



## Current Activities in Support of Building Energy Codes

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***Purpose:** To provide an update on DOE activities related to the development of proposed code changes and deployment of existing codes:*

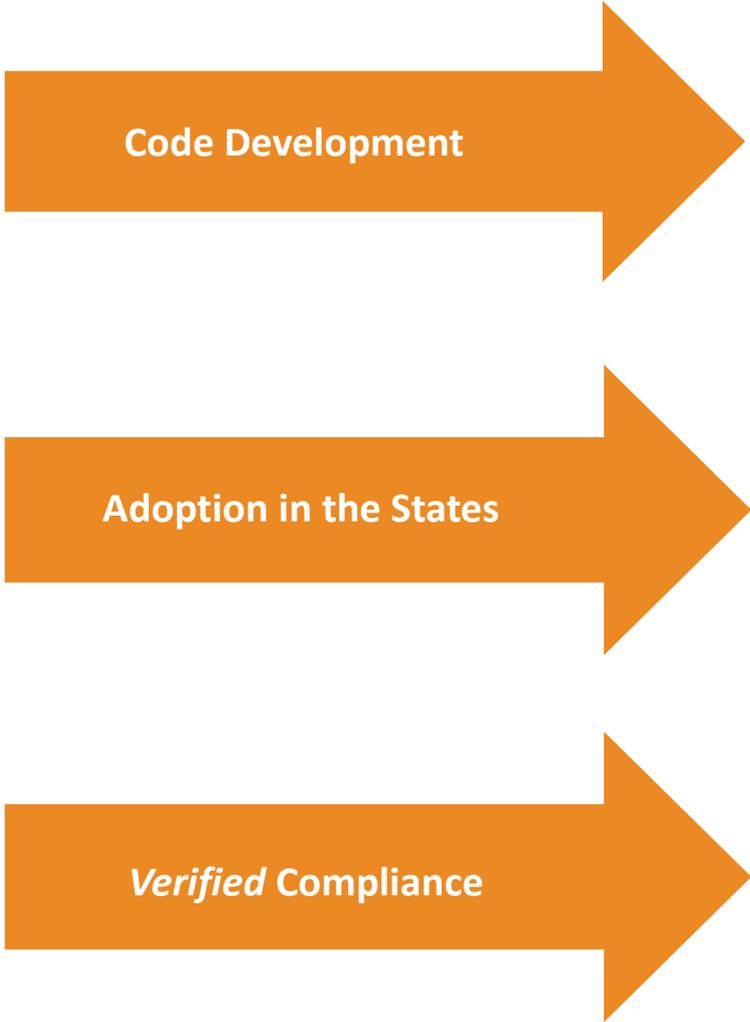
- Goals and direction
- Activity updates
- Available resources

# Goals and Direction

## Model Energy Codes: Accomplishments

### *30% Initiative for Increased Energy Savings*

- **Commercial**—Published in 2010
  - ANSI/ASHRAE/IESNA Standard 90.1—2010 with savings of approximately 25% compared to 90.1—2004
  - Savings of up to 30% in the 2012 IECC commercial energy code
- **Residential**—Published in 2011
  - 2012 IECC with savings of approximately 30% compared to the 2006 IECC residential code



