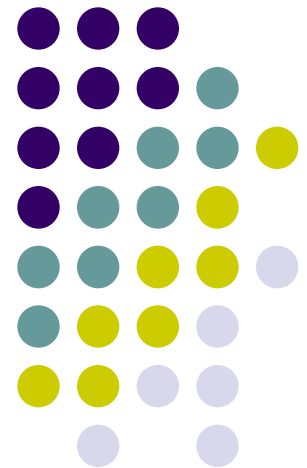


# Beyond Codes

## 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						
<b>City of Scottsdale Building Code</b>	15%	No Req'mts	No Req'mts	Partial	No Req'mts	Recir. pump	No Req'mts	No Req'mts	No Req'mts
<b>City of Scottsdale Green Building Program</b>	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
<b>Energy Star Program</b>	15%	Req'd	Req'd	Yes	Optional	No Req'mts	Optional	Not Addressed	Not Addressed
<b>LEED for Homes Program</b>	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
<b>Environments for Living – Certified Green Program</b>	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
<b>City of Austin Building Code</b>	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
<b>City of Boulder Building Code</b>	30% to 75%	Optional points	Optional points	Yes	Optional points	Optional points	Optional points	Optional points	Optional points
<b>City of Albuquerque Building Code</b>	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	
<b>ARLINGTON COUNTY, VA</b>	N/A	Projects that request density bonus	N/A	LEED certified level	2004
<b>ASPEN/PITKIN COUNTY, CO</b>	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
<b>AUSTIN, TX</b>	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
<b>BOSTON, MA</b>	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
<b>BOULDER, CO</b>	All homes	N/A	Local rating checklist w/ optional measures	N/A	2001, 2008 update
<b>FRISCO, TX</b>	All homes	N/A	Local prescriptive measures	N/A	2001, 2007 update
<b>PASADENA, CA</b>	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
<b>SAN FRANCISCO, CA</b>	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
<b>WASHINGTON, DC</b>	N/A	All projects over 50,000 sq. ft.	N/A	LEED or equivalent rating system	2009 - 2012 Phase In
<b>SCOTTSDALE, AZ</b>	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](http://www.architecture2030.org)

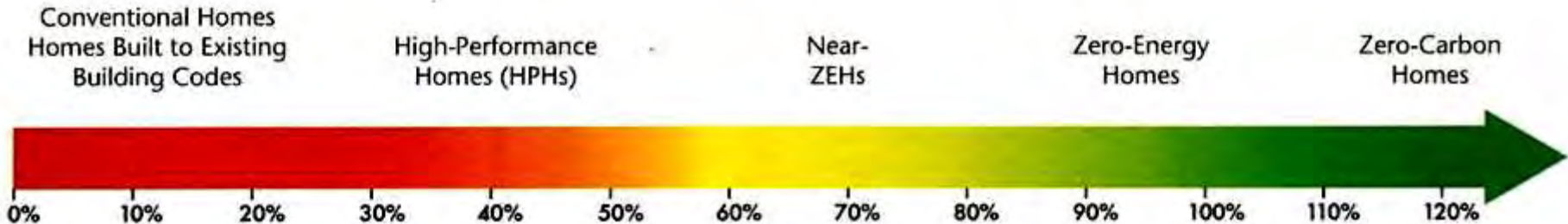
# Code Equivalents for 2030 Challenge

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; 3<sup>rd</sup> party entities
- Building Performance
  - Energy, water and IAQ performance measures
  - create synergy with energy code and 3<sup>rd</sup> 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

