Sustainability and the Expanding Role of Building Codes

International Green Construction Code (IgCC)

Anthony Floyd, AIA, LEED-AP
City of Scottsdale
Office of Environmental Initiatives
April 13, 2010
Overview

1. Background
2. IGCC and Green Code Efforts
3. Conclusions
Early Controls in the U.S.

- **Sporadic Regulations**
  - Wooden chimneys were forbidden in New York as early as 1648 and latter called for the removal of thatched roofs
  - Fire district was established 1766 where “all buildings shall be made of stone or brick and roofed with tile or slate”
  - Plumbing regulations - 1880
  - Elevator and hoist laws - 1883
  - In the late 1770s George Washington recommended that height and area limitations be imposed on wood frame buildings
Early Controls in the U.S.

- **Organizations**
  - American Society of Civil Engineers (1852)
  - American Institute of Architects (1857)
  - American Society for Testing and Materials (1902)
  - Underwriter’s Laboratories
  - National Bureau of Standards

- **National Board of Fire Underwriters** published the **National Building Code - 1905**
  - Result of a number of severe losses suffered by fire insurance companies suffered in the latter part of the 19th century and the early part of the 20th century
Early Controls in the U.S.

- **Model Code Organizations**
  - Building Officials Conference of America (1915)
    - Building Officials and Code Administrators
  - Pacific Coast Building Officials Conference (1922)
    - International Conference of Building Officials
  - Southern Building Code Congress (1949)
    - Southern Building Code Congress International

Building Codes are a Social Construct

- Market
- Codes & Standards
- Governmental Policy

- The greatest good for the greatest number

"Building law can advance no faster than the prejudices of interested persons will allow" (1881 remark on NY Building Law)
Expanding Scope of 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
Risk - Through the Microscope of Codes…

- Fire Safety
- Structural Integrity
- Means of Egress
- Light
- Ventilation
- Heat
- Water & Wastewater
- Electrical & Gas
- Energy Efficiency

Risks to Future Generations

- Climate Impact
- Resource Depletion
- Means of Egress
- Light
- Ventilation
- Heat
- Water & Wastewater
- Electrical & Gas
- Energy Efficiency

Externalized Costs to Society

- Loss of Habitat
- Loss of Biodiversity
- Toxicity of Materials
- Nutrification of Water
- Loss of Agricultural Land
- Increased Transportation
- Heat Island Effect
**Risk - The Bigger Picture…**

Risks to Future Generations

- Climate Impact
- Embodied Energy
- Pollution
- Toxicity of Materials
- Nutrification of Water

**Central Circle**

- Fire Safety
- Structural Integrity
- Means of Egress
- Light
- Ventilation
- Heat
- Water & Wastewater
- Electrical & Gas
- Energy Efficiency

- Dependence on Non-Renewable Energy
- Loss of Habitat
- Loss of Biodiversity
- Loss of Agricultural Land
- Increased Transportation
- Externalized Costs to Society

- Heat Island Effect
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 Plan Reviewers and Inspectors
  - ICC-ES rating of green materials
The scope of building codes is expanding to address the health, performance, comfort and services that people expect in buildings with the least adverse impact on natural resources and environmental health.
What Happens When Green Becomes Code?

“When you change codes, it means that everyone can live in a green building; everyone can have healthier air and live in a space that’s consistent with their values.”

Russell Unger, NYC Green Codes Task Force steering committee chair
Nation’s First Set of Model Codes and Standards for Green Building

The International Code Council (ICC)
cordially invites you to attend a special briefing with its Cooperating Sponsors,
The American Institute of Architects
and
ASTM International,
to mark the release of the
International Green Construction Code® (IGCC) Public Version 1.0

Monday, March 15
2:00-3:00 PM
International Code Council
500 New Jersey Avenue, NW, 6th Floor
Washington, DC 20001

The release of IGCC Public Version 1.0 is an important milestone in our
to offer a safe and sustainable regulatory framework to regulate green
construction of commercial and high performance buildings.

