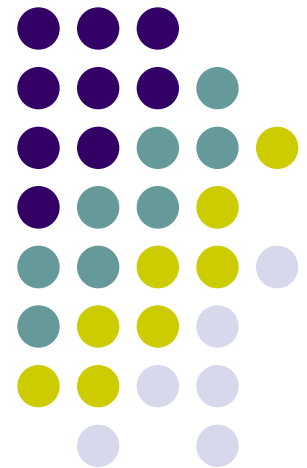


Beyond Codes

Scottsdale Green Building

Anthony Floyd, AIA
City of Scottsdale
Green Building Manager



Passive Survivability

- Vulnerability of Buildings
 - Effects of climate changes including rising sea level, severity and frequency of tropical storms, power outages, hotter summers
 - Energy supply shortages
 - petroleum age will effectively end well within the expected lifetimes of buildings being designed and built today

- Designing for Passive Survivability
 - Design criteria to address maintaining basic livable conditions in the event of
 - extended power outages
 - interruptions of fuel supply
 - loss of water and sewer services



Passive Survivability and Existing Housing

- Storm-resilient buildings
- Limited building height
- High-performance building envelope
- Minimized cooling loads
- Natural ventilation
- Passive solar heating
- Solar water heating
- Natural daylighting

- Photovoltaic power
- Configured heating equipment to operate on PV power
- Rainwater Harvesting
- Graywater, waterless urinals and on-site sewage treatment
- Edible landscaping & gardens



Cooling-load avoidance strategies help maintain thermal conditions in a building even when the power goes out.

Passive Survivability



Exterior Shading devices



Ceiling fans and operable windows to maximize daylight and natural ventilation



Back-up power supplied by PV



Passive cooling systems

Regional Adaptation



Rain Barrel



Cistern



On-Site Retention

Green Home Standards Comparisons

- Energy Star
- LEED for Homes
- Environments for Living
- 2009 IECC
- 2009 IRC
- NAHB
- City of Albuquerque
- City of Boulder
- City of Austin
- City of Tucson
- State of California

Evolving Green Building Standards For Single Family Dwellings

City Code or 3rd Party Program	Percentage above 2006 IECC	Performance Testing		Thermal By-Pass Inspection	Lighting Efficiency	Water Heating	Appliances	Indoor Water Efficiency	Indoor Environmental Quality
		Ducts	Envelope						
City of Scottsdale Building Code	15%	No Req'mts	No Req'mts	Partial	No Req'mts	Recir. pump	No Req'mts	No Req'mts	No Req'mts
City of Scottsdale Green Building Program	15%	Optional points	Optional points	Partial	Task Lighting	Recir. pump	No Req'mts	50% High Efficiency Toilets	Seal Ducts during constr.; Low VOC Paints; MERV 8 Air Filters; CO Detectors
Energy Star Program	15%	Req'd	Req'd	Yes	Optional	No Req'mts	Optional	Not Addressed	Not Addressed
LEED for Homes Program	15%	Req'd	Req'd	Yes	4 Energy Star labeled fixtures or bulbs	Optional points	Optional points	Optional points	MERV 8 Air Filters; CO Detectors
Environments for Living – Certified Green Program	20%	Req'd	Req'd	Yes	50% High Efficacy	Energy Efficiency Rating Factor (EF)	100% Energy Star labeled	100% High Efficiency Fixtures	Very Low VOC Paints; Carpet must have Green Label; CO Detectors
City of Austin Building Code	30% by 2009	Req'd	Req'd	Partial	90% High Efficacy by 2009	Restriction on electric	No Req'mts	Not Addressed	MERV 6 Air Filters
City of Boulder Building Code	30% to 75%	Optional points	Optional points	Yes	Optional points	Optional points	Optional points	Optional points	Optional points
City of Albuquerque Building Code	30%	No Req'mts	No Req'mts	Yes	70% Energy Star labeled	Energy Star Labeled by 2009	Energy Star labeled washers	No Req'mts	Not Addressed