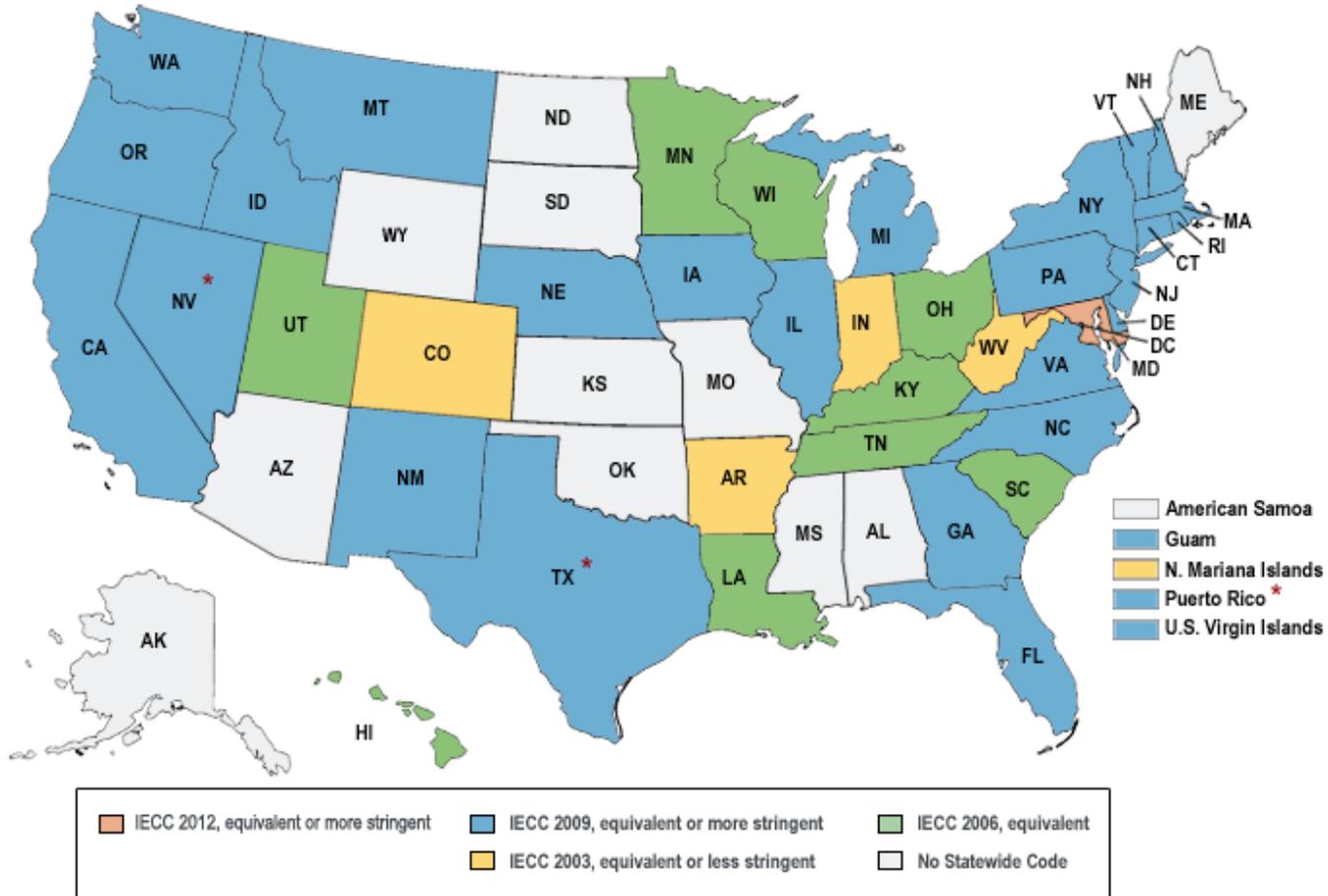
Code Development

Adoption in the States

*Verified Compliance*

## Status of Code Adoption: Residential

Overview of the currently adopted residential energy code in each state.



As of January 1, 2012

## Model Energy Codes: 50/70/90 Goals

### 50% Goal for Increased Energy Savings:

- Cost-effective energy savings for 2015 and future
- Need to go beyond simple prescriptive approaches
- Exploring performance-based options
- Alternative paths to compliance

### 70% Initiative for Increased Adoption:

- 40 states and territories to adopt ARRA target codes or most current model codes by 2015
- 2012 IECC and Standard 90.1—2010

### 90% Compliance by 2017:

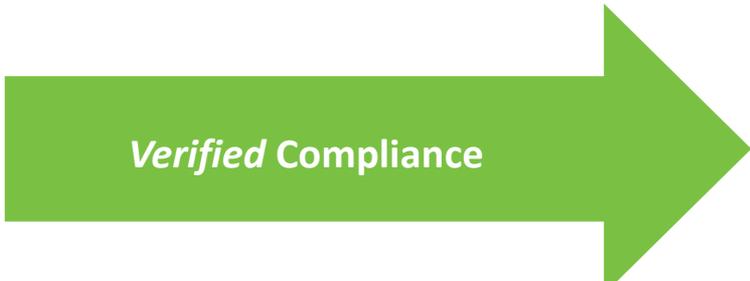
- Demonstrated compliance with ARRA requirements
- Increase the number and availability of compliance guides, field measurement tools, and resources



Code Development



Adoption in the States



*Verified Compliance*

# Activity Updates

## Determinations of Energy Savings

### Energy Conservation and Production Act (ECPA), as amended by EPACT 1992

**Sect 304:** DOE is required to make a ***Determination*** within one year of publication of the revised model energy code, States then have *two years* to adopt the Commercial code and review the Residential code