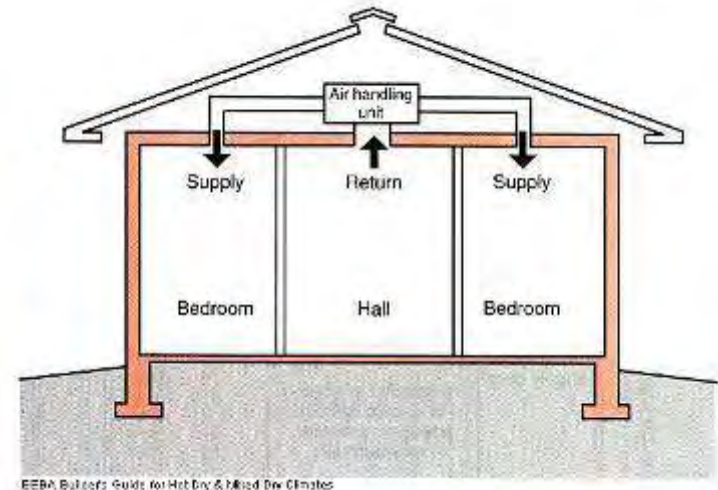
# Mandatory Measures

- Energy Efficiency
  - Insulated ductwork
  - Return air paths



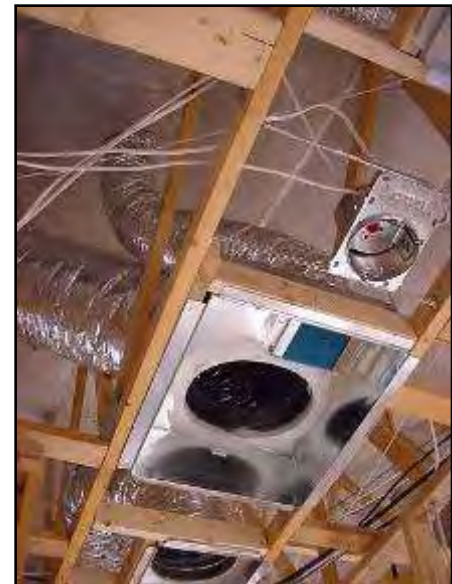
# Mandatory Measures

- 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



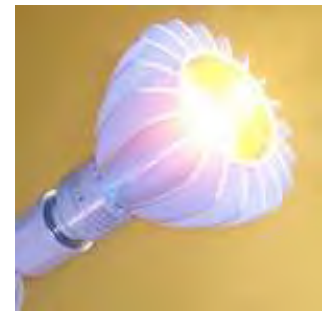
# Mandatory Measures

- 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 luminaries 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

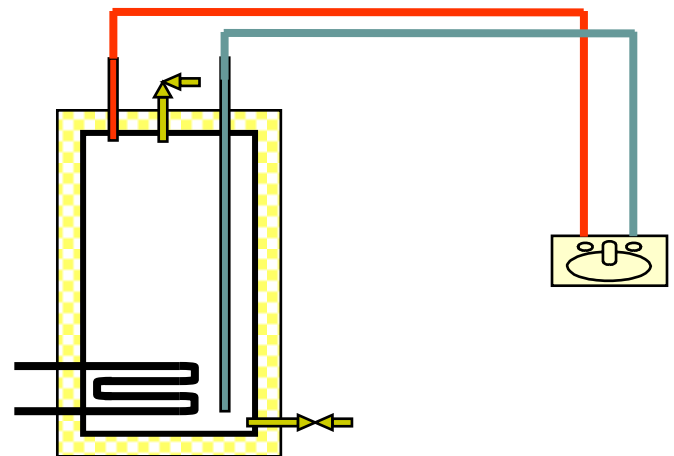
- Indoor Environmental Quality
  - Whole house ventilation system installed per ASHRAE 62.2 for single family dwellings
  - Energy Star bathroom exhaust fan controlled by
    - an occupancy sensor,
    - automatic-timer switch or
    - automatic humidistat controller





# 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



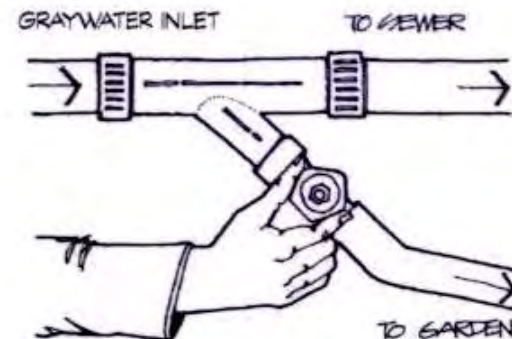
# Mandatory Measures

- 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](mailto:afloyd@scottsdaleaz.gov)

480-312-4202

[www.scottsdaleaz.gov/greenbuilding](http://www.scottsdaleaz.gov/greenbuilding)