Local Governmental Policies for Private Sector Green Building Standards

JURISDICTION	TYPES OF PROJECTS COVERED		GREEN BUILDING CRITERIA		EFFECTIVE DATE
	SINGLE FAMILY RESIDENTIAL	MULTI-FAMILY AND COMMERCIAL	SINGLE FAMILY RESIDENTIAL	MULTI-FAMILY AND COMMERCIAL	
ARLINGTON COUNTY, VA	N/A	Projects that request density bonus	N/A	LEED certified level	2004
ASPEN/PITKIN COUNTY, CO	Projects that are over 1,000 sq. ft.	Projects that are over 1,000 sq. ft.	Local rating checklist w/ optional measures	Local rating checklist w/ optional measures	2003
AUSTIN, TX	Projects that are part of PUD and special development zones including downtown	Projects that are part of PUD and special development zones including downtown	Local rating checklist w/ optional measures	Local rating checklist w/ optional measures	2003
BOSTON, MA	N/A	Projects over 50,000 sq. ft. that are subject to the city's Large Project Review process	N/A	LEED with additional local criteria	2007
BOULDER, CO	All homes	N/A	Local rating checklist w/ optional measures	N/A	2001, 2008 update
FRISCO, TX	All homes	N/A	Local prescriptive measures	N/A	2001, 2007 update
PASADENA, CA	N/A	Multi-family over 4 stories and projects over 25,000 sq. ft.	N/A	LEED certified or silver level for projects over 50,000	2008
SAN FRANCISCO, CA	All homes	All multi-family and other projects over 5,000 sq. ft.	Local rating checklist w/ optional measures	LEED certified or silver level for projects over 25,000	2008 - 2012 Phase In
WASHINGTON, DC	N/A	All projects over 50,000 sq. ft.	N/A	LEED or equivalent rating system	2009 - 2012 Phase In
SCOTTSDALE, AZ	All homes	All projects	Homes must be at least 15% better than 2006 IECC	Buildings must be at least 15% better 2006 IECC	2007

Architecture 2030

- This fossil fuel reduction standard for the operation of all new buildings must be increased to:
 - 60% in 2010
 - 70% in 2015
 - 80% in 2020
 - 90% in 2025
 - carbon-neutral by 2030 (meaning they will use no fossil fuel energy to operate).

www.architecture2030.org

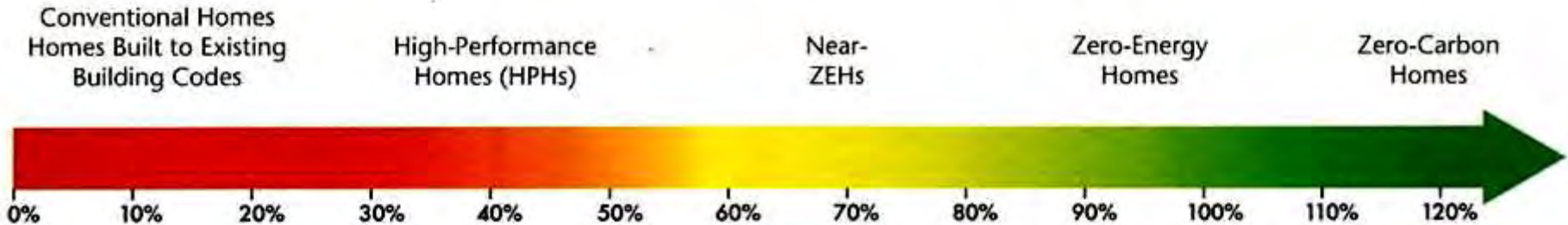
Code Equivalents for 2030 Challenge

Code or Standard	Commercial	Residential
ASHRAE 90.1-2004	30% below	N/A
ASHRAE 90-1-2007	25% below	N/A
ASHRAE 189 (in progress)	Meets target	N/A
→ IECC 2006	30% below	30% below
California Title 24 – 2005	N/A	15%–25% below
California Title 24 – 2008	10% below	N/A
Oregon Energy Code	25% below	30% below
Washington Energy Code	25% below	25%–30% below
RESNET HERS Index	N/A	65 or less
LEED-NC 2.2 and LEED for Homes	New construction, EA credit 1: 6 points Renovation, EA credit 1: 8 points	HERS Index 65
LEED 2009 (in progress)	New construction, EA credit 1: 7 points Renovation, EA credit 1: 9 points	N/A
GBI Standard (in progress)	Path A, 8.1.1.1: 150 points	N/A
EECC Option (prescriptive path)	N/A	EC-154
NBI Option (prescriptive path)	New construction, Core Performance with enhanced features	N/A

Adapted from *Meeting the 2030 Challenge Through Building Codes*, 2008

New Housing Energy Continuum

Percentage of Projected Energy Savings



Conventional homes

Complies with existing energy codes with 100% reliance on utility supplied energy.