- Final Determination for 90.1-2007 & 2009 IECC published July 2011
- Final Determination for 90.1-2010 published in October 2011
- Preliminary Determination for 2012 IECC published in October 2011

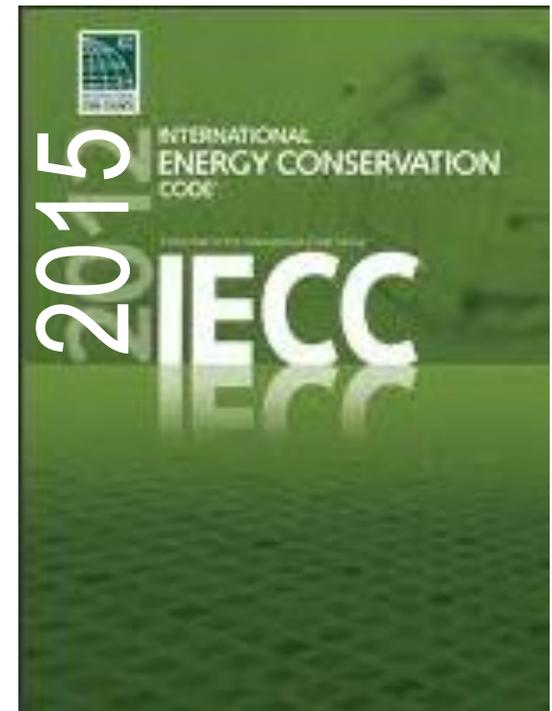
## **Objective:** *Improve Energy Efficiency in a Cost Effective Manner*

DOE Goal for next three years: Codes and standards aimed at additional savings compared to the 2006 IECC:

- End-uses traditionally covered in residential codes/standards: heating, cooling, and water heating
- Additional savings through updated federal standards (equipment and lighting)
- Interaction with the IECC and Standard 90.2 processes

Cost-effective improvements:

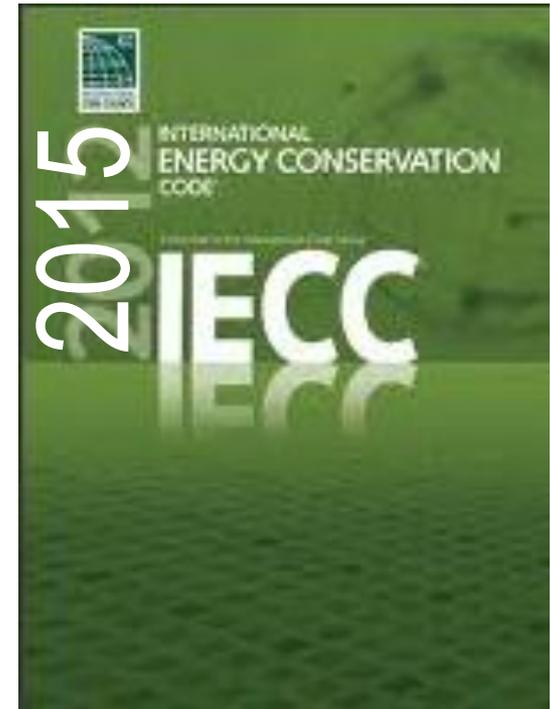
- Life-cycle economic perspective



It's not only about *energy*—efficiency should not compromise indoor air quality, health, building durability, or occupant comfort.

## An open and transparent process:

- Solicit and consider stakeholder input on proposed methodology
- Publish final methodology documenting approach, data sources, and assumptions
- Publicly available EnergyPlus simulation runs and results
- Incorporate cost into DOE code proposal development
  - DOE construction cost database



All posted to *Code Development* section of [www.energycodes.gov](http://www.energycodes.gov)

## Residential Code Development

### Residential Cost Methodology RFI

*Published September 13, 2011*

- Published in the Federal Register—comments due November 2011
- DOE sought input on how it might improve its methodology for assessing cost-effectiveness for changes to residential building energy codes
- Public input on the overall methodology, preferred data sources, and parameter assumptions—proposed Life-cycle approach
- Affects the assessment of published codes and code change proposals
- Challenge: Cost of codes have not been uniformly calculated or explicitly stated—need for increased transparency and process duplication
- DOE will publish final methodology for code proposal development

## Public Input:

- 35 Public comments received and processed
- Key topics: First costs, replacement measures, maintenance costs

