REACHING 30% ENERGY REDUCTION…

APPROACHES TO REACHING NEW LEVELS OF ENERGY PERFORMANCE

Terri S. Hall, PE, LEED AP

- Bachelor of Science in Mechanical Engineering
- 17 years of experience
- Principal and Operations Director for Clark Nexsen, a 500 person architecture & engineering firm
- Has managed many projects that have become or are in the process of becoming LEED Certified, Silver and Gold

Peter J. Aranyi, AIA

- Bachelor of Architecture
- 22 years of experience
- Principal and Operations Director for Clark Nexsen, a 500 person architecture & engineering firm
- Has managed many projects that have become or are in the process of becoming LEED Certified, Silver and Gold

Rebekah Burke, PE, LEED AP

- Bachelor of Science in Architectural/Engineering
- 10 years of experience
- Sustainable Design Department Director for Clark Nexsen, a 500 person architecture & engineering firm
- Chair and Advocacy Committee Chair of Hampton Roads Green Building Council

Wendy Cockerham, LEED AP

- B.S. degree in Construction Engineering & Management from N.C. State
- LEED Accredited Professional
- Weaver Cooke's Director of Sustainable Construction
- Division Manager for Weaver Cooke
- Board of Directors and Liaison to the Advocacy Committee for Piedmont Triad Chapter of the USGBC

CLARK NEXSEN -- FIRM INTRODUCTION

Charlotte *Raleigh* *Richmond* *Roanoke* *Norfolk* *Washington, DC*

Architecture ◆ Engineering ◆ Planning ◆ Interior Design ◆ Landscape Architecture

- 90 Years of Practice with over 520 Employees; over 115 in North Carolina
- Integrated Architecture, Engineering, & Interiors Practice
- Leader in Sustainable Design; 176 LEED APs in every Discipline
- Full-Service A/E Firm Enhances Quality, Coordination, Cost Control, & Schedule

CLARK NEXSEN -- RELEVANT EXPERIENCE

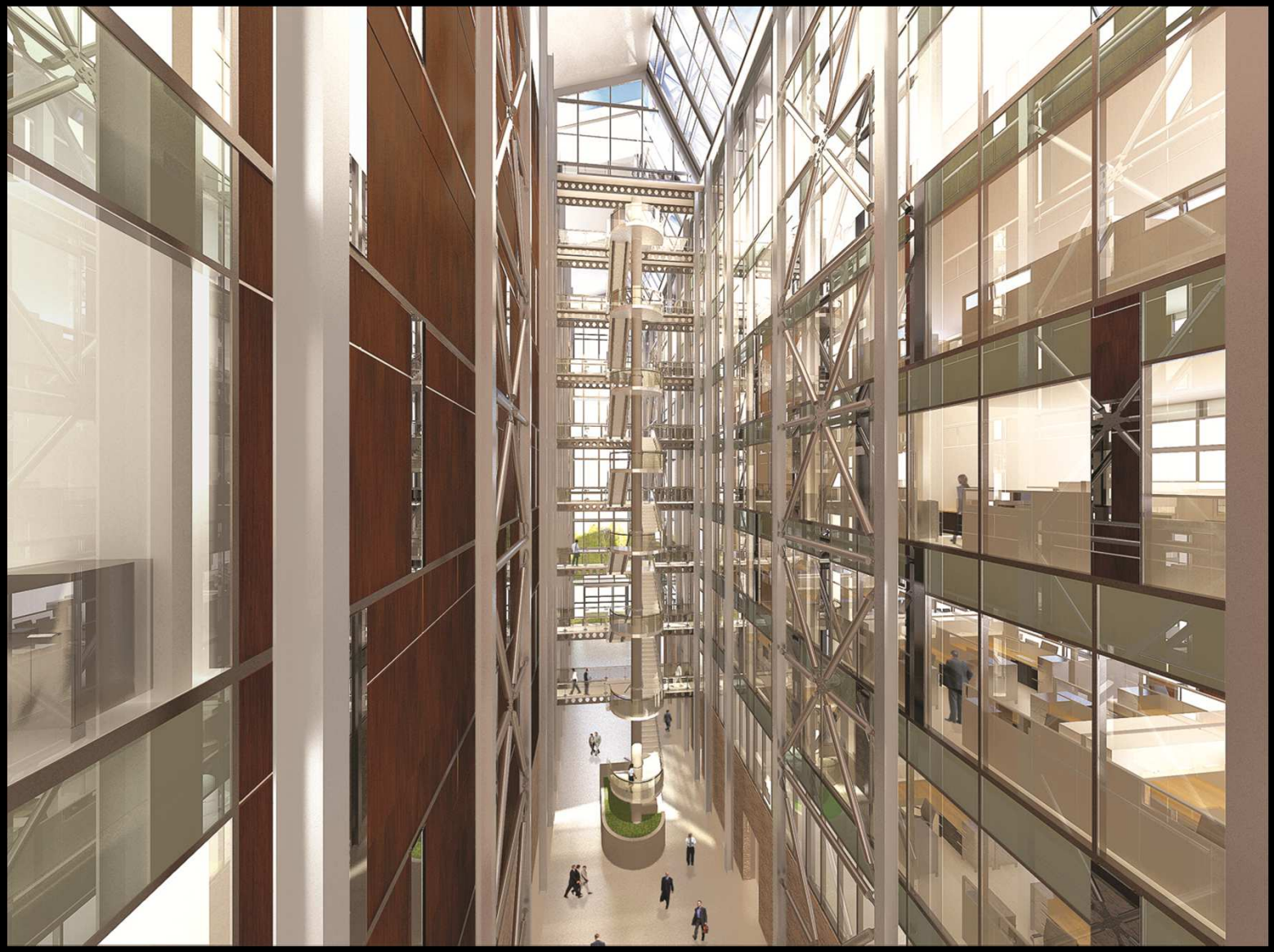
North Carolina State Construction Office / DOI Experience

- Appalachian State University
- Central Piedmont Community College
- East Carolina University
- Elizabeth City State University
- Fayetteville State University
- Mayland Community College
- Montgomery Community College
- North Carolina A&T State University
- North Carolina Central University
- North Carolina Eastern School for the Deaf
- North Carolina State University
- Rockingham Community College
- Sampson Community College
- The University of North Carolina at Asheville
- The University of North Carolina at Chapel Hill
- The University of North Carolina at Charlotte
- The University of North Carolina at Greensboro
- The University of North Carolina at Pembroke
- University of NC Wilmington
- Wake Technical Community College
- Western Carolina University
- Winston-Salem State University