High performance homes

Saves 30 to 50% of utility energy costs over conventional homes using efficiency and renewable energy technologies.

Near-zero energy homes

Saves 60 to 90% utility energy costs over conventional homes.

Net-zero energy homes

Produces as much energy as it uses, saving 100% utility energy costs.

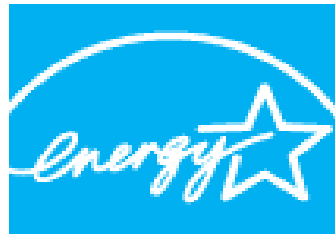
Zero-carbon homes

Produces more energy than it uses and exporting at least 20% electricity to the grid.

Building Ratings, Codes and Standards

Rating Systems

LEED
BREEM
Energy Star
GB Initiative
Green Globes
Local GB Programs



Standards

ASTM
ASHRAE
Green Seal
Local Std's



Codes & Ordinances

IBC
IMC
IECC
Local Ord's



Expanding Scope of Building Codes and Standards

- Minimum requirements to safeguard public health, safety and general welfare

- Structural strength
- Means of egress
- Stability
- Sanitation
- Adequate light and ventilation
- Safety to life and property from fire

- Accessibility
- Energy conservation
- Water conservation
- Other hazards attributed to the built environment

Aligning the Instruments

Rating Programs

Government Policy

Standards & Codes

Market Supply & Demand

Efforts to Integrate Green Building and Codes

- **USGBC Codes Committee**
 - Harmonize building regulations and green building designs, practices and programs
- **International Code Council (ICC)**
 - MOU with USGBC
 - Sustainable Building Technology Committee
 - Green Building Certification Exam for Inspectors
 - ICC-ES Sustainable Attributes Verification Program



ICC-Evaluation Service for Green Materials

- **Sustainable Attributes Verification Program**
 - Recycled content
 - Regional materials
 - Biobased materials
 - Certified wood products
 - Solar reflectance index and thermal emittance of roofing materials
 - Volatile organic compound (VOC) content
 - Paints, coatings, adhesives, sealants
 - Urea formaldehyde resin content in composite wood products
 - Low-emission floor coverings

ASHRAE 189 - New Standard for Green Building Design

- Proposed Standard for the Design of Green Buildings
 - will provide minimum requirements for the design of sustainable buildings
 - 30% better than ASHRAE 90.1 - 2007
 - 1% on-site renewable energy requirement
 - 20% reduction in water use
 - Equivalent to LEED Silver



The
LIGHTING
AUTHORITY

Evolving Green Building Rating Criteria

- Changing Expectations
 - evolving local ordinances and design guidelines; building and energy codes; federal energy policy
- Qualification and Verification Process
 - professional training and testing for national GB programs, rating systems and standards
 - verification methods during design, plan review, inspections; self-certification; compliance certificates; 3rd party entities
- Building Performance
 - Energy, water and IAQ performance measures
 - create synergy with energy code and 3rd party energy programs



Integration with Local Building Regulatory Process

- Coordination with building code, energy code and adopting ordinances
 - Development review process
 - Plan review and inspections
- Setting benchmarks and raising standards
 - Above code programs lay foundation for future code changes



Green Building Measures

- Mandatory Measures/Prerequisites
 - Site
 - Energy
 - Indoor Environmental Quality
 - Water
 - Durability/Fire-Protection

Mandatory Measures

- Site
 - Protect all exterior entrances from direct summer sun exposures (east, west, south)
 - recessed or covered entry
 - Native or Xeriscape landscape
 - low water consuming plants





Louvers



Recessed Entrances



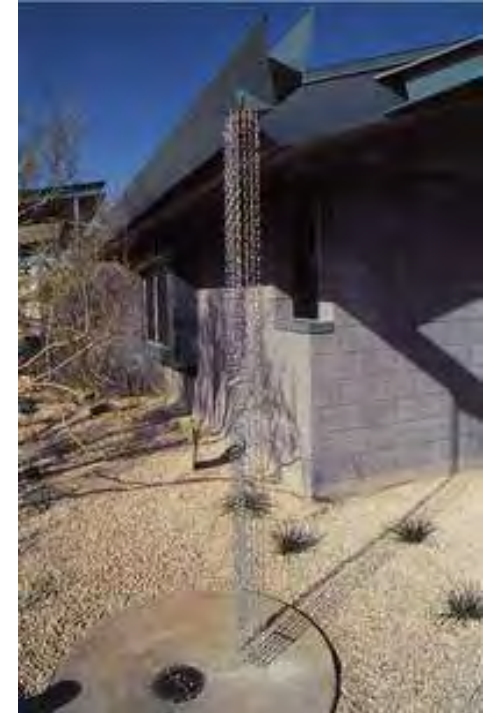
Shaded Entry Courtyard



Vine Covered Trellis

Mandatory Measures

- Rainwater Harvesting
 - Collect and divert at least 25% of roof run-off to landscape areas via gutters, downspouts, scuppers, grading and swales