## Modifications:

- Additional first cost considerations
- Replacement of features
- Reference cities
- Multi-family prototype size

Original comments available: [\*Docket EERE 2011 BT-BC 0046\*](#)



Federal Register

## Life-cycle economic approach:

- 30 year period of analysis
- Account for replacements of equipment and features
- Based on a typical mortgage with fixed interest rate
- EIA fuel prices and escalation rates

## Reported Results:

- Results reported at national, climate zone and state levels
- Simple payback and cash flow analyses also included to aid state adoption

*Final methodology to be published in March 2011 on:*  
[www.energycodes.gov](http://www.energycodes.gov)



## The Challenge:

- Traditional code formats are being strained
- Need for increased code compliance

## Residential Proposal R+D:

- Concepts have been analyzed for optimal efficiency based on associated energy savings
- DOE proposed concepts include a test of cost-effectiveness
- Accepting comments on residential concepts

## Reviewing the following potential areas:

- Equipment, fenestration, radiant barriers, quality testing & verification

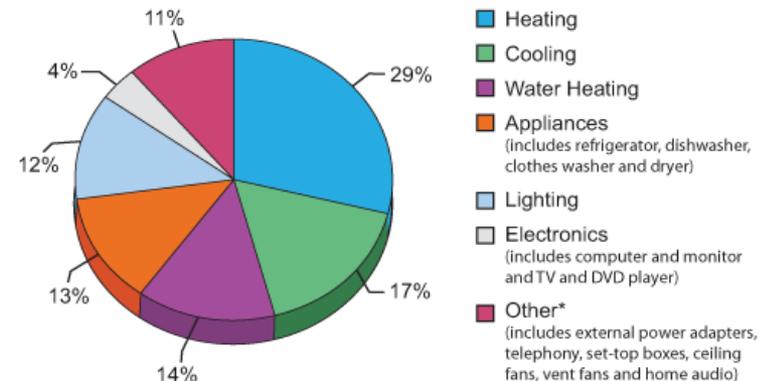


*Potential future DOE residential energy efficiency concepts:*

- Envelope insulation levels
  - Comparable to 2012 IECC levels
- Verified tightness of building envelope
  - Mechanical ventilation
  - Heat recovery in cold climates
- Fenestration U-factor and SHGC
- Cool roof design or radiant barrier in hot climates
- High-efficiency equipment and appliances

## Where Does My Money Go?

Annual Energy Bill for a typical Single Family Home is approximately \$2,200.



*Methods of assuring increased compliance with the energy code.*

# Available Resources

*Support states as they work to demonstrate 90% Compliance with the Target Energy Codes*

BECP guidelines and tools to use in measuring compliance with building energy codes:

- ✓ Foster uniformity and objectivity in measuring compliance rates
- ✓ Eliminate need for each state to develop their own procedures and tools
- ✓ Provide tools that states can adapt for their own preferred use



## Package of Integrated Compliance Resources:

- **Procedures** for measuring compliance – *“Measuring State Energy Code Compliance” (March 2010 report)*
- A short companion step-by-step **“quick-start” guide** summarizing procedures
- **Informational flyers** to help states schedule onsite evaluations
- A **jurisdictional survey** for evaluating compliance related processes
- The **Sample Generator online tool** to be used for generating a valid sample set
- Compliance evaluation **checklists and instructions** tailored to various codes
- The **Score + Store online tool** for collecting, storing, and analyzing the resulting onsite evaluation data, and for calculating state-wide scores

**State Sample Generator**  
Generate a random code compliance sample. [Learn more...](#)

**SELECT A STATE**  
Click a state to generate construction samples.

State

**State Sample Generator**  
Generate a random code compliance sample. [Learn more...](#)

**WYOMING**  
Choose a construction category and time period to filter sample results.

Construction Category

Time Period  Average of 3 Most Recently Available Years  
 Average of 2 Most Recently Available Years  
 Most Recently Available Year

**CONSTRUCTION SAMPLES**  
**Commercial New**  
Construction starts represent an annual average from 2007-2009 data.

Location	Construction Starts	Small	Medium	Large	X-Large	XX-Large
<b>State Total</b>	<b>537</b>					
Climate Zone 5 Total	13					
Climate Zone 6 Total	437					
Climate Zone 7 Total	87					

**WYOMING**  
Choose a construction category and time period to filter sample results.

Construction Category

Time Period  Average of 3 Most Recently Available Years  
 Average of 2 Most Recently Available Years  
 Most Recently Available Year

