

ENERGY CODE COMPLIANCE: CHALLENGES & SOLUTIONS



**2009 IECC: REACHING
90% COMPLIANCE**

Greenprints Atlanta 2010



BCAP

Dedicated to the adoption, implementation,
and advancement of building energy codes



BCAP – Building Codes Assistance Project



Non-profit, based in D.C. since 1994

Formed as a joint project of the *Alliance to Save Energy*, the *Natural Resources Defense Council*, and the *American Council for an Energy Efficient Economy*

Provide *resources, education & advocacy assistance* for adoption, implementation, & advancement of effective energy codes on behalf of the US Department of Energy and other funders



Non-Compliant Construction Practices



US Compliance rates



State	Energy Code	Compliance Rate
Arkansas	92 MEC	55%
California	Title 24	70%
Idaho	1996 IRES	52%
Nevada	Various	0 to 9%
New York	2002 NYRes	0%
Oregon	2993 OREC	100%
Washington	1997 WSEC	93%



Enforcement Structures



State or Local
Government
Employees
Enforce Code

Third
Party

Self-Certify
&
Judicial
Enforcement



Why is Compliance Low?



- Little/no enforcement
- Lack of knowledge
- Inconsistency



Barriers to Compliance

- Little/no enforcement
 - Low priority
 - Insufficient resources
 - Low political will (pressure from builders/developers)



Barriers to Compliance - Resources



Residential code

Current practice:

1.25 hours for building plan review & inspection

Recommended:

2.5 hours for building plan review & inspection

29 hours per year in training

Note: does not include vehicle, equipment, office expense or time needed to travel to building sites



Barriers to Compliance



- Lack of knowledge
 - Builders don't understand energy efficiency
 - Code officials don't have expertise or training
 - Architects learn design, not building science/performance
 - Consumers ASSUME codes assure energy efficiency



Barriers to Compliance



- Inconsistency/lack of standard protocols
 - Record-keeping
 - Interpretation and application of code requirements



Improving Compliance



1. Improve enforcement and visibility/priority of energy code.
2. Improve the understanding of the energy code.
3. Improve the consistency of code enforcement.



Improve Enforcement/Visibility/Priority of Code



- Provide sufficient budget & staff
- Link codes to national/state/local goals & priorities
- Automate review/permit/inspection
- Existing buildings: use time-of-sale or other requirements to measure performance



Improve Enforcement/Visibility/Priority of Code

- Link financial assistance to compliance
- Make data publicly available
- Withhold certificates of occupancy on non-compliant buildings
- Inspect and test buildings



Improve Understanding of Codes



- Mandate certification/training requirements
- Provide holistic training
- Train officials and builders together
- Develop and use regional code experts
- Use compliance failures to adjust training content
- Hold field training sessions for all parties



Improve Consistency of Code Enforcement



- Standardize practice & procedures
 - Permit requirements
 - Record-keeping
 - Plan review and inspection protocol
 - Code interpretations
- Link plan review & permits to site inspection
- Conduct site inspections to coincide with critical compliance milestones



Improve Consistency of Code Enforcement

- Use third party enforcement
 - Private sector firms
 - HERS-As-Codes, Energy Star
 - Utilities
- Use commissioning
- Use compliance testing
- Promote use of checklists and other tools to clarify requirements

REScheck Inspection Checklist
New York State Energy Conservation Construction Code
REScheck Software Version 5.5 Release 1

DATE: 12/21/02

Bldg. |
Dist. |
Loc. |

Ceilings:

| | 1. Ceiling 1: Flat Ceiling or Suspend Truss, R-35.0 cavity insulation
Comments: _____

| | 2. Ceiling 2: Cathedral Ceiling (no attic), R-19.0 cavity + R-5.0 continuous insulation
Comments: _____

Above-Grade Walls:

| | 1. Wall 1: Wood Frame, 15" o.c., R-19.0 cavity insulation
Comments: _____

Basement Walls:

| | 1. Basement Wall 1: Solid Concrete or Masonry, 2.0' thick by 0.0' min.,
R-11.0 cavity insulation
Comments: _____