22 North Carolina Campuses;
Over 200 New & Renovation Projects

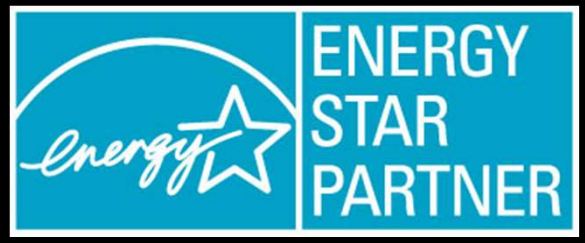
CLARK NEXSEN -- RELEVANT EXPERIENCE

DoD Experience



WEAVER COOK -- FIRM INTRODUCTION

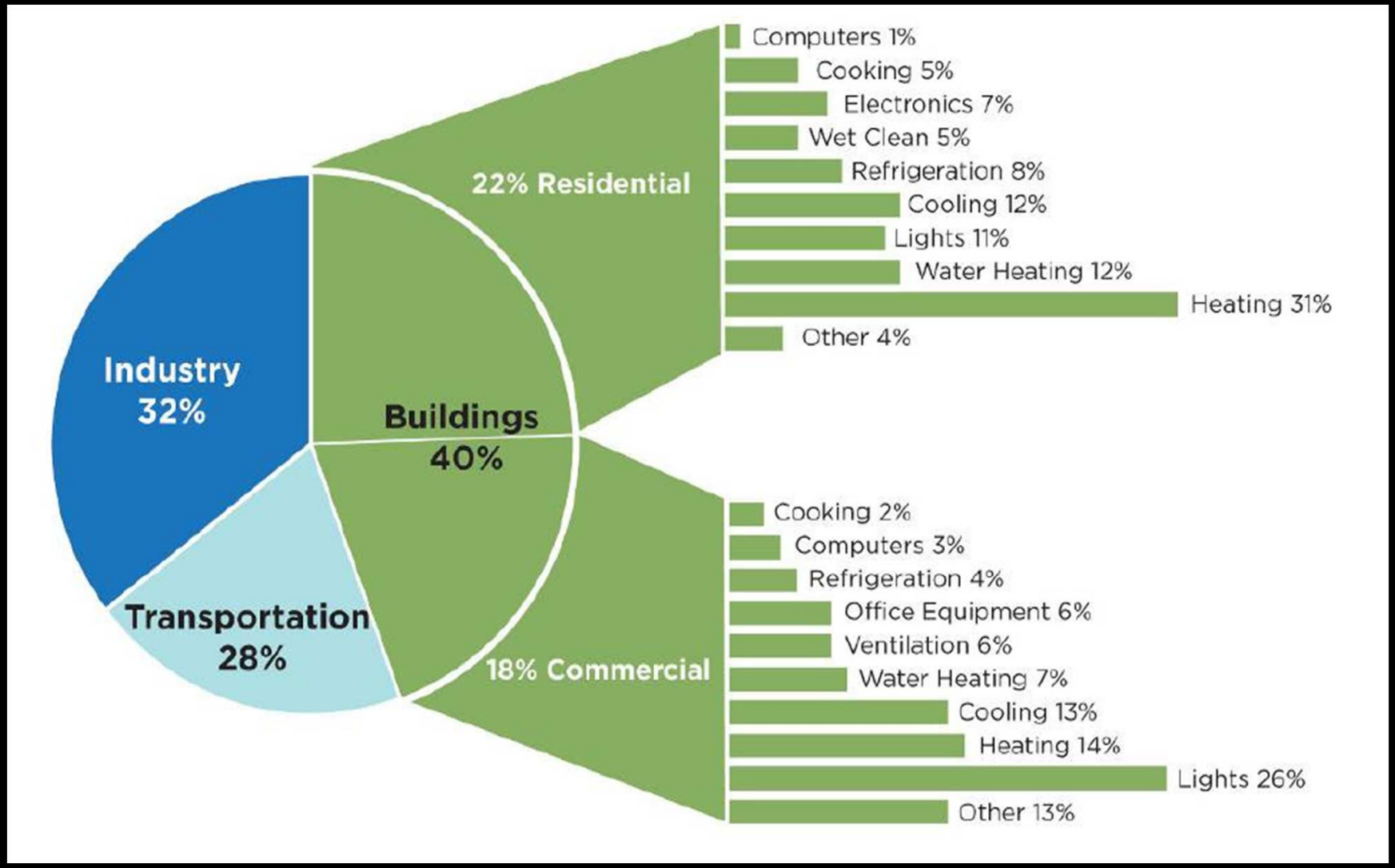
- Founded in 1939 in Greensboro, NC
- Leader in green construction
  - 1.3 million SF of sustainable projects
  - 14 LEED APs on staff
  - ENERGY STAR partner
  - Built and occupy the first LEED Gold commercial building in NC
- Average Annual Revenues: $100 Million



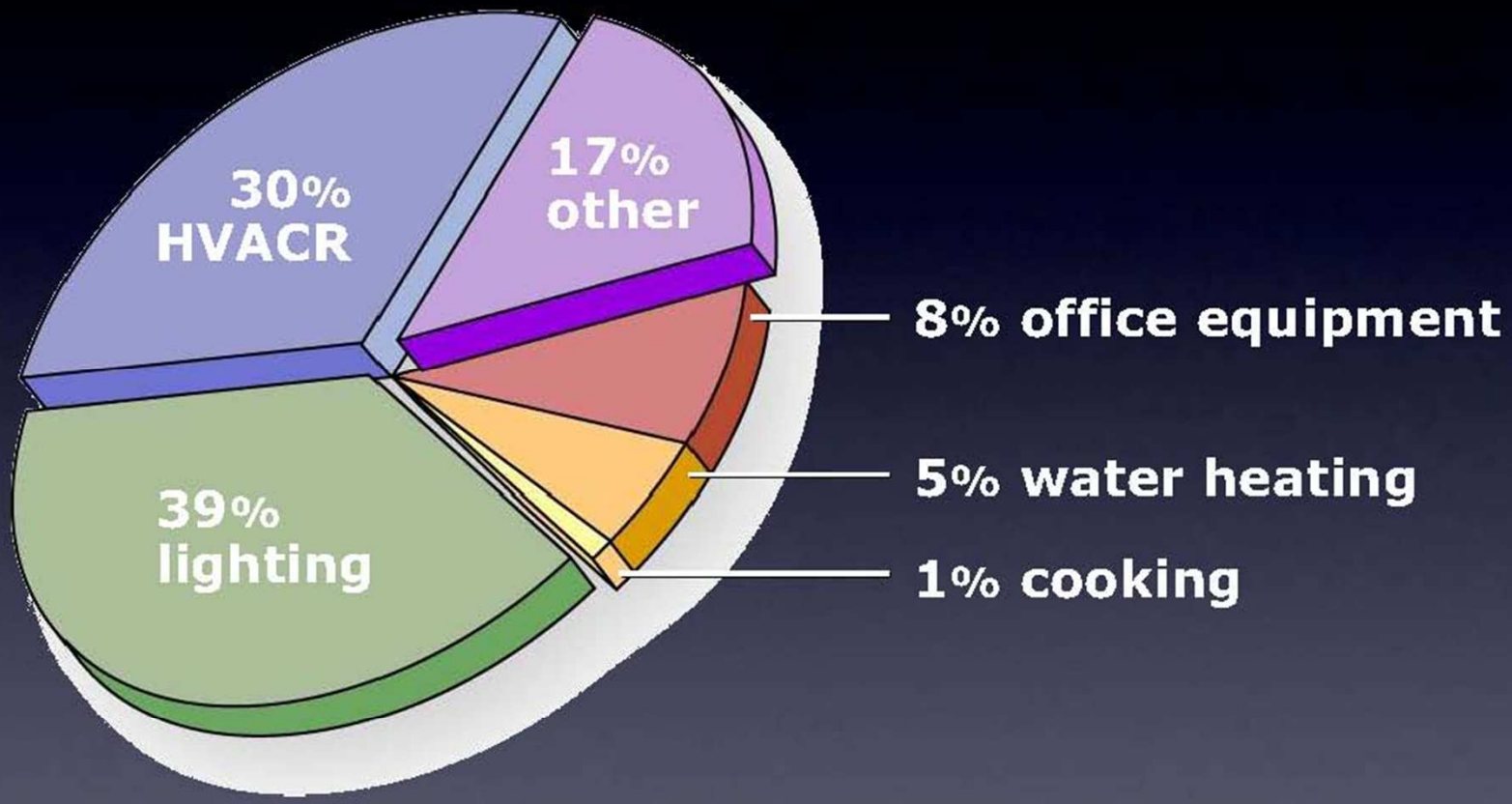
Why Reduce Energy?

