-12 School Buildings



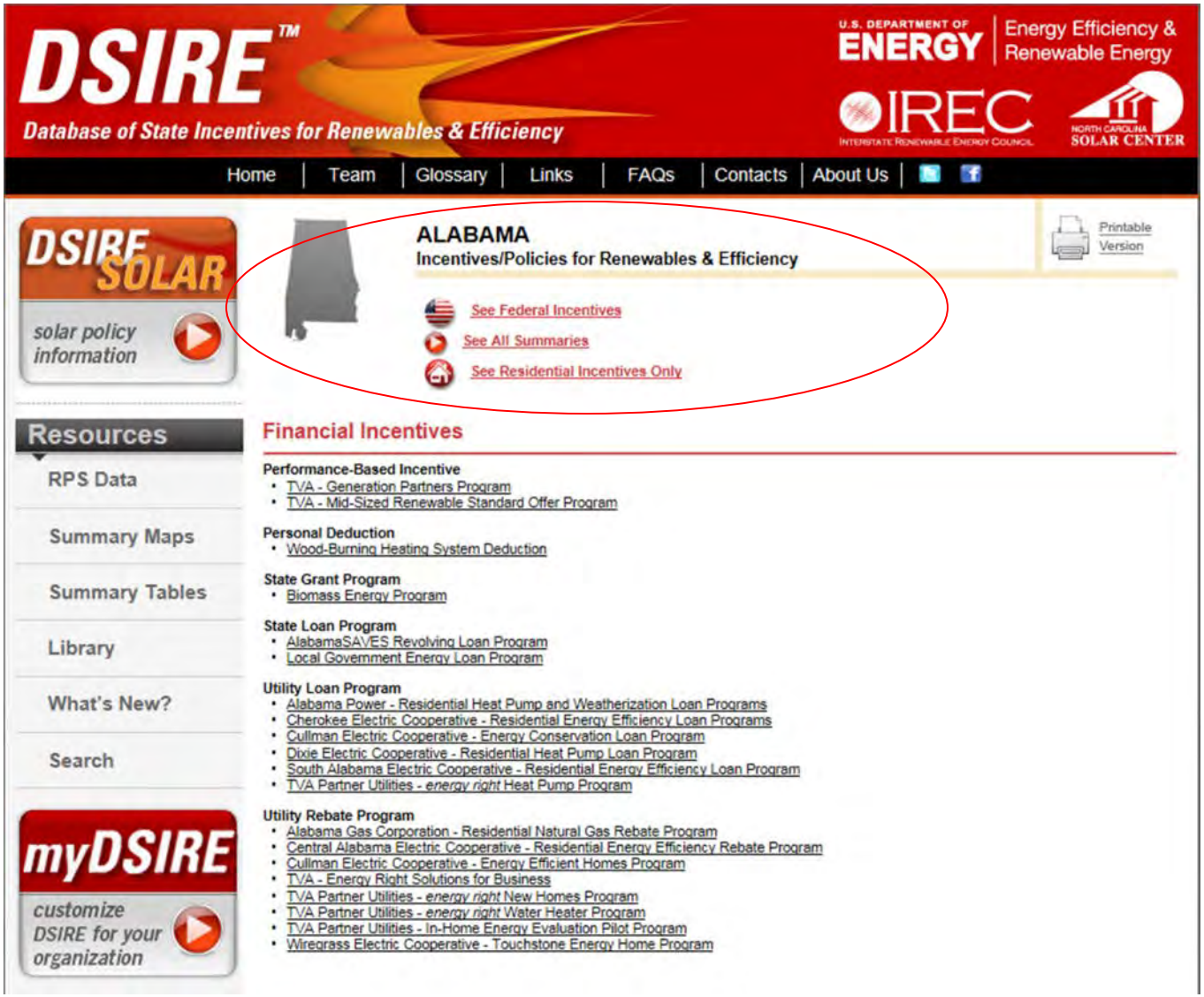
For K-12 school buildings and applies to all sizes and classifications (elementary, middle, high). Space types covered include administrative and office, classrooms, hallways, restrooms, gymnasiums, assembly, libraries, food preparation and dining areas. Case studies and technical examples throughout the guide illustrate the recommendations and demonstrate the technologies in real-world applications.

What is the LEED Program

- Leadership in Energy and Environmental Design
  - National Green Building Program
  - Administered by USGBC / GBCI
  - Not Just Focused on Energy
    - Sustainable Sites
    - Water Efficiency
    - Materials & Resources
    - Energy & Atmosphere
    - Indoor Environmental Quality
  - www.usgbc.org (to learn more)

Alabama Chapter

Resources for Energy Efficiency $$



Development and Evolution

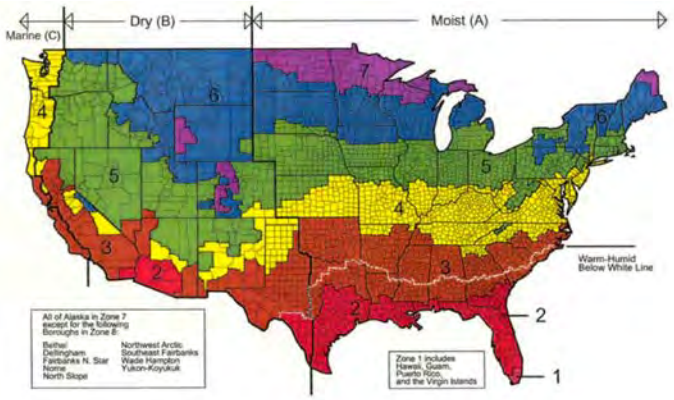
1999 2001 2004 2005 2008

Serving builders across the Southeast since 1999.

EarthCraft Light Commercial

What is EarthCraft Light Commercial (ECLC)?

- 3rd Party Certification Program
- Commercial Projects 15,000 sf or less
- Southeastern climate zones:
  2a, 3a & 4a



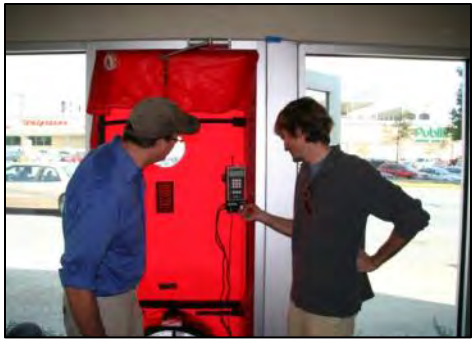
- Prescriptive Approach
  to Building Performance
- New Construction or Major Renovations
  must be able to meet ASHRAE 90.1-2007 energy code

ECLC Certification Process

- Design Review/Pre-Construction Meetings
- On-site Visits 2 PDW and 1 Final
- Performance Testing Envelope & Duct Leakage

Design & Planning

Construction



Certification

Project Registration → Design and Planning Review → Pre-Construction Meeting → INITIAL Site Visit → PDW Inspection → FINAL Inspection → Certification Application

ECLC Standards

An integrated systems approach

- Regionally specific
- Environmentally conscious design and construction
- Efficient use of natural resources: water, energy and building materials
- Potential utility cost savings: reduction in demand for water/energy
- Improved indoor air quality
- Comfortable working environment
- Envelope and duct performance confirmed through on-site inspections and performance testing

Resources

- **www.ashrae.org** *(Standard 90.1-2007 & Users Manual)*

- **www.energycodes.gov**

- **www.iesna.org**

- **www.bcap-energy.org**
- **www.iccsafe.org**
- **www.earthcraft.org**
- **www.southface.org**