IGCC Public Version 1.0 provides immediate opportunities for
progressive jurisdictions to incorporate “green” components into their
building codes. We hope you will join us for this important review and update.
If you are unable to attend the briefing in person, please participate in our audio
conference call by dialing 866-609-4868.
International Green Construction Code

- Designed to integrate with established building codes as an overlay
- Written in mandatory language as a model code for local adoption
- Work in tandem with existing Green Building Rating programs
- Work within regulatory framework of local, state and federal laws
Feedback Loop between IgCC and LEED

LEED and Other Green Rating Programs

Closing the gap between the minimum code compliance requirements and the minimum criteria for LEED certification

IgCC and ASHRAE 189.1

Raising the Standard of Care
Public Version 1.0 released in March 2010

Comment Deadline May 14, 2010
## Steps to Ratification

<table>
<thead>
<tr>
<th>IgCC Development</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Version 1.0 release</td>
<td>March 15, 2010</td>
</tr>
<tr>
<td>Comment Deadline</td>
<td>May 14</td>
</tr>
<tr>
<td>Comments Posted</td>
<td>July 2</td>
</tr>
<tr>
<td>2010 Public Comment Hearing</td>
<td>August 14-22 in Chicago</td>
</tr>
<tr>
<td>Public Version 2.0 release</td>
<td>November 3</td>
</tr>
<tr>
<td>Code Change Submittal Deadline</td>
<td>January 3, 2011</td>
</tr>
<tr>
<td>2011 IGCC Code Development Hearing</td>
<td>May 16-22, Dallas</td>
</tr>
<tr>
<td>2011 IGCC Final Action Hearing</td>
<td>November 3-6, 2011, Phoenix</td>
</tr>
<tr>
<td>Publish 2012 IGCC</td>
<td>Early 2012</td>
</tr>
</tbody>
</table>
ASHRAE 189.1P
Standard for Green Commercial Buildings

Published in January 2010
NAHB/ICC 700
National Green Building Standard

- National design/construction standard for Residential - New Construction and Remodeling
  - Minimum baseline requirements for single- and multi-family projects
  - Online Scoring Tool
    - www.nahbgreen.org/ScoringTool.aspx
TABLE 302.1
REQUIREMENTS DETERMINED BY THE JURISDICTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Section Title or Description and Directives</th>
<th>Jurisdictional Requirements</th>
</tr>
</thead>
</table>
| 102.4.12 302.1 (1) | ICC 700 Environmental Performance Level - Select one box. | □ Bronze  
  □ Silver  
  □ Gold  
  □ Emerald |

CH 3. JURISDICTIONAL REQUIREMENTS AND PROJECT ELECTIVES

<table>
<thead>
<tr>
<th>Section</th>
<th>Section Title or Description and Directives</th>
<th>Jurisdictional Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>302.1 (2)</td>
<td>Optional compliance path – ASHRAE 189.1</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>302.1 (3)</td>
<td>Project Electives – The jurisdiction shall indicate a number between 0 and 14 to establish the minimum total number of project electives that must be satisfied.</td>
<td></td>
</tr>
</tbody>
</table>

CH 4. SITE DEVELOPMENT AND LAND USE

<table>
<thead>
<tr>
<th>Section</th>
<th>Section Title or Description and Directives</th>
<th>Jurisdictional Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>402.2.1.2</td>
<td>Floodplain preservation</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>402.2.3</td>
<td>Conservation area</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>402.2.5</td>
<td>Agricultural land</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>402.2.6</td>
<td>Greenfields</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>403.4.1</td>
<td>High occupancy vehicle parking</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>403.4.2</td>
<td>Low emission, hybrid and electric vehicle parking</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>405.1</td>
<td>Light pollution control</td>
<td>□ Yes □ No</td>
</tr>
</tbody>
</table>
Jurisdictional Requirements

