Alabama Implementation Action Kit

THE ENERGY CODES OUTREACH AND ADVOCACY PROJECT

March 2010 - August 2010

A project of the Building Codes Assistance Project and the Southeast Energy Efficiency Alliance.

Prepared for the Alabama Department of Economic and Community Affairs.
**Building Codes Assistance Project (BCAP)**

BCAP is in a strong position as a non-profit and a national advocacy organization to assist in local and broad-based activity to advance codes. We offer unique expertise, in that over fifteen years we have supported numerous state and city building departments in adopting and implementing energy codes. During that time, we have provided education and delivered resources on codes across the country. As a trusted resource, we are able to identify and navigate past the policy and programmatic pitfalls to help states and jurisdictions put the best possible strategy in place to improve efficiency in new and existing buildings. We are well-positioned to share value across organizations and pull together local efforts, identify issues on a national scale, and provide a broad perspective unbiased by corporate/material interests.

**Southeast Energy Efficiency Alliance (SEEA)**

SEEA promotes energy efficiency for a cleaner environment, a more prosperous economy, and a higher quality of life in the Southeastern region of the United States. Based in Atlanta, and working in eleven states, SEEA brings together businesses, utilities, governments, public utility commissions, energy service companies, manufacturers, retailers, energy and environmental organizations, low-income energy advocates, large energy consumers, and universities to promote energy-efficient policies and practices.
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Acronyms

ACEEE – American Council for an Energy-Efficient Economy ACEEE
ADECA – Alabama Department of Economic and Community Affairs
ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BCAP – Building Codes Assistance Project
BPI – Building Performance Institute Certification
CEUs – Continuing education units
COAA – Code Officials Association of Alabama
DOE – Department of Energy
EECC – Energy Efficient Codes Coalition
EPA – U.S. Environmental Protection Agency
HERS – Home Energy Rating System
IBC – International Building Code
ICC – International Code Council
I-Codes – International Codes
IECC – International Energy Conservation Code
IgCC – International Green Construction Code
IRC – International Residential Code
LEED – Leadership in Energy and Environmental Design
OCEAN – Online Code Environment and Advocacy Network
RECA – Responsible Energy Codes Alliance
RESNET – Residential Energy Services Network
SCAC – Georgia State Codes Advisory Committee
SEEA – Southeast Energy Efficiency Alliance
SEP – State Energy Program
SHGC – Solar Heat Gain Coefficient
Executive Summary

The Building Codes Assistance Project and the Southeastern Energy Efficiency Alliance have worked to gather information relevant to the successful adoption and implementation of an energy code in Alabama. As explained in the Alabama Gap Analysis Report, there is significant potential for substantial energy efficiency gains in the state through the adoption and successful implementation of a statewide energy code. Once the State of Alabama adopts the energy code, municipalities will be charged with implementing and enforcing it. This Implementation Action Kit offers a pathway to achieve these goals by providing municipalities with strategies, tools, and resources pulled together from a range of sources. We have included inspection checklists and the well-known Responsible Energy Codes Alliance (RECA) guide for Alabama for the 2006 IECC in the Appendix, and the document is largely interactive with the www.bcap-ocean.org site. While it should not be used as a substitute for training, the Action Kit does provide essential resources to municipalities that will support their efforts to address future energy cost and demand through the adoption and implementation of a strong energy code.
Introduction

It is often cited that buildings account for roughly 40 percent of total energy use in the United States and 70 percent of our electrical use. In order to tap into this significant opportunity for energy savings, though, states and cities must plan ahead. The typical building lasts for anywhere from 50 to 100 years, meaning that new construction today will impact energy use in 2060 and beyond. Moreover, new construction is the most cost-effective point in the life of a building to establish minimum energy efficiency elements. That is why it is crucial that Alabama adopts and implements building energy codes to reduce energy use and save consumers and businesses millions on their utility bills. If buildings in Alabama were built to the model energy codes—the 2009 International Energy Conservation Code (IECC) and ASHRAE Standard 90.1-2007—the annual savings would be as follows:

- By 2030, homes would have saved 26 trillion Btu and avoided 1,788 thousand metric tons of CO2; homeowners would have saved $185 million in utility bills (based on 2006 prices).

- By 2030, commercial buildings would have saved 19 trillion Btu and avoided 1,321 thousand metric tons of CO2; building owners would have saved $117 million in utility bills (based on 2006 prices).