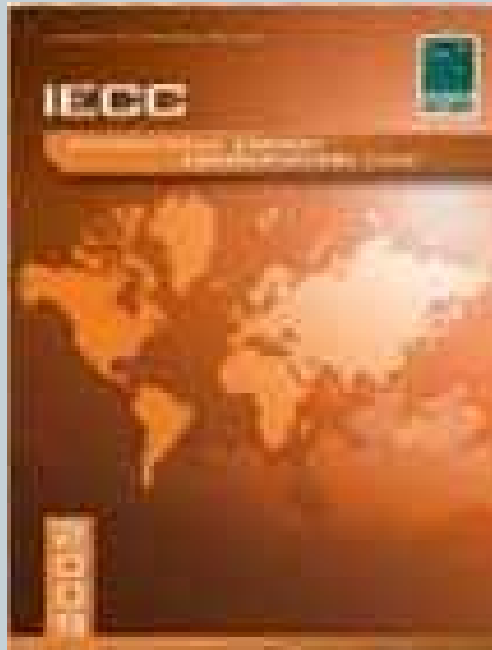
Windows:

| | 1. Window 1: Metal Frame with Thermal Break, Double Pane with Low-E, U-factor: 0.350
For windows without labeled U-factors, describe features:
#Panes: _____ Frame Type: _____ Thermal Break? Yes No
Comments: _____



New Federal Requirements

- Adopt model codes
- 90% compliance for new and existing buildings within 8 years



90% Compliance – DOE Guidance



DOE's "Topic Briefs" (9? 10? 11?) can be found at:

http://www.energycodes.gov/news/arra/compliance_evaluation.stm



Topic Brief 1: Measuring 90% Compliance



At minimum, 176 buildings must be evaluated:

- 44 new + 44 existing homes
- 44 new + 44 existing commercial buildings (S, M, L)
- Additional commercial samples for XL and XXL

Buildings assessed must be distributed across climate zones, building types, and jurisdictions and chosen through a statistically valid methodology.

90% goal for 2017 – but annual measurements are required.



Topic Brief 1 – Measuring 90% Continued



- Each of the 44 buildings will receive a compliance rating of 0-100% based on the proportion of code requirements met. Scores for each group of 44 will be averaged to derive an overall compliance metric.
- Alt. approach is pass/fail; any building that fails any code requirement fails completely -- not the recommended approach.



Topic Brief 1 - Measuring 90% Continued



Data Completeness:

- Identify where codes are working well or failing
- Determine how codes are being implemented and enforced
- Assess where corrective actions and educational efforts are needed



Topic Brief 2: Sample Size



44 samples for most categories

1. Distributed across climate zones based on most current building start data
2. Then, distributed across jurisdictions also based on building starts
3. For commercial buildings, sampling must also incorporate building size



Topic Brief 2: Statistical Confidence



- Data evaluations to determine statistical mean, standard deviation, confidence levels, etc. should be conducted separately for residential and commercial.
- 90% compliance rate must be supported by analysis demonstrating a 95% confidence level.



Topic Brief 3: Onsite Compliance Evals



Evaluation Approaches:

- 1st Party – self reporting; unacceptable
- 2nd Party – state or local government; possible
- 3rd Party – accredited firm on behalf of government; recommended approach



Topic Brief 3: Onsite Evals Continued



Building department or state agency: in some cases, can be seen as a type of self-certification

Public sector third party: may reduce conflict of interest

Private sector third party: HERS raters, utilities, construction/design professionals

Preferred approach: private sector third party under contract to a government agency



Topic Brief 3: Onsite Evals Continued



Recovery Act evaluation requirements:

1. Annually measure the rate of compliance: this can be conducted through local building departments
2. By 2017, officially determine 90% compliance: this should be conducted through private sector third parties



Topic Brief 3: Onsite Evals Continued



State must demonstrate objectivity and competence of evaluators:

- Accredited professional certification programs
- State-run training and testing program
- On-going education and testing
- Licensing and certification



Topic Brief 4: Above-Code Buildings



Buildings that exceed code cannot offset buildings that don't meet code.

In other words, there are no bonus points for above-code buildings.



Topic Brief 5: Sample Distribution & Make-Up



Commercial building size strata:

- Small: 1-2 stories, single zone, up to 25,000 sq ft
- Medium: >25,000 sq ft and <60,000 sq ft
- Large: >60,000 sq ft and <250,000 sq ft
- X-Large: >250,000 sq ft and <400,000 sq ft
- XX-Large: >400,000 sq ft

Typically, 14-15 buildings from S, M, L categories -- distributed across climate zones and counties based on past construction rates.



Topic Brief 5: Sampling Continued



1. Determine a compliance rate for each applicable category (S-XXL)
2. These average compliance rates will be weighted according to the proportion of total square footage (e.g., small buildings are 13% of total commercial)
3. Weighted averages will be summed to arrive at total
4. XL and XXL require sampling of buildings in addition to the 44 for new commercial construction.



Topic Brief 5: Sampling Continued



Buildings sampled for the 90% compliance evaluation should represent a “reasonable cross section of the building types within the state.”

- Building use (activities or function)
- Ownership (public or private)
- Design

Don't leave multi-family out of residential sample or only sample retail buildings in the commercial sector.