Mandatory Measures

- Energy Performance

- Buildings designed to be at least 30% above the 2006 energy code (IECC)



- ICC Code Hearing approved 18% above IECC
 - Better wall, ceiling and floor insulation
 - Efficient lighting
 - Reduced air leakage
 - Improved duct efficiency
 - More efficient windows

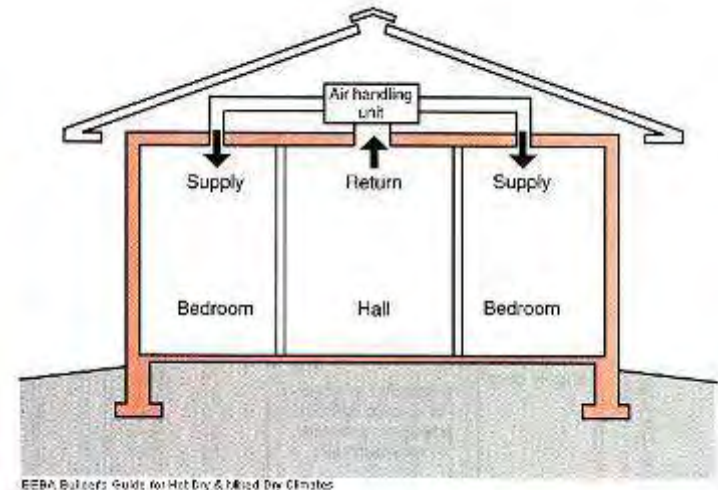
Mandatory Measures

- Energy Efficiency
 - Insulated ductwork
 - Return air paths



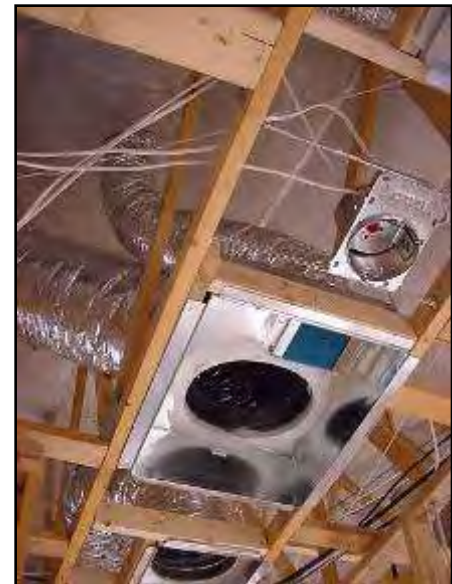
Mandatory Measures

- Building Envelope Tightness (third party)
 - Thermal bypass inspection per EPA Energy Star
 - Envelope leakage determined by a RESNET-certified rater using a RESNET-approved testing protocol
 - Or per testing option per 2009 IECC



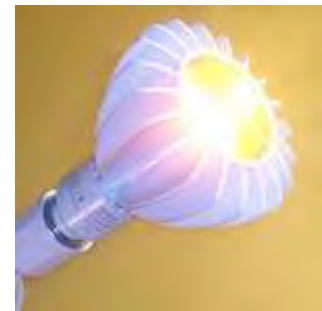
Mandatory Measures

- Duct Tightness (third party)
 - Ducts tested and documented by a RESNET-certified rater using a RESNET-approved testing protocol
 - Or testing option per 2009 IECC
 - Duct tightness test not required if the air handler and all ducts are located within conditioned space



Mandatory Measures

- High Efficiency Lighting
 - At least 80% of all interior lighting shall be either Energy Star labeled fixtures or Energy Star labeled luminaires installed in conventional fixtures
 - Or lighting efficacy definition per 2009 IECC





Mandatory Measures

- On-Site Renewable Energy
 - Provide an on-site renewable energy power system with a peak electrical generating capacity of 10 to 25% of the electrical service load
 - Or provide an on-site solar water heating system that provides 60 to 80% of domestic hot water needs