### CH 5. MATERIAL RESOURCE CONSERVATION AND EFFICIENCY

<table>
<thead>
<tr>
<th>Section</th>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>502.1</td>
<td>Enhanced construction material and waste management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>502.1</td>
<td>Minimum percentage of waste material diverted from landfills - Select a percentage only where “Yes” is selected in the previous row.</td>
<td>50%</td>
<td>65%</td>
</tr>
</tbody>
</table>

### CH 6. ENERGY CONSERVATION AND EARTH ATMOSPHERIC QUALITY

<table>
<thead>
<tr>
<th>Section</th>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>602.1, 602.3, 602.3.2, 302.1.1</td>
<td>Enhanced energy performance - for buildings pursuing performance based compliance and buildings greater than 25,000 square feet in total building floor area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Table 602.1, 302.1, 302.1.1</td>
<td>TANEU of Jurisdictional Choice - Where “Yes” is selected in the previous row, the jurisdiction shall indicate a TANEU of 63 or less in Table 602.1 for each occupancy for which it intends to require enhanced energy performance.</td>
<td>See Table 602.1 and Section 302.1</td>
<td></td>
</tr>
<tr>
<td>602.3.2.4</td>
<td>Reduced CO2e emissions calculations and reporting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>613.2</td>
<td>Post C. of O. TANEU, energy demand, and CO2e emissions reporting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CH 7. WATER RESOURCE CONSERVATION AND EFFICIENCY

<table>
<thead>
<tr>
<th>Section</th>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>702.1.2</td>
<td>Enhanced plumbing fixture and fitting flow rates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>702.1.2</td>
<td>Enhanced plumbing fixture and fitting flow rate tier – Select a tier only where “Yes” is selected in the previous row.</td>
<td>Tier 1</td>
<td>Tier 2</td>
</tr>
<tr>
<td>702.7</td>
<td>Municipal reclaimed water.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CH 9. COMMISSIONING, OPERATION AND MAINTENANCE

<table>
<thead>
<tr>
<th>Section</th>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>904.1.1.1</td>
<td>Periodic reporting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Project Electives

## TABLE 303.1
### PROJECT ELECTIVES CHECKLIST

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Check the corresponding box to indicate each project elective selected.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 3. JURISDICTIONAL REQUIREMENTS AND PROJECT ELECTIVES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>304.1</td>
<td>Whole Building Life Cycle Assessment</td>
<td>□</td>
</tr>
<tr>
<td>CH 5. MATERIAL RESOURCE CONSERVATION AND EFFICIENCY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>507.2</td>
<td>Waste management (502.1 + 20%)</td>
<td>□</td>
</tr>
<tr>
<td>507.3(1)</td>
<td>Reused, recycled content, recyclable, bio-based and indigenous materials (50%)</td>
<td>□</td>
</tr>
<tr>
<td>507.3(2)</td>
<td>Reused, recycled content, recyclable, bio-based and indigenous materials (80%)</td>
<td>□ (2 Electives)</td>
</tr>
<tr>
<td>507.4(1)</td>
<td>Multi-story building – footprint reduced by at least 45%</td>
<td>□</td>
</tr>
<tr>
<td>507.4(2)</td>
<td>Multi-story buildings – footprint reduced by at least 70%</td>
<td>□ (2 Electives)</td>
</tr>
<tr>
<td>507.5</td>
<td>Reduced building volume</td>
<td>□</td>
</tr>
<tr>
<td>507.6.1</td>
<td>Service life – 100 year design service life category</td>
<td>□</td>
</tr>
<tr>
<td>507.6.1</td>
<td>Service life – 200 year design service life category</td>
<td>□ (2 Electives)</td>
</tr>
<tr>
<td>507.6.2</td>
<td>Interior adaptability</td>
<td>□</td>
</tr>
<tr>
<td>507.7</td>
<td>Moisture control</td>
<td>□</td>
</tr>
</tbody>
</table>
4 - Site Development and Land Use

- Preservation of Natural Resources
- Transportation Impact
- Heat Island Mitigation
- Site Lighting
- Detailed Site Development Requirements
- Project Electives
5 - Material Resource Conservation and Efficiency