- World energy consumption is projected to grow by 53% from 2010 to 2030 (U.S. Energy Information Agency)

Energy Consumption in the U.S.



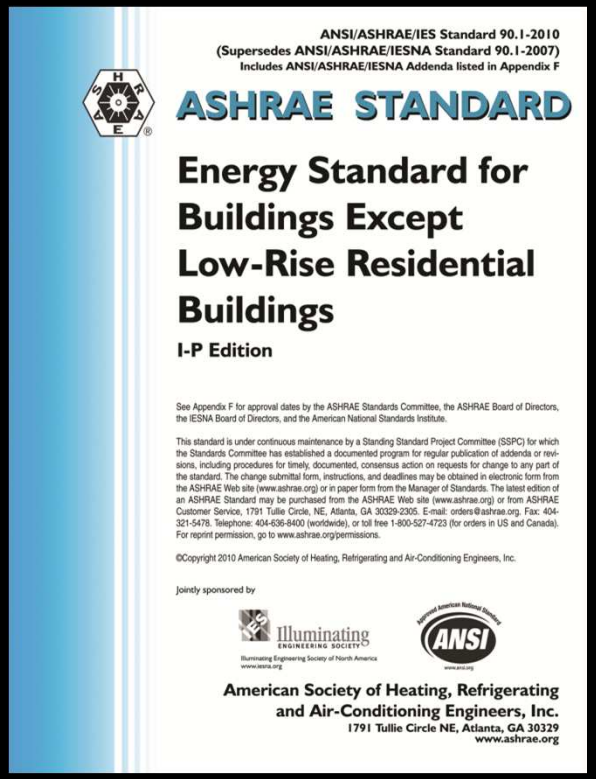
The Case for Energy Efficiency and Sustainable Buildings



Average Energy Consumption in Commercial Buildings

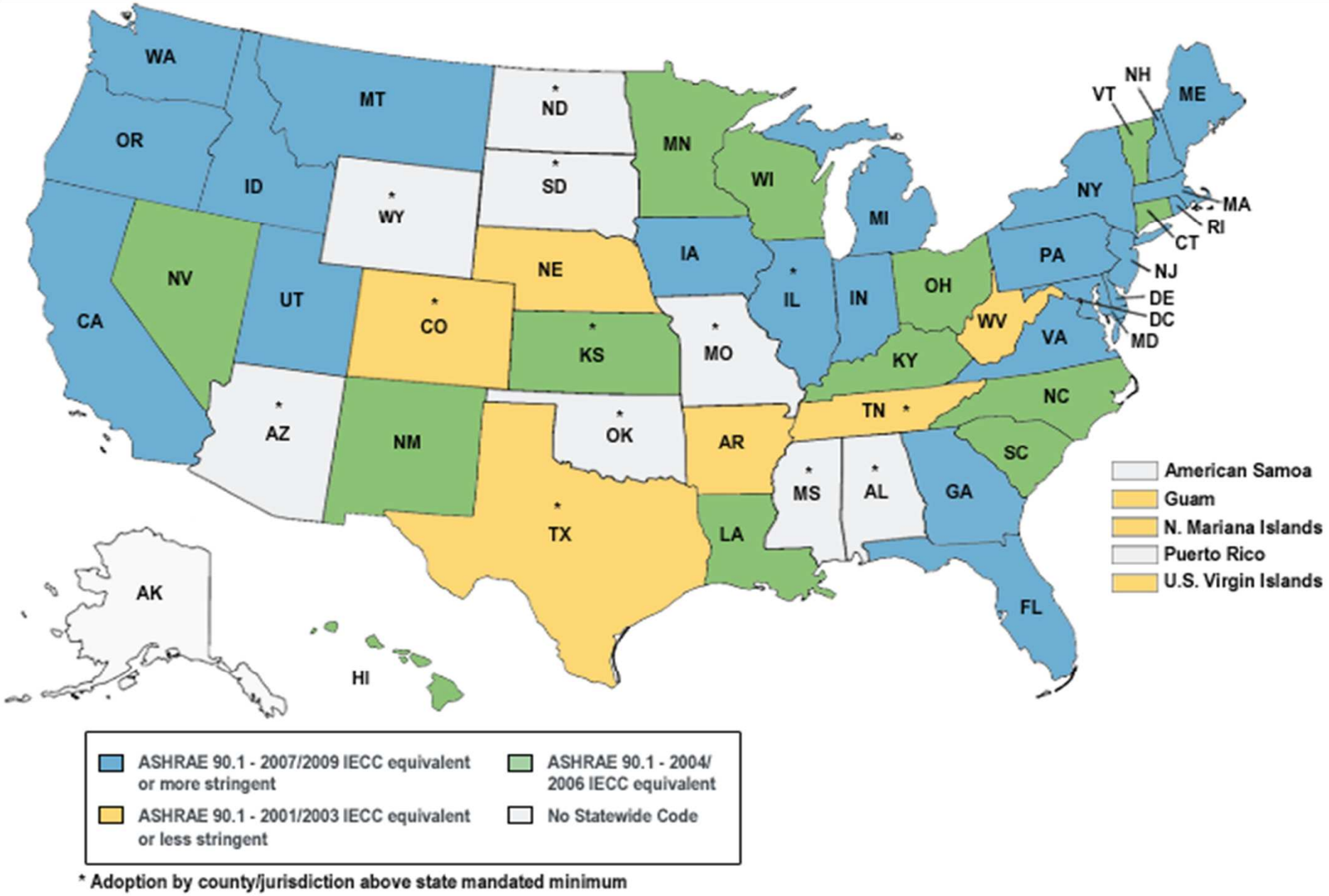
ASHRAE Standard 90.1

Purpose



"… Provide minimum requirements for the energy-efficient design of buildings except low-rise residential buildings"

Current State Adoptions of Standard 90.1



EPAct (Energy Policy Act) 2005

Sec 109. Federal Building Performance Standards

"Federal building energy efficiency performance standards that require that—the buildings be designed to achieve energy consumption levels that are at least 30 percent below the levels established in the version of the ASHRAE Standard …that is in effect as of the date of enactment of this paragraph"

Federal Buildings are at least 30% below ASHRAE 90.1-2004

Overall Building Energy Intensity:

2010…….10%

2015…….20%"

EISA (Energy Independence and Security Act) 2007

Sec 433. Federal Building Performance Standards

"For new Federal buildings and Federal buildings undergoing major renovations…shall be designed so that the fossil fuel-generated energy consumption of the buildings is reduced "

Sec 431 Overall Building Energy Intensity

2010…….55%

2030…….100%"

Sec 523 Standard Relating to Solar Hot Water Heaters

``"if life-cycle cost effective…not less than 30% of hot water demand for each new Federal building and Federal building undergoing major renovations be met through the installation and use of solar hot water heaters."