Alabama cannot afford to waste energy and leave millions of dollars in savings on the table. The state took a significant step towards adopting its first mandatory, statewide energy code with the passage of Act 2010-185 in March 2010, which established the Alabama Energy and Residential Codes Board (the Board) and granted it the authority to adopt a code. With an influx of stimulus funding to support energy code adoption and implementation—as well as a growing realization within the Alabama energy and building communities that energy codes are not just good practice, but also good business—it appears that the state is finally ready to promote energy-efficient construction through the enforcement of energy codes.

While adoption is a state-level issue, energy codes must be implemented on the local level, albeit with state support. This Action Kit is designed to provide recommendations to local governments to assist in implementing the 2006 IECC within their jurisdictions. It addresses a number of strategies to improve code compliance through education and outreach, training, and enforcement, and offers regional and national resources for additional energy codes support and guidance. The experiences of the participating jurisdictions will also guide the state in attaining 90 percent compliance with the model energy codes by 2017, in accordance with the requirements under the American Recovery and Reinvestment Act (Recovery Act).
Energy Codes: The Basics

The International Code Council (ICC) and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) provide multiple options for adopting a building code that cover all aspects of construction. For residential construction, the ICC develops the IECC and the International Residential Code (IRC). For commercial construction, the ICC develops the International Building Code (IBC) and the International Green Construction Code (IgCC), while ASHRAE publishes Standard 90.1-2007 and Standard 189.1. For more information on these organizations and the code development process, please visit:

- The ICC homepage
- The ASHRAE homepage
- BCAP Code Development Topics Page
- BCAP Action Plan for Commercial Codes & Standards

In Alabama, the IRC and IBC are much more prevalent than the IECC or Standard 90.1. Both have chapters addressing energy efficiency, but the energy chapter in the IBC is often omitted.

The IECC

The IECC is a comprehensive energy conservation code that establishes minimum design and construction parameters for energy-efficient buildings through the use of prescriptive and performance based provisions. In response to feedback from the many building professionals who rely on the model energy code, the ICC has refined and simplified the IECC over the years. The ICC updates the IECC on a three-year cycle, and applies to all new residential and commercial buildings.

The 2006 IECC made the code more user-friendly and reduced the number of climate zones by more than half, as compared to the 2003 IECC. The 2009 IECC, the current national model energy code, achieves 13-15 percent greater energy savings than the 2006 IECC residential code and five percent greater energy savings than the commercial portion of the 2006 IECC. The next update is set to occur in 2012 and is estimated to be 30 percent more efficient than the 2006 IECC according to current proposals. For more information on the IECC code development process, please visit:

- Energy Efficient Codes Coalition (EECC) 30 Percent Solution
- 2012 IECC Code Proposals—Commercial and Residential

Costs of Building to the IECC

Costs associated with energy codes are often cited as a downside to adopting and implementing the IECC. In reality, the incremental costs of building a home that conforms to the 2009 IECC are minimal and have a relatively short payback period. According to BCAP’s Incremental Cost Analysis, the weighted average incremental cost of building a home in Alabama to the 2009 IECC is $668.76. The median energy savings for the building owner is $205 per year, resulting in a simple payback period of 3.26 years. These estimates are for the 2009 IECC, which suggests that the costs associated with
building to the 2006 IECC would be even lower.

**Chart 1: Incremental Cost for Building to the 2009 IECC**

<table>
<thead>
<tr>
<th>Weighted Average Incremental Cost of building a Home</th>
<th>Median Energy Savings for Building Owner</th>
<th>Simple Payback Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>$668.76</td>
<td>$205</td>
<td>3.26 Years</td>
</tr>
</tbody>
</table>

We believe these cost estimates are conservative and represent an upper bound on incremental cost, as they utilize only traditional building techniques and do not take advantage of certain technologies or performance trade-offs that would lower these costs further and improve energy performance. For a detailed description of BCAP’s methodology, please read:

- BCAP [Incremental Cost Analysis Report](#)

**Going Above the IECC**

As of this publication, the Board was considering a number of options for adopting an energy code, including the 2006 IECC with strengthening amendments that would make it approximately 30 percent more efficient—roughly equivalent to many of the proposals for the 2012 IECC. Should this happen, the Board would do well to review regulations from other states in the Southeast that have taken similar measures, such as Georgia and North Carolina.

