Beyond Codes
Scottdale Green Building

Anthony Floyd, AIA
City of Scottdale
Green Building Manager
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

<table>
<thead>
<tr>
<th>City Code or 3rd Party Program</th>
<th>Percentage above 2006 IECC</th>
<th>Performance Testing</th>
<th>Thermal By-Pass Inspection</th>
<th>Lighting Efficiency</th>
<th>Water Heating</th>
<th>Appliances</th>
<th>Indoor Water Efficiency</th>
<th>Indoor Environmental Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Scottsdale Building Code</td>
<td>15%</td>
<td>No Req’mts</td>
<td>No Req’mts</td>
<td>Partial</td>
<td>No Req’mts</td>
<td>Recir. pump</td>
<td>No Req’mts</td>
<td>No Req’mts</td>
</tr>
<tr>
<td>City of Scottsdale Green Building Program</td>
<td>15%</td>
<td>Optional points</td>
<td>Optional points</td>
<td>Partial</td>
<td>Task Lighting</td>
<td>Recir. pump</td>
<td>No Req’mts</td>
<td>50% High Efficiency Toilets</td>
</tr>
<tr>
<td>Energy Star Program</td>
<td>15%</td>
<td>Req’d</td>
<td>Req’d</td>
<td>Yes</td>
<td>Optional</td>
<td>No Req’mts</td>
<td>Optional</td>
<td>Not Addressed</td>
</tr>
<tr>
<td>LEED for Homes Program</td>
<td>15%</td>
<td>Req’d</td>
<td>Req’d</td>
<td>Yes</td>
<td>Optional</td>
<td>4 Energy Star labeled fixtures or bulbs</td>
<td>Optional points</td>
<td>Optional points</td>
</tr>
<tr>
<td>Environments for Living – Certified Green Program</td>
<td>20%</td>
<td>Req’d</td>
<td>Req’d</td>
<td>Yes</td>
<td>50% High Efficiency</td>
<td>Energy Efficiency Rating Factor (EF)</td>
<td>100% Energy Star labeled</td>
<td>100% High Efficiency Fixtures</td>
</tr>
<tr>
<td>City of Austin Building Code</td>
<td>30% by 2009</td>
<td>Req’d</td>
<td>Req’d</td>
<td>Partial</td>
<td>90% High Efficacy by 2009</td>
<td>Restriction on electric</td>
<td>No Req’mts</td>
<td>Not Addressed</td>
</tr>
<tr>
<td>City of Boulder Building Code</td>
<td>30% to 75%</td>
<td>Optional points</td>
<td>Optional points</td>
<td>Yes</td>
<td>Optional points</td>
<td>Optional points</td>
<td>Optional points</td>
<td>Optional points</td>
</tr>
<tr>
<td>City of Albuquerque Building Code</td>
<td>30%</td>
<td>No Req’mts</td>
<td>No Req’mts</td>
<td>Yes</td>
<td>70% Energy Star labeled</td>
<td>Energy Star Labeled by 2009</td>
<td>Energy Star labeled washers</td>
<td>No Req’mts</td>
</tr>
</tbody>
</table>
## Local Governmental Policies for Private Sector Green Building Standards

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

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

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
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
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

[Images of CO detector and 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