North Carolina Senate Bill 668

"All major facilities of public agencies shall be designed , constructed and certified to at least 30 percent greater energy efficiency than the standard under ASHRAE 90.1 - 2004. For major renovations a 20 percent greater energy efficiency than standard ASHRAE 90.1-2004 shall be used"

North Carolina new public facilities are at least 30% below ASHRAE 90.1-2004

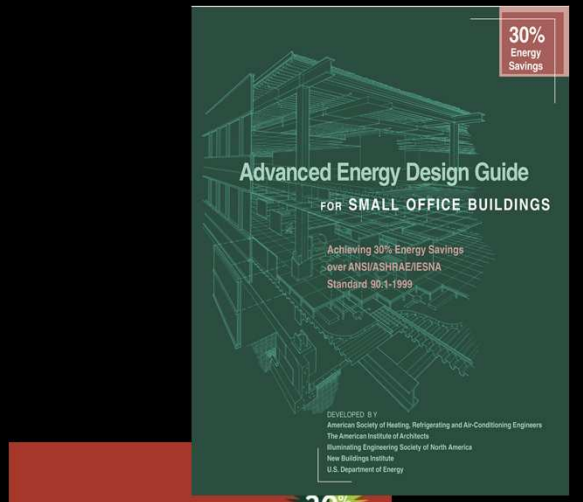
North Carolina Building Code (2012)

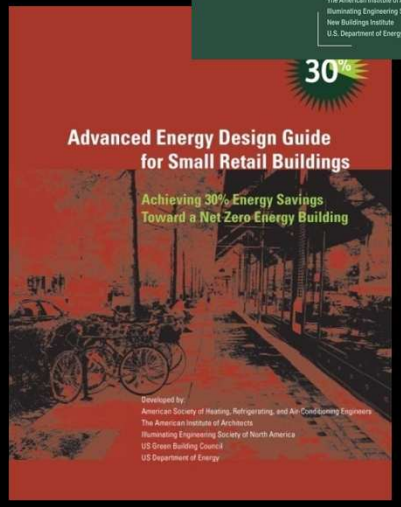
Adopts the ICC 2009 Family of Codes (with amendments)

IECC (International Energy Conservation Code) references
ASHRAE 90.1-2007

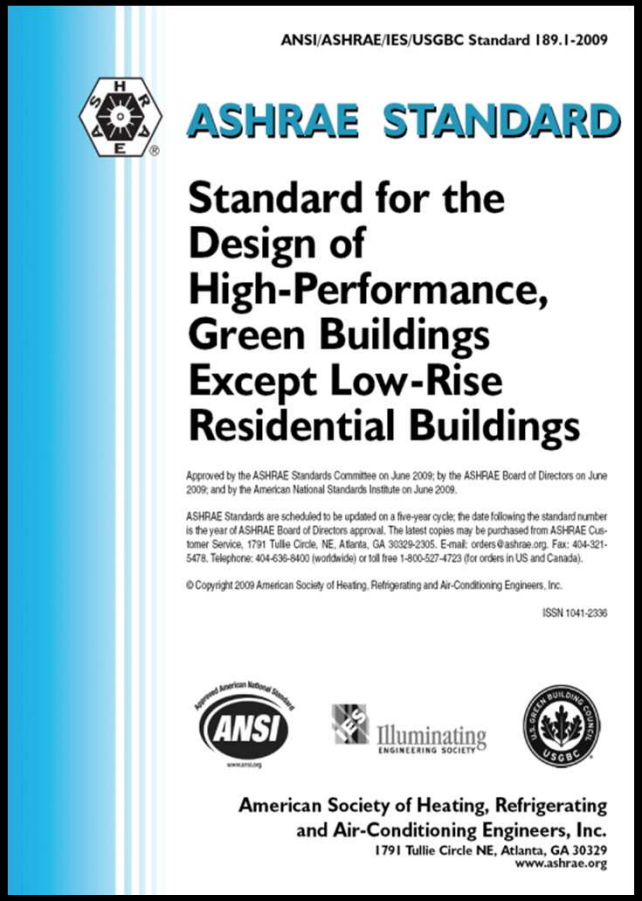
Special Projects/Publications

- **Advanced Energy Design Guides – provide 30 % energy savings over Standard 90.1 - 1999**
  - **Small office buildings**
  - **Small retail buildings**
  - **Warehouses**
  - **Highway Lodgings**
  - **Kindergarten through grade 12 schools**
  - **Health Care Facilities**