Mandatory Measures

- Indoor Environmental Quality
 - Carbon monoxide (CO) detectors
 - Kitchen exhaust rate - min. 100 cfm



CO detector



Kitchen exhaust hood

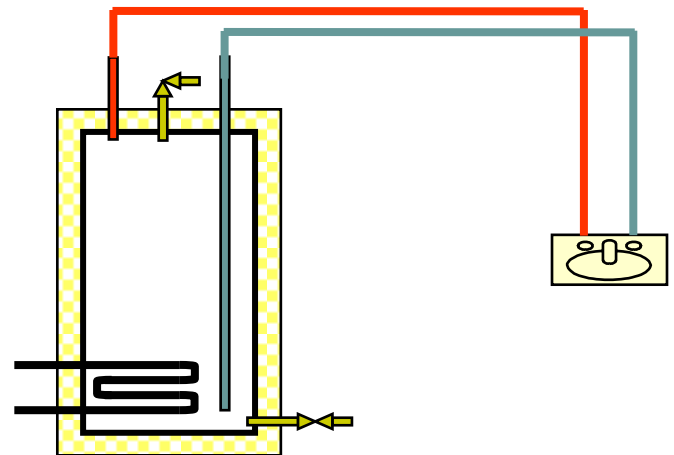
Mandatory Measures

- Indoor Environmental Quality
 - Whole house ventilation system installed per ASHRAE 62.2 for single family dwellings
 - Energy Star bathroom exhaust fan controlled by
 - an occupancy sensor,
 - automatic-timer switch or
 - automatic humidistat controller



Mandatory Measures

- Water Heating and Distribution System
 - Water heaters shall be Energy Star labeled
 - Demand-controlled recirculation pump when water heater is greater than 20 feet from furthest fixture
 - activated by a push button or occupant sensor control in each full bathroom and kitchen
 - insulated hot water lines



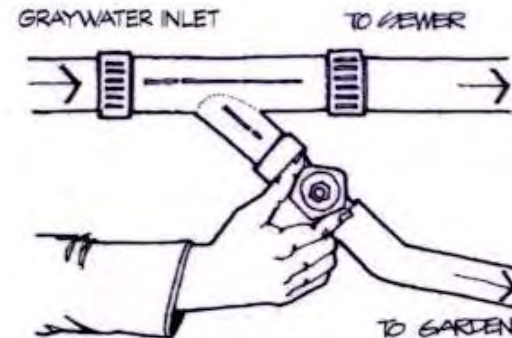
Mandatory Measures

- Water Efficiency
 - All toilets shall be Water Sense labeled
 - high efficiency performance (1.28 or less gallons per flush which includes dual flush toilets)
 - Showers shall make efficient use of water
 - total maximum flow rate of shower heads and body sprays shall not exceed a maximum flow rate of 2.5 gallons per minute per shower stall
 - Or performance approach
 - minimum 20% indoor water use reduction



Mandatory Measures

- Graywater Recycling
 - Provide graywater drain line with at least one plumbing fixture connection (i.e. – shower, lavatory, washing machine) for landscape irrigation
 - Or performance approach for outdoor water use
 - minimum 50% landscape water use reduction



Mandatory Measures

- Interior Finishes
 - Low VOC paints and finishes
 - *Maricopa County Air Quality Rule 335*
- Solid Waste
 - Built-in kitchen recycling bins



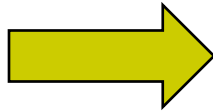
Shifting Perspectives and Growing Expectations

Radical Approach
(lifestyle changes)



Incremental Approach
(e.g. recycled content product)

Doomsday
(crisis)



Inconsequential
(business as usual)

Transitional Tools

- **Promotion and Recognition**
 - Community Exposure
- **Development Process Incentives**
 - Expedited Plan Review
 - Reduced Development Fees
- **Financial Incentives**
 - Fee waivers
 - Tax credits
 - Bonus development

Institutional Tools

- **Rating Systems, Codes and Standards**
- **Financing, Insurance and Property Value**
 - Green and energy efficient mortgages
 - Lower risks associated with healthy interiors, performance and durability
 - Higher value for lower operating costs, durability and healthy interiors
- **Today's green will be tomorrow's standard**

For More Information



Office of Environmental Initiatives

Green Building Program Manager

Anthony Floyd, AIA, LEED-AP

afloyd@scottsdaleaz.gov

480-312-4202

www.scottsdaleaz.gov/greenbuilding