- **Material and Waste Management**
  - At least 35% of construction waste material must be diverted from landfills
  - Building areas must be provided for post construction storage of recyclables
  - Space must be provided for storage of discarded lamps, batteries, electronics and other items that require special disposal
5 - Material Resource Conservation and Efficiency

**Material Selection**
- At least 50% of the total materials must be any combination of the following:
  - Used materials
  - Recycled content materials (at least 25% combine post-consumer and pre-consumer)
  - Recyclable materials (min. recovery rate of 30%)
  - Bio-based materials (at least 50% bio-based content)
  - Indigenous regional materials
5 - Material Resource Conservation and Efficiency

- Building Service Life Plan
  - must be included in construction documents

<table>
<thead>
<tr>
<th>BUILDING DESIGN SERVICE LIFE CATEGORY</th>
<th>60 Years</th>
<th>25 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural elements and concealed materials and assemblies</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td>Materials and assemblies where replacement is cost prohibitive or impractical</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td>Major materials and assemblies that are replaceable</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>Mechanical, electrical and plumbing equipment and systems</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Site hardscape</td>
<td>30</td>
<td>25</td>
</tr>
</tbody>
</table>
5 - Material Resource Conservation and Efficiency

- **Construction Material Storage, Handling and Moisture Control**
  - Porous and fibrous materials must be protected from moisture damage during construction

- **Project Electives**
  - Material selection percentages
    - reused, recycled content, recyclable, bio-based and indigenous materials
  - Longer building service life
    - 100 year
    - 200 year
6 - Energy Efficiency and Atmospheric Quality

- Energy Performance and Emissions – TANEU

<table>
<thead>
<tr>
<th>Building Occupancy Types</th>
<th>IgCC TANEU of Entry</th>
<th>TANEU of Jurisdictional Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business: Group B</td>
<td>70</td>
<td>--</td>
</tr>
<tr>
<td>Educational: Group E</td>
<td>70</td>
<td>--</td>
</tr>
<tr>
<td>Factory and Industrial: Groups F-1, F-2</td>
<td>70</td>
<td>--</td>
</tr>
<tr>
<td>High Hazard: Groups H-1, H-2, H-3, H-4, H-5</td>
<td>70</td>
<td>--</td>
</tr>
<tr>
<td>Institutional: Groups I-1, I-2, I-3, I-4</td>
<td>70</td>
<td>--</td>
</tr>
<tr>
<td>Mercantile: Group M</td>
<td>70</td>
<td>--</td>
</tr>
<tr>
<td>Residential: Groups R-1, R-2, (R-3, R-4)</td>
<td>70</td>
<td>--</td>
</tr>
<tr>
<td>Storage: Groups S-1, S-2</td>
<td>70</td>
<td>--</td>
</tr>
<tr>
<td>Utility and Miscellaneous: Group U</td>
<td>70</td>
<td>--</td>
</tr>
</tbody>
</table>

a. Minimum acceptable performance for all building types and sizes.
b. Where the jurisdiction elects to adopt a greater threshold for energy efficiency, a TANEU of 63 is ten (10) percent better than the IgCC 'Point of Entry'. The TANEU of Jurisdictional Choice shall apply only to buildings pursuing performance-based compliance in accordance with Section 602.3.2.
Energy Efficiency and Atmospheric Quality

- **Metering, Monitoring and Reporting**
  - *energy display* must be provided that is capable of showing the current energy demand

- **Renewable Energy Systems**
  - renewable energy must provide at least 2% of total calculated annual energy use

- **Commissioning**
  - mechanical, lighting, electrical systems, building envelope