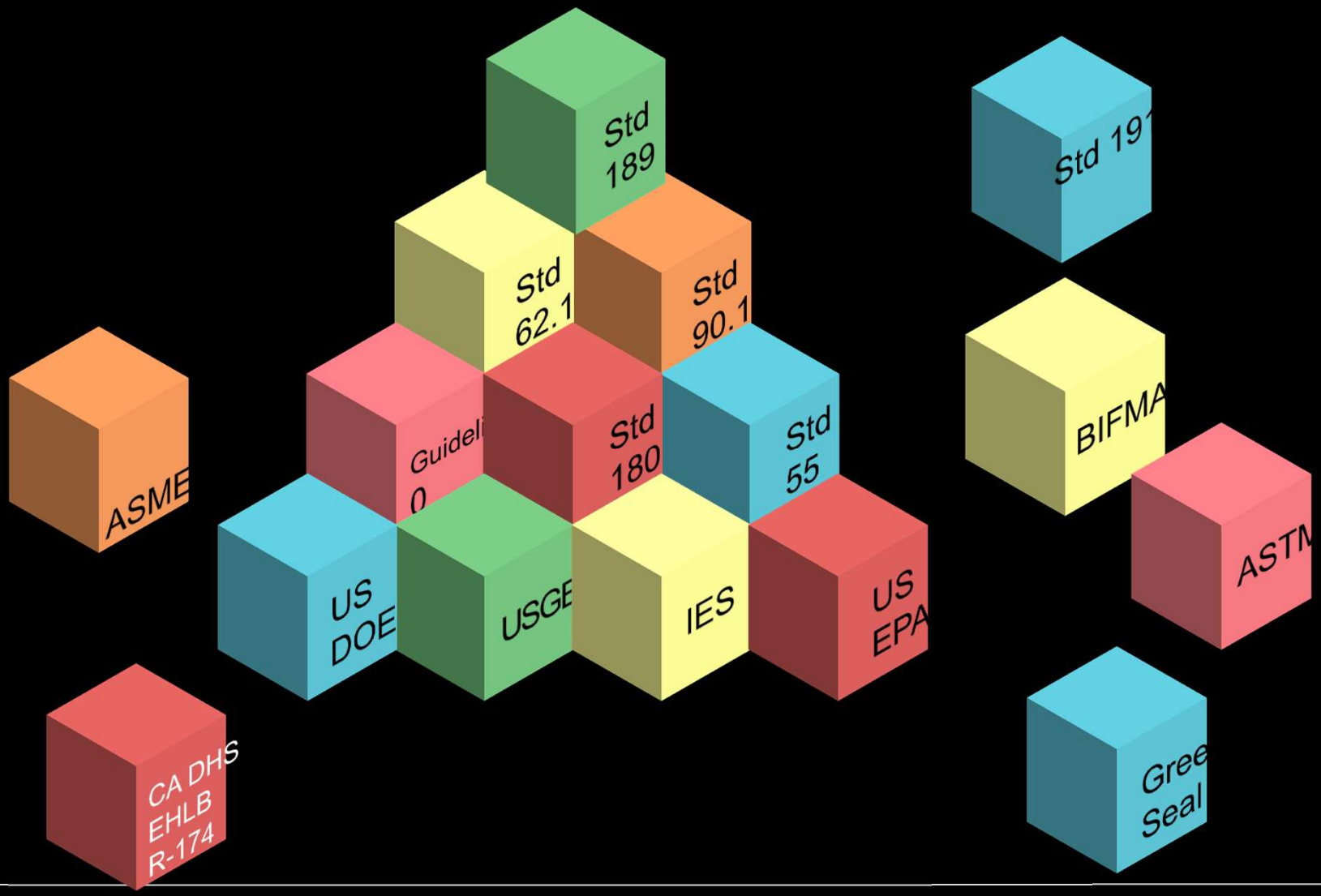




ANSI/ASHRAE/USGBC/IESNA Standard 189.1 2009



Standard 189.1 Building Blocks



How can we reduce energy by 30%?

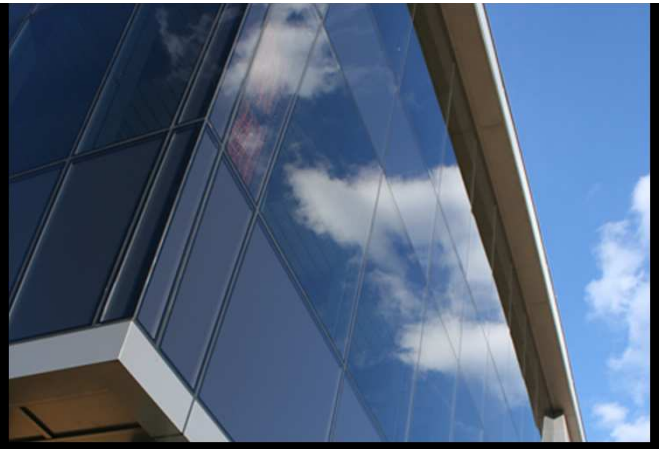
Architectural
Engineering
Construction
Operations
Integrated Approach

Architectural:

- **Building Orientation**
- **Siting and Location**
- **Building Envelope Efficiency**
- **Use of Day Lighting**
- **Solar Films**
- **Solar Control (Shading)**
- **Fenestration**

Architectural:

- **Material Use**
- **High Performance Glazing**
- **High Albedo Roofs**
- **Green Roofs/ Walls**
- **Thermal Mass Storage**

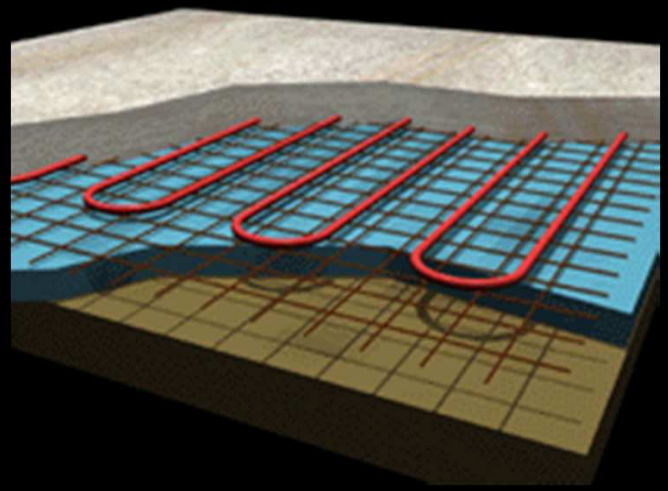


Engineering:

- **Energy Star**
- **Natural Ventilation**
- **Geothermal**
- **Solar Thermal Hot Water**
- **Under Floor Air Distribution**
- **Lighting Controls**
- **SEER**
- **Variable Frequency Drives**
- **Displacement Ventilation**

Engineering:

- **Motion Sensors**
- **Photovoltaic Panels**
- **Radiant Slabs**
- **Heat Recovery (OA energy recovery, Chiller waste heat recovery, sanitary waste recovery, etc.)**
- **Lighting Upgrades**