**CONSTRUCTION SAMPLES**  
**Commercial New**  
Construction starts based on 2009 data.

Location	Construction Starts	Sample Size				
		Small	Medium	Large	X-Large	XX-Large
<b>State Totals</b>	<b>264</b>	<b>10</b>	<b>10</b>	<b>9</b>	<b>0</b>	<b>0</b>
Climate Zone 6 Totals	437	9	8	7		
Campbell County	38	2	-	3		
Fremont County	39	1	3	-		
Natrona County	59	3	-	4		
Park County	41	3	5	-		
Climate Zone 7 Totals	87	1	2	2		
Lincoln County	12	-	1	-		
Sublette County	12	-	-	2		
Teton County	63	1	1	-		

Download as: [CSV File](#)

Online web application that provides statistically valid random sampling guidance for states by county based on construction start data:

1. Choose your state and building type
2. Generate statistical sample by project location (county)

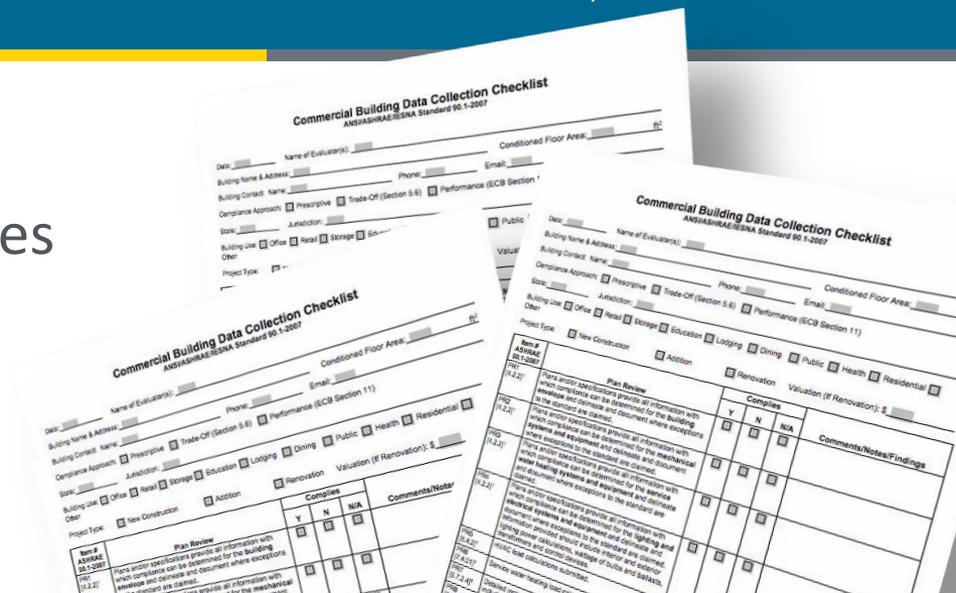
<http://energycode.pnl.gov/SampleGen/>

# Compliance Checklists

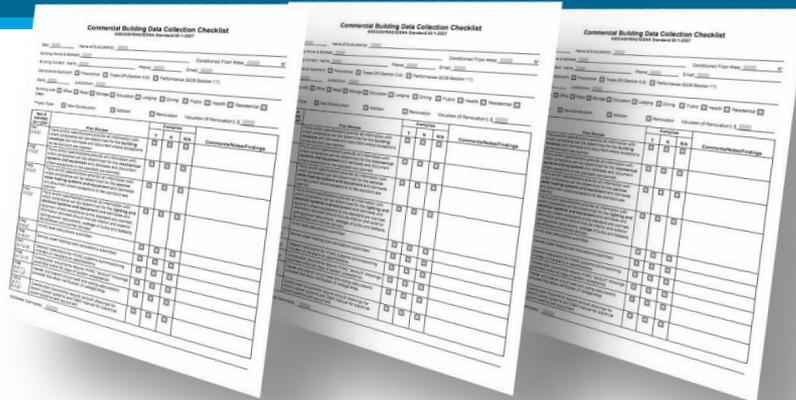
- Record results of a compliance check and verify installed features comply:
- Structured based on typical construction progression and inspections
  - Plan review, foundation, framing, mechanical, final

## Developed and available for:

- ASHRAE Standard 90.1-2004 and 2007
- IECC 2009 (Residential – each climate zone)
- IECC 2006 (Residential – each climate zone)
- IECC 2009 (Commercial)
- IECC 2006 (Commercial)