- **Project Electives**
### Water Resource Conservation and Efficiency

- **Fitting and Fixture Consumption**
  - Mandatory 20% water use reduction

<table>
<thead>
<tr>
<th>Plumbing Fixture or Supply Fitting</th>
<th>Flow Rate or Volume&lt;br&gt; <strong>(g)</strong></th>
<th>Duration</th>
<th>Daily Uses Per Occupant</th>
<th>Occupants</th>
<th>Daily Volume&lt;br&gt; Gallon per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shower head</td>
<td></td>
<td>5 min</td>
<td>1</td>
<td>Note c</td>
<td></td>
</tr>
<tr>
<td>Lavatory faucet, private</td>
<td>0.25 min</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lavatory, public (metered)</td>
<td>1 cycle</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lavatory, public (nonmetered)</td>
<td>0.25 min</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen and bar sink faucets</td>
<td>4 min</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urinal</td>
<td>1 cycle</td>
<td></td>
<td>2/male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water closet</td>
<td>1 cycle</td>
<td></td>
<td>1/male</td>
<td>males</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3/female</td>
<td>females</td>
<td></td>
</tr>
<tr>
<td><strong>Total Design Water Use (D) (gal/day)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For SI: 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 0.895 kPa.
Water Resource Conservation and Efficiency

- **Water Treatment Devices**
  - Water softeners
  - Reverse osmosis treatment systems
- **Metering**
  - Each potable, reclaimed and on-site water systems
- **Rainwater Collection and Reuse**
- **Graywater Systems**
- **Reclaimed Water Systems**
- **Project Electives**
  - Non-potable water supply for fire sprinkler system and fire pumps
Indoor Environmental Quality and Comfort

- **Indoor Air Quality & Pollutant Control Measures**
  - Building Flush Out
- **Materials Emissions and Pollutant Control**
  - Interior pressed wood
  - Adhesives and sealants
  - Architectural paints and coatings
  - Flooring
  - Acoustical ceiling tiles and wall systems
  - Insulation
- **Sound Transmission and Daylighting**
- **Project Electives**
IAPMO
Green Plumbing and Mechanical Code Supplement

- Use of alternate water sources
  - gray water
  - rainwater harvesting
  - reclaimed
- High-efficiency plumbing fixtures
- Hot water distribution systems
  - efficient plumbing lay out
- High-efficiency HVAC systems
- Enhanced indoor environmental quality

Published in February 2010
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
Alignment of Tools and Instruments

- Rating Programs
- Government Policy
- Standards & Codes
- Market Supply & Demand
Growing Momentum Towards Sustainable Building Practices

- **Changing Regulatory Environment**
  - local guidelines, ordinances and policy; building and energy codes; federal energy policy and stimulus funding

- **Improved Verification Process**
  - energy and green training for inspectors and 3rd party verifiers
  - documentation and verification methods during plan review and inspections
  - certificate of completion and accountability forms

- **Building Performance Verification**
  - measuring energy, water and IAQ performance
Moving Forward

- Setting benchmarks and identifying standards
  - Above-code energy and green building programs raise the bar for new building standards and codes

- Integration with planning process
  - Establish framework for early consideration of sustainable design options

- New incentives and performance measures
  - Develop suitable incentives and verification tools
Institutional Tools

*Long Term and Systemic*

- Building Codes and Standards
- Development and Land Use Regulations
- Financing, Insurance and Property Value
  - Higher value and lower risks for lower operating costs, performance, durability & healthy interiors
  - Property Assessed Clean Energy (PACE) financing, PPAs, Solar Leasing
- Development Incentives
  - Land use bonus densities
- Tax Structure
  - Tax Credits and exemptions

*Fireman's Fund Insurance Company*

A company of *Allianz*

- Green Home Coverage
- 5% credit to base premium for Green certified homes
Transitional Tools
*Short Term and Immediate*

- **Promotion and Recognition**
  - Community exposure and market differentiation

- **Development Process Incentives**
  - Expedited plan review
  - Reduced development fees
  - Feebates and rebates

- **Voluntary Rating Systems**
  - Market transformation

- **Development Guidelines**
  - Community design guidelines

- **Financial Incentives**
  - Rebates, tax credits and exemptions
Thank you

Anthony Floyd, AIA, LEED-AP
City of Scottsdale
Office of Environmental Initiatives
Green Building Program
afloyd@scottsdaleaz.gov
480-312-4202
www.scottsdaleaz.gov/greenbuilding