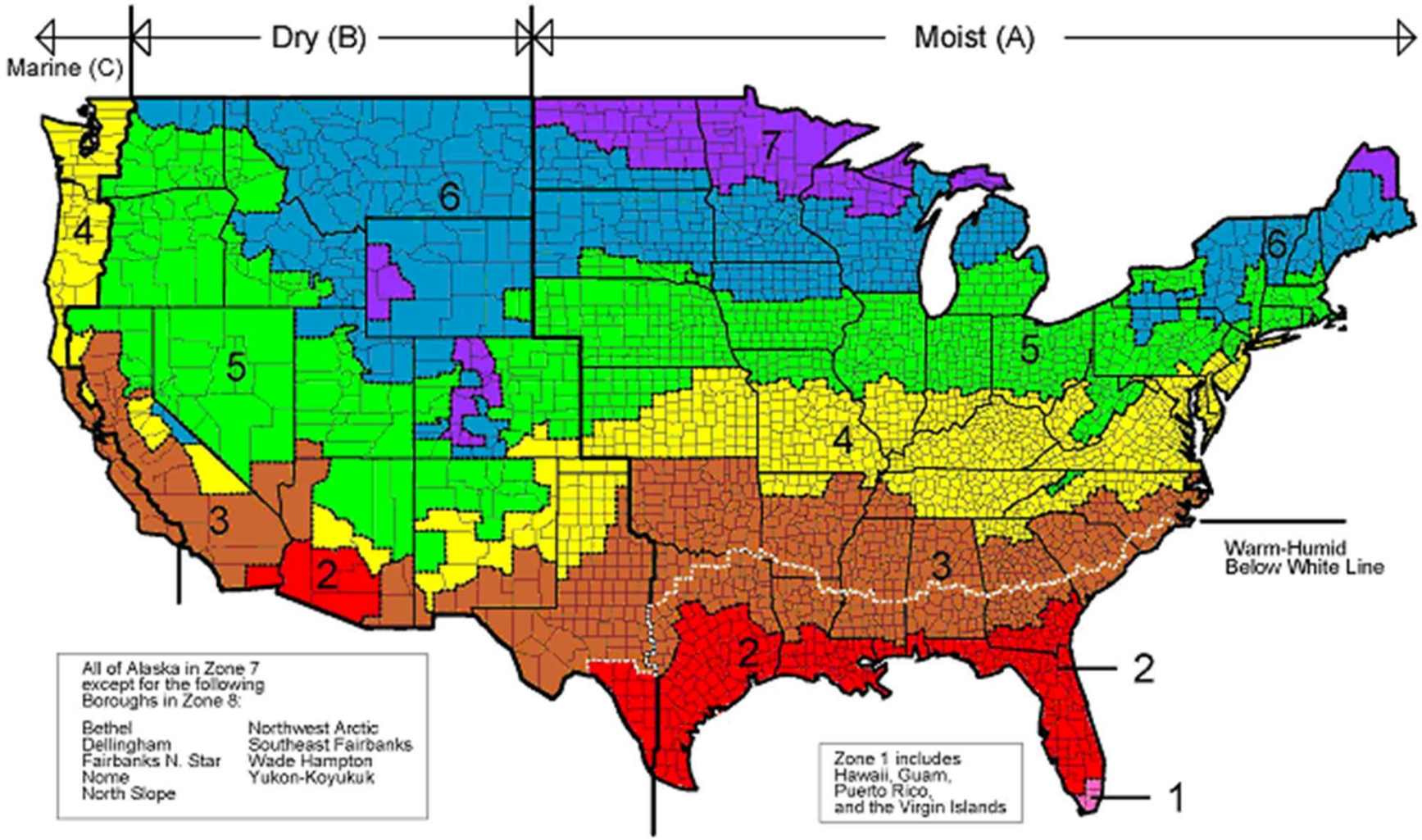


Construction and Operations:

- **Commissioning**
- **Measurement Verification**
- **Auditing**
- **Education for owners, bidders and installers**

What does this mean for North Carolina?

ASHRAE 90.1 – CLIMATE ZONES:



Example Building Comparison - Dormitory in Climate Zone 3A					
Component	Standard				
	90.1-2001	90.1-2004	90.1-2007	90.1-2010	189.1-2009
Roof	R-15 c.i.	R-15 c.i.	R-20 c.i.	R-20 c.i.	R-25 c.i.
Wall	R-13	R-13	R-13 + R-3.8 c.i.	R-13 + R-3.8 c.i.	R-13 + R-5.0 c.i.
Glazing Thermal Transmittance	U-0.57	U-0.57	U-0.65	U-0.6	U-0.5
Interior Lighting	1.5 Watts/SF	1.0 Watts/SF	1.0 Watts/SF	0.61 Watts/SF	0.61 Watts/SF
Cooling Efficiency	9.7 SEER	12 SEER	13 SEER	13 SEER	14 SEER
Economizer	No	No	Yes	Yes	Yes
Heating Efficiency	80% E_t	80% E_t	80% E_t	80% E_t	92% E_t