Item Number	Pre-Inspection/Plan Review
PR1 [103.2] <sup>1</sup>	<p><b>Documentation.</b> Determine if a complete set of plans/construction drawings, specifications, and energy code compliance documentation is available in the building department. If there is no building department or the locality does not conduct plan review, this information should be obtained from the registered design professional or builder having responsibility for the project. If documentation indicating a trade-off or performance approach is not provided, a prescriptive approach must be assumed for verifying compliance. Construction documents should sufficiently demonstrate energy code compliance, including but not limited to the following information:</p> <ul style="list-style-type: none"> <li>The location and R-values of insulation materials</li> <li>U-factors and SHGC values for windows, doors, skylights, and other fenestration products</li> <li>Information related to duct and piping location, insulation type and R-value, and means of sealing</li> </ul> <p>Under the assumption that only state or local government with a responsible enforcement and/or permitting agency are included in compliance evaluations, plans and documentation are expected to be held by the responsible agency. If this is not the case, mark this code requirement and the next (PR1 and PR2) as non-compliant, unless there is another entity responsible for enforcement identified (e.g. utility, contractor licensing board, etc.) in which case they should be contacted to review PR1 and PR2 information.</p>
PR2 [403.6] <sup>2</sup>	<p><b>HVAC Load Calculations.</b> Verify that HVAC load calculations have been completed and submitted. Verify the methodology used in the load calculations. List the resultant heating and/or cooling loads as applicable in the Verified Value column.</p>



- Web application stores building evaluation data gathered as part of a state compliance evaluation
- Scores the data (both individual building and state scores) and allows analysis of data collected across states

**Score + Store** Welcome markus.kobold@pnl.gov Account Logout  
Manage user accounts Manage templates

Back to My Checklists 3. Framing / Rough-In Inspection

**Framing / Rough-In Inspection** TOTAL SCORE: 100% Save Checklist

**Score + Store** Welcome markus.kobold@pnl.gov Account Logout  
Manage user accounts Manage templates

### Checklist Metrics

**Code Requirements with Highest Compliance Rate (Top 3)**  
PR6 - [8.4.1.1] Feeder connectors sized in accordance with approved plans.  
PR7 - [8.4.1.2] Branch circuits sized for maximum drop of 3%.  
ME8 - [6.4.4.1.2] HVAC ducts and plenums insulated.

**Code Requirements with Lowest Compliance Rate (Top 3)**  
PR1 - [4.2.2] Plans and/or specifications provide all information with which compliance can be determined for the building envelope and delineate and document where exceptions to the standard are claimed.  
FR3 - [5.4.3.2] Fenestration and doors labeled for air leakage.  
FR2 - [5.4.3.2] Doors meet maximum air leakage requirements.

**Code Requirements Most Frequently Not Observed (Top 3)**  
FR14 - [5.8.2.3,5.5.3.6] U-factor of opaque doors associated with the building thermal envelope meets requirements.  
FR12 - [5.8.2.1] Fenestration products rated in accordance with NFRC.  
FR13 - [5.8.2.2] Fenestration products are certified as to performance labels or certificates provided.