Topic Brief 5: Sampling Continued



Commercial building types to sample:

- Office
- Retail/Mercantile
- Warehouse/Storage
- Education/School
- Lodging/Hotel/Motel
- Restaurant/Dining/Fast Food
- Public Assembly/Religious
- Healthcare
- High Rise Residential



Topic Brief 5: Sampling Continued



Residential building types to sample:

- Modular homes
- One- or two-family detached dwellings
- One- or two-family attached dwellings
- Townhouses
- Multifamily apartments
- Multifamily condominiums



Topic Brief 6: Evaluation Checklists



Compliance approaches:

Prescriptive, Trade-off, Performance

DOE's evaluation checklists will be generic enough to be used with any compliance approach.

Note: If documentation supporting a trade-off or performance approach is not available, the evaluation of the building must be based on the prescriptive compliance path.



Topic Brief 6: Checklists Continued



Checklist items grouped according to construction phases:

- Plan review
- Foundation
- Framing/Rough-in
- Insulation
- Final

Plus, an additional inspection for:

- Electrical/Lighting (for commercial)



Topic Brief 6: Checklists Continued



Composite building compliance evaluation allows sampling different buildings in different stages of construction as long as:

- Similar building attributes (residential subdivision or condominium complex)
- Similar building types (e.g., townhouse)
- Located in same jurisdiction
- Commercial – must fall within the same size category (S, M, L, XL, XXL)



Topic Brief 6: Checklists Continued



Type of information required by the checklists:

- R-values
- Fenestration U-factors and SHGC values
- Equipment efficiencies (commercial)
- HVAC equipment capacities
- Infiltration and duct leakage test results
- Conditioned floor area



Topic Brief 6: Checklists Continued



Checklist items have different weights depending on energy efficiency impact.

- Tier 1 items receive 3 points
- Tier 2 items receive 2 points
- Tier 3 items receive 1 point (*didn't see any*)

A building meeting all code requirements will receive a rating of 100%. Failure to meet one or more requirements will result in a rate of less than 100%.



Topic Brief 6: Checklists Continued



Compliance = (points received/possible points) x 100
rate

$$82\% = (37/45) \times 100$$

Note: Achieving a 95% confidence level may require more buildings to be evaluated.....



Topic Brief 7: Compliance Roadmap



ARRA requires that states submit, “A plan for ... achieving compliance...within 8 years...in at least 90 percent of new and renovated residential and commercial building space. Such plan shall include active training and enforcement programs and measurement of the rate of compliance each year.”



Topic Brief 7: Roadmap Continued



How to meet ARRA requirements:

- Local code agencies conduct self assessments
- Identify areas that need improvement
- Training and reinforcement to generate improvements
- Further self assessments
- Final assessment conducted by an accredited third party



Topic Brief 7: Roadmap Continued



Self assessments conducted throughout the year can be combined to report to DOE an estimate of the annual measurement of compliance.

Note: the methodology for determining the state's overall compliance rate should closely match the methodology to be used for the final, third party evaluation.



Topic Brief 8: Renovations



“Renovations” defined:

any work on or in existing buildings where all or part of the work is required to meet code and for which a permit was issued, including additions, alterations, and repairs.

Do not assign a compliance metric to each renovation project. Instead, renovation samples will be evaluated as a group of observations; some projects have a few observations, others have many more.



Topic Brief 8: Renovations Continued



Deriving the compliance metric for renovations:

$(\# \text{ of items in compliance} / \text{total } \# \text{ items evaluated}) \times 100$

Items (in compliance and total) are summed across groups. Score is assigned to the group as a whole, not individual buildings.



Topic Brief 8: Renovations Continued



A minimum of 44 residential and 44 commercial buildings must be evaluated.

90% compliance rate must be supported by analysis demonstrating a 95% confidence level.



Topic Brief 8: Renovations Continued



Building sampling must be distributed across the state (by climate zones and counties) but building size need not be considered.

Additional stipulation: Any renovation included in the sample of 44 must have at least 10% of the checklist items evaluated.



Up-coming BCAP work: State, Local, International



- Energy Code Roadmaps and Gap Analysis
- Assistance on Adoption
 - Engaging key stakeholders
 - Providing exemplary legislative models
- Assistance on Implementation
 - Compliance assurance through outreach, curriculum development, new approaches in training, etc.
 - Enforcement assessment and assistance



OCEAN – A Repository and Conduit



Online Code Environment & Advocacy Network

- Lessons learned, best practices, and resources
- State amendments, local policies, implementation and enforcement practices, etc.
- Facilitated collaboration among diverse organizations and groups

www.bcap-ocean.org

Ultimate Goal: program development that builds on the experiences of others.



Many thanks



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