RELEVANT EXPERIENCE

Housing Initiative – UNC Wilmington

RELEVANT EXPERIENCE

Seahawk Crossing Student Housing & East Parking Deck, Phase III – UNC Wilmington

RELEVANT EXPERIENCE

Building E Classroom Building - Wake Technical Community College

RELEVANT EXPERIENCE

Building E Classroom Building - Wake Technical Community College

RELEVANT EXPERIENCE

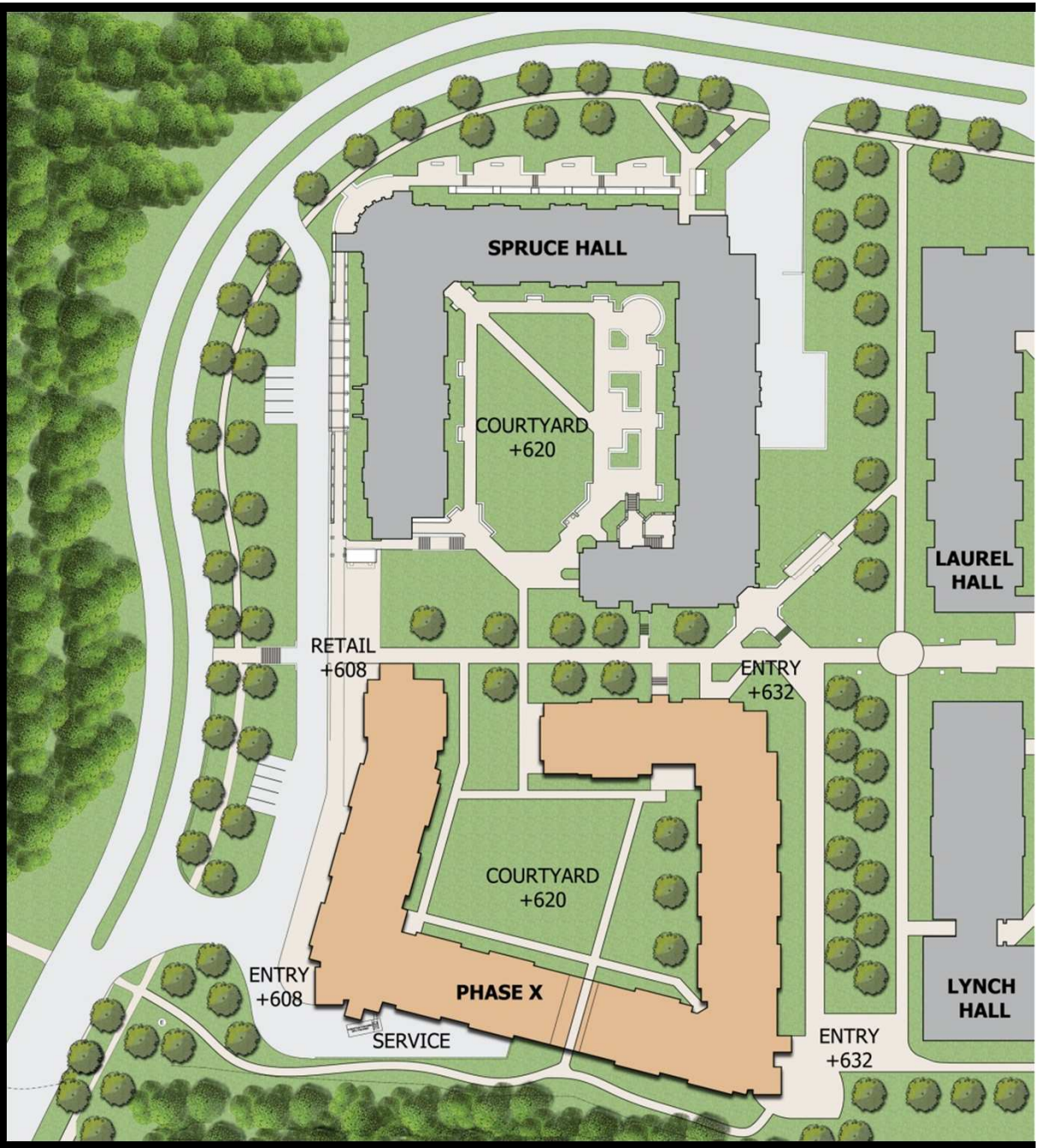
Wallace Creek

RELEVANT EXPERIENCE

Phase IX Student Housing – UNC Charlotte

RELEVANT EXPERIENCE

Phase X – The University of North Carolina at Charlotte



RELEVANT EXPERIENCE

Phase X - The University of North Carolina at Charlotte

OPTION **A** - ROUND CORNER TO MATCH SPRUCE HALL

OPTION **B** - MATCH GEOMETRY OF RETAIL END

OPTION **C** - FOLLOW GEOMETRY OF WEST WING

CAMERON BLVD PERSPECTIVE

RELEVANT EXPERIENCE

Proximity Hotel – Greensboro, North Carolina

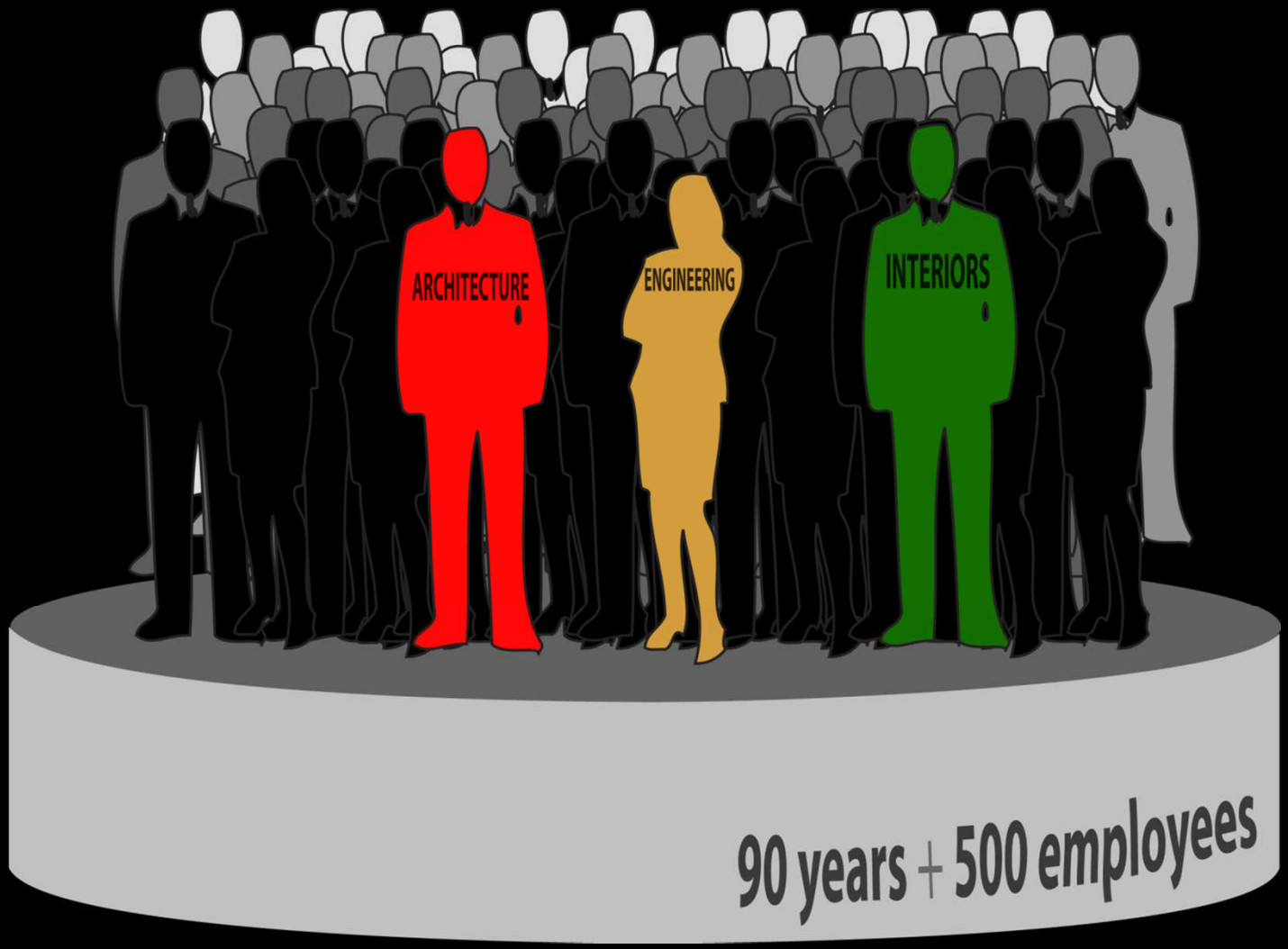
- 1st LEED Platinum Hotel in the US
- 39% less energy use
- 34% less water use
- 87% construction waste diverted from landfill
- Solar water heating accounts for over 12% reduction in building's energy usage

Component	90.1-2004	UNCW-III	UNCC-9	UNCC-10	WTCC Bldg E	Wallace Creek
Roof	R-15 c.i.	R-38 c.i.	R-27 c.i.	R-40c.i.	R-23 c.i w/Green Roof	R-38.5 c.i.
Wall	R-13	R-22	R-27	R-27	R-20	R-22.5
Glazing Thermal Transmittance	U-0.57	U-0.35	U-0.45 Shading devices, low E, High SC	U-0.45 Shading devices, low E, High SC	U-0.27 Shading devices, low E, High SC	U-0.26 Shading devices, low E, High SC
Interior Lighting	1.0 Watts/SF	0.8Watts/SF	0.79 Watts/SF	0.74 Watts/SF Lighting sensors	0.9 Watts/SF Lighting sensors	0.7 Watts/SF Lighting sensors
Cooling Efficiency	12 SEER	13 SEER	19 EER	19 EER	12 SEER	22.5 EER
Economizer	No	Yes	Yes	Yes	No	No
Heating Efficiency	80% E_t	N/A	95% E_t	95% E_t	95%E_t	N/A
Mechanical	PTAC	Split System HP	4 pipe FCU, ERV, Chiller, Condensing Boilers, Occ Sensor	4 pipe FCU, ERV, Chiller, Condensing Boiler, Occ Sensor	Campus CHW, Displacement Ventilation, Radiant floors, Condensing Boilers, Occ Sensor	Hybrid Geotherm WSHP, Solar HW, PV's, CO2 Sensors
Energy Savings	--	15%	23%	31%	~32%	~40%