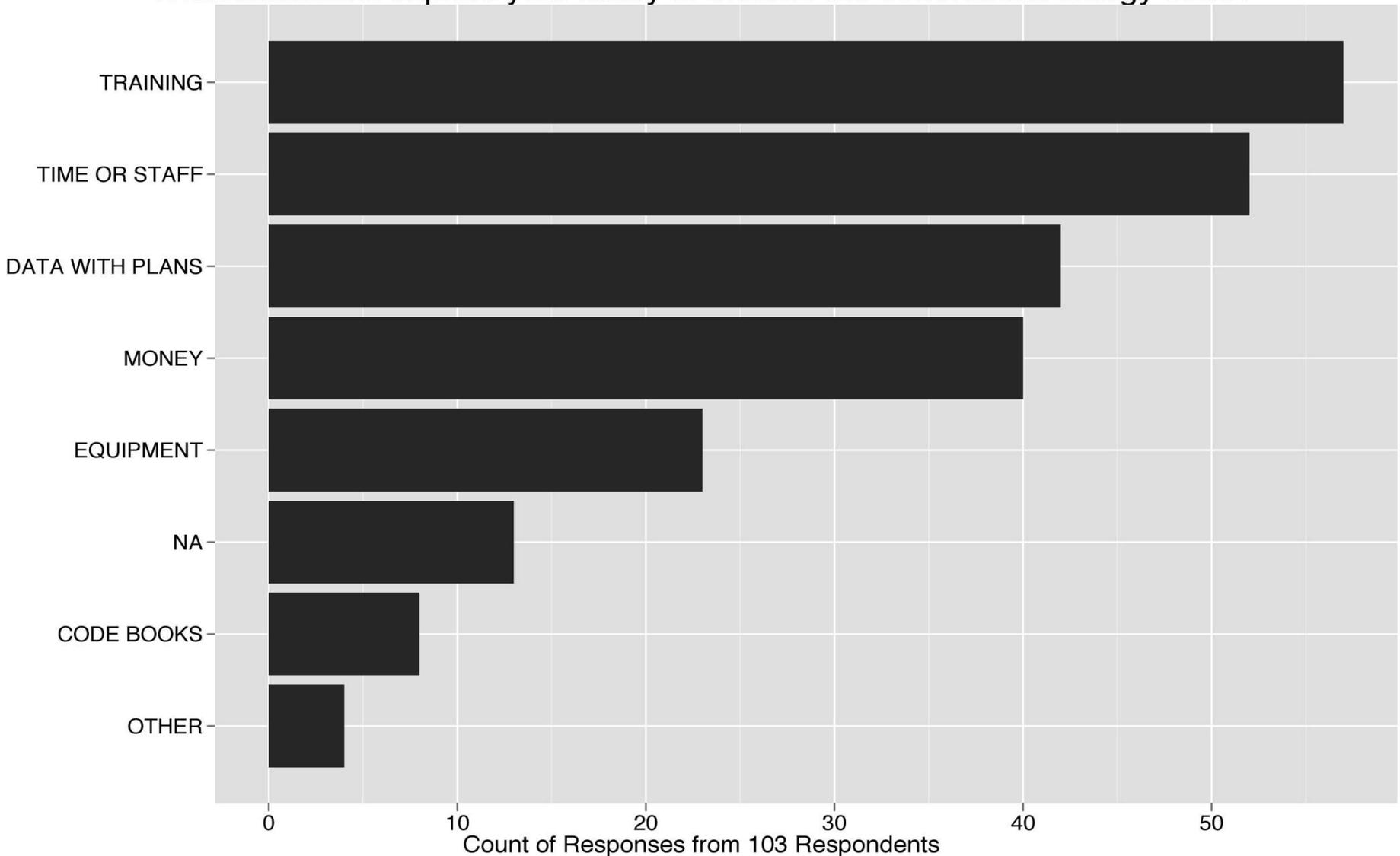
**Compliance Approach Breakdown**

Trade-Off (9%) Performance (5%) Prescriptive (86%)

[www.energycodes.gov/ScoreStore/login](http://www.energycodes.gov/ScoreStore/login)

# Common Barriers to Compliance

What limitations impede your ability to enforce the commercial energy code?



## Integration with COMcheck inspection checklist:

### Air Leakage, Insulation, and Component Certification:

- ✓ 3. [502.4.3] Sealing of the building envelope. Openings and penetrations in the building envelope are sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams are sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials allow for expansion and contraction of the construction materials.

Plans reference page/section: *Elevation view*

- ✓ 4. [502.4.1 +] Window and door assemblies. The air leakage of window and sliding or swinging door assemblies that are part of the building envelope are determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, or NFRC 400 by an accredited, independent laboratory, and labeled and certified by the manufacturer.

Exception applies: Site-constructed windows and doors that are weatherstripped or sealed in accordance with Section 502.4.3.

Plans reference page/section: \_\_\_\_\_

- ✓ 5. [502.4.2 +] Curtain wall, storefront glazing and commercial entrance doors. Curtain wall, storefront glazing and commercial-glazed swinging entrance doors and revolving doors are tested for air leakage in accordance with ASTM E 283. For curtain walls and storefront glazing, the maximum air leakage rate is 0.3 cubic foot per minute per square foot of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage rate is 1.00 cfm/ft<sup>2</sup> of door area.

Exception applies: Requirement is not applicable.