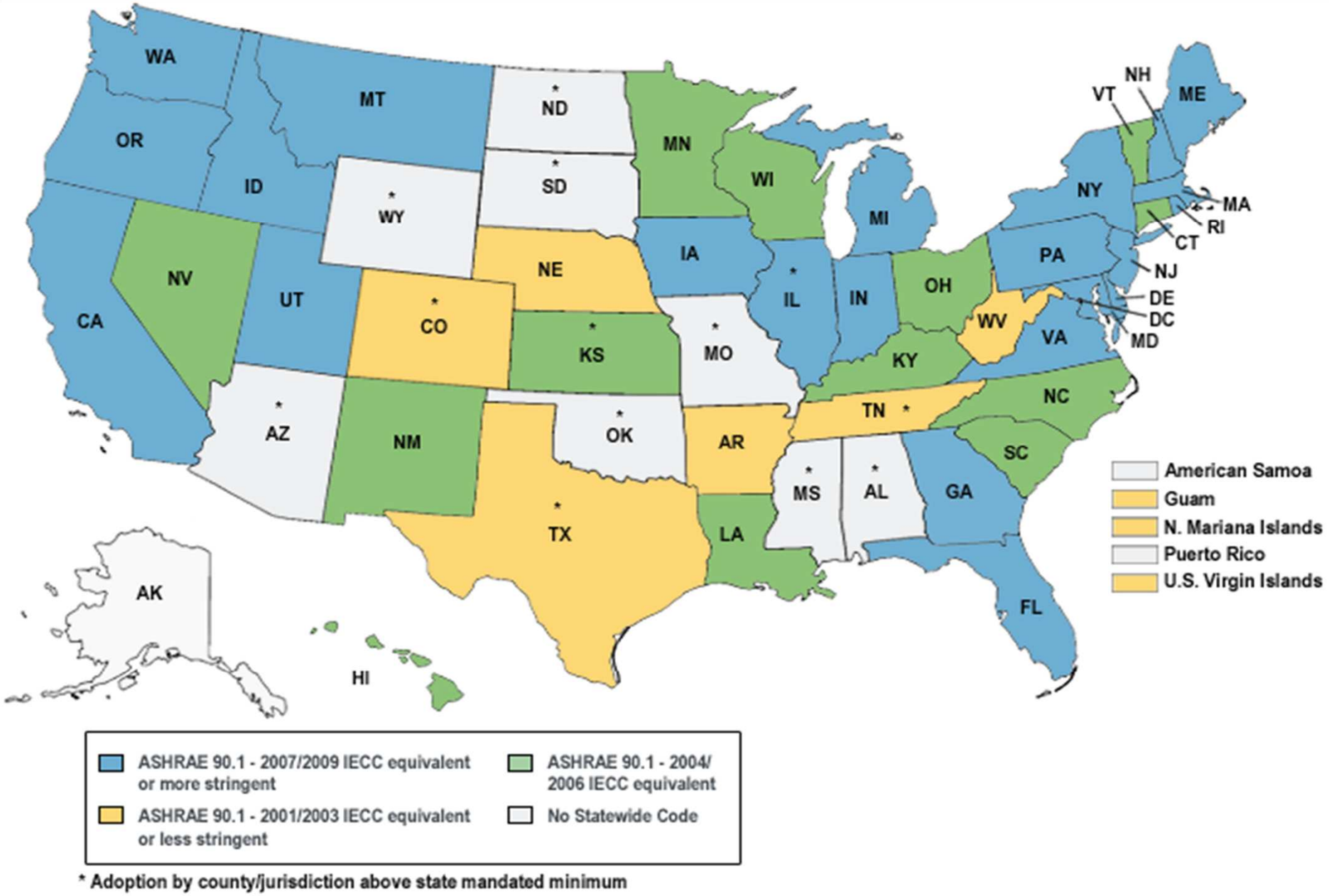
REACHING 30% ENERGY REDUCTION…

APPROACHES TO REACHING NEW LEVELS OF ENERGY PERFORMANCE

CLARK • NEXSEN



Current State Adoptions of Standard 90.1



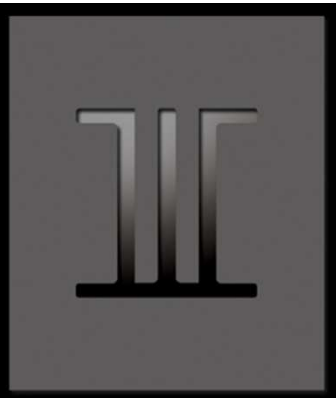
USGBC LEED Project Experience for Higher Education

USGBC LEED Registered Projects	Goal	Status
Northern Wake Campus, Phase 1C (Bldg. E) Wake Technical Community College, Raleigh, NC	Gold	Bidding
Phase IX Student Housing The University of North Carolina at Charlotte, Charlotte, NC	Gold	Construction
Seahawk Crossing Student Housing & Parking Deck University of North Carolina Wilmington, Wilmington, NC	Silver	LEED Review
Alderman Road Residence Halls Phase II University of Virginia	Certified	Construction
Few Quad Living/learning Center Renovation Duke University, Durham, NC	Silver	LEED Review
Freidl Humanities Building Adaptive Re-Use Duke University, Durham, NC	Silver	LEED Approved
Ambler Johnston Living / Learning Center Renovations Virginia Tech, Blacksburg, VA	Silver	Construction
Jamestown North & South Residence Halls The College of William & Mary, Williamsburg, VA	Certified	LEED Approved
Century Park Living/Learning Center Phase I The University of Southern Mississippi - Hattiesburg, MS	Silver	Construction

Clark Nexsen Historical Cost for Residence Hall Projects:

Recently completed residence hall projects since 2008

New Projects	SF	Const. Cost	Beds	Cost/Bed	Cost/SF	Year	Structure	Unit Type	Bldgs.	Flrs.	Const.	LEED
UNC Wilmington Seahawk Landing	265,000	$33,375,000	609	$54,803	$126	2008	Wood	Single Apts.	7	3	CM	N/A
USC Aiken Pacer Crossings Residence Hall	90,000	$14,235,000	310	$45,919	$158	2008	Steel	Double Suites	1	4	D/B	N/A
UNC Wilmington Seahawk Crossing	256,000	$39,425,350	667	$59,108	$154	2009	Wood	Apartment	4	3	CM	Silver
Bluefield College East River Residence Hall	24,438	$3,680,000	102	$36,078	$151	2009	Wood	Apts/Trad	1	3	CM	N/A
Virginia Military Institute New 3rd Barracks	132,000	$28,500,000	300	$95,000	$227	2009	Concrete/ Steel	Barracks	1	4	CM	N/A
James Madison University Shenandoah Residence Hall	116,140	$23,714,651	422	$56,196	$204	2009	Concrete	Double Trad.	2	5	D/B	N/A
Western Carolina University Balsam & Blueridge Residence Halls	220,000	$44,100,000	800	$55,125	$200	2010	Steel	Mixed Suites	2	4	GC	N/A
Old Dominion University Quad, France House & England House (III)	95,464	$17,639,800	328	$53,780	$185	2009	Steel	Mixed Suites	2	4	CM	N/A
Old Dominion University Quad, Dominion House (IV)	105,254	$21,367,000	304	$70,286	$203	2009	Steel	Mixed Suites	1	4	CM	N/A
Virginia State University Howard Quad Phase I	113,000	$20,050,000	462	$43,398	$177	2010	Steel	Mixed Suites	2	4	CM	Silver
University of Southern Mississippi Century Park Phase I	205,000	$35,000,000	860	$40,698	$171	2010	Steel	Double Suites	4	4	GC	Silver
UVA Alderman Road Phase 2 Residence Halls + Commons Bldg	136,220	$26,218,752	440	$59,588	$192	2010	CMU/Plank	Double Trad.	3	6	D/B	Certified
UNC Charlotte Phase IX Residence Hall	180,215	$31,851,150	437	$72,886	$177	2011	Steel	Apts/Suites	1	5	CM	Gold



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