Plans reference page/section: \_\_\_\_\_

- 6. [303.1.1 +] Building thermal envelope insulation. An R-value identification mark is applied (by manufacturer) to each piece of insulation 12 inches or greater in width. Alternately, the insulation installers have provided a signed, dated and posted certification listing the type, manufacturer and R-value of insulation installed. Refer to code section for blown or sprayed insulation installation/settling depths and marker requirements.
- 7. [303.1.2] Insulation mark installation. Insulating materials are installed such that the manufacturer's R-value mark is readily observable upon inspection.
- 8. [303.1.4] Insulation product rating. The thermal resistance (R-value) of insulation has been determined in accordance with the U.S. FTC R-value rule.
- 9. [303.2] Installation. All material, systems and equipment are installed in accordance with the manufacturer's installation instructions and the International Building Code.

The screenshot displays the COMcheck-Web interface in a Windows Internet Explorer browser. The main window shows a project overview with a table of components and assemblies. A secondary window, titled 'ComCheckOregonExample2.cck - COMcheck: 3.8.1', provides a detailed trade-off analysis for the 'Envelope' component.

**Project Overview Table:**

Row	Component	Assembly
1	Roof 1	Non-Wood Joist/Rafter/Truss
2	Skylight 1	Metal Frame, Double Pane
3	Exterior Wall 1	Solid Concrete or Masonry
4	Door 1	Glass
5	Window 1	Metal Frame, Double Pane with
6	Window 2	Metal Frame, Double Pane

**Trade-Off Analysis Table (Envelope):**

Component	Assembly	Concrete Density	Construction Details	Gross Area	Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	SHGC	Projection Factor	M...
Building										
1	Roof 1	Non-Wood Joist/Rafter/T...		6112	ft2	40.0	0.0	0.033		
2	Skylight 1	Metal Frame, Double Pane	Glazing: Ti...	112	ft2			0.500	0.80	
3	Exterior Wall 1	Solid Concrete:8" Thickness	Medium... Furring: M...	6000	ft2	11.0	10.0	0.065		
4	Door 1	Glass (> 50% glazing):M...	Type: Entr...	42	ft2			0.500	0.30	0.00
5	Window 1	Metal Frame, Double Pan...	Glazing: Ti...	1500	ft2			0.600	0.63	0.00
6	Window 2	Metal Frame, Double Pane	Glazing: Cl...	56	ft2			0.700	0.72	0.00
7	Door 2	Insulated Metal	Non-Swinging	288	ft2			0.140		
8	Door 3	Insulated Metal	Swinging	40	ft2			0.200		
9	Exterior Wall 2	Solid Concrete:8" Thickness	Medium... Furring: M...	6000	ft2	11.0	10.0	0.065		
10	Exterior Wall 3	Solid Concrete:8" Thickness	Medium... Furring: M...	6000	ft2	11.0	10.0	0.065		
11	Exterior Wall 4	Steel-Framed, 24" o.c.		1000	ft2	19.0	0.0	0.094		
12	Floor 1	Slab-On-Grade:Unheated	Insulation:...	180	ft		10.0			

**Summary:** Envelope **Fails**, Interior Lighting **-36%**, Exterior Lighting **+44%**

## Trade-Off: COMcheck

- Prescriptive drill down
- Software
- Web-based tools
- COMcheck Plus
- Technical support
- Publications
- Code notes
- Resource guides
- Training programs

**WASHINGTON**  
Climate Zone 5 & 4 Marine  
Climate Zone 6  
Ceiling R-value 49

Click a county to see the requirements for its climate zone.

**Download REScheck™ Software**

**Download COMcheck™ Software**

**COMcheck-Web™**  
No title assigned  
2001 IECC

Component	Assembly	Construction Details	Gross Area	Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor
Roof 1	Non-Wood Joist/Rafter/Truss		6112 ft <sup>2</sup>	0.0	26.1	0.037
			112 ft <sup>2</sup>			0.500
			6000 ft <sup>2</sup>	22.0	0.0	0.114
			42 ft <sup>2</sup>			0.700
			1500 ft <sup>2</sup>			0.600
			56 ft <sup>2</sup>			0.700

**Building Energy Codes Resource Guide**  
Code Officials Edition

**Building Energy Codes University**  
Training Hard to Save Energy

**START LEARNING NOW!**  
BEUC Course Index  
Resources for Trainers

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BECP Home

**AIA**

**UPCOMING EVENTS**  
No events currently scheduled.

**QUESTIONS?**  
Ask an Advisor!

*DOE's Building Energy Codes Program is resource on compliance with building energy codes and standards – tell us how we can be help you with your energy codes programs.*

Visit us at: **[www.energycodes.gov](http://www.energycodes.gov)**

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