In July 2009, the Georgia State Codes Advisory Committee (SCAC) assembled task forces consisting of stakeholders from state and local governments, utilities, homebuilders and other private industries to review the 2009 IECC and ASHRAE 90.1-2007, as well as ICC-700 as an option green building standard. The IECC Task Force sent the SCAC proposed amendments to the code in April 2010, which the SCAC recently approved. This code includes a series of amendments that make the Georgia energy code more efficient than the 2009 IECC. First, compliance paths for air-sealing requirements may only be met using a blower door test, not the visual inspection that is allowed in 2009 IECC. Next, in order to conduct the pressure test, you must be a certified Duct and Envelope Tightness (DET) verifier. All Home Energy Rating System (HERS) raters, Building Performance Institute (BPI) building analysts, or Home Performance with Energy Star contractors are automatically certified as DET verifiers. In addition, Georgia’s new code has more stringent duct leakage testing requirements.
than the 2009 IECC, does not permit power attic ventilators, and prohibits electric furnaces from being a primary heat source. It also requires ducts to be sealed using approved methods, and it standardizes glazing U-factor and SHGC across the state. On July 29, 2010, the code was approved by the SCAC and the DCA Board, and will take effect on January 1, 2011. The Georgia Residential Green Building Code Task Force will submit its proposed amendments to ICC-700 in summer 2010.

North Carolina has also adopted an energy code with strengthening amendments that bring it above code. On March 11, 2008, the state adopted the 2009 North Carolina Energy Conservation Code. Based on the 2006 IECC and referencing ASHRAE 90.1-2004 for commercial buildings, the code includes strengthening amendments to the base code, such as requiring fenestration U-factor and SHGC values of 0.40 across the state.

The NC Building Code Council began the current code update process in the spring of 2009 with an anticipated effective date of January 1, 2012. It will use the 2009 IECC as the base code. Moreover, the state was awarded a $500,000 federal grant to improve the code's stringency by 30 percent over the 2006 IECC and improve compliance through comprehensive training and enforcement.

ASHRAE Standard 90.1

ASHRAE Standard 90.1 provides minimum requirements for the energy efficiency of new or renovated buildings except low-rise residential buildings (three stories or less). Standard 90.1 is updated on a three-year cycle, and the most recent version is Standard 90.1-2007, the national model code. It is approximately seven percent more efficient than the previous 2004 version, while the next update, which should occur in late 2010, is intended to be 30 percent more efficient. For more information on how Standard 90.1-2007 differs from the 2009 IECC, please read:

- ICC Comparison Between the 2009 IECC and ASHRAE 90.1-2007

IECC and ASHRAE Climate Zones

The 2006 IECC implements a new, simplified climate zone system. The new climate zones were created for ASHRAE Standard 90.1-2004 and then adopted by the IECC in 2006. The updated system reduces the number of climate zones from 19 to eight. The zones were determined by factoring in heating and cooling degree-days, high wet bulb temperatures, and variations in solar radiation, making them more accurate than the old zones, which relied almost entirely on heating degree days. The new climate zones have since been adopted by several organizations, including the Environmental Protection Agency (EPA) ENERGY STAR Program, Building America, and ASHRAE’s Advanced Energy Design Guide for Small Office Buildings, as well as their 90.2 code.

Under the new zone system, the country is also divided into four climate types: marine, dry, moist, and warm-humid, the last of which applies to parts of Alabama. Whereas the state was previously divided into five zones, the 2006 system places almost all of the state in Zone 3, with the small southwest portion of the state—consisting of Baldwin and Mobile counties—in Zone 2. With the new system, some requirements for locations across the state will be higher and some will be lower than under the old code, but overall, the newly standardized system will be easier to implement and enforce.
The IBC and IRC: Issues and Challenges

A number of communities in Alabama have adopted the IBC, which covers commercial construction. The 2006 IBC’s Chapter 13 simply references the IECC, which, in turn, references ASHRAE Standard 90.1-2007 as an alternative compliance path. In theory, then, the IBC is equivalent to the IECC and Standard 90.1. However, it is difficult to make this claim because the vast majority of the municipalities in
Alabama that adopt the IBC eliminate Chapter 13 or choose not to enforce it by not adopting the IECC. Therefore, in practice, adopting the IBC is not equivalent to adopting the IECC.

For single-family residential construction, adopting the IRC is closer to being equivalent to the IECC. Chapter 11 references the IECC as an alternative compliance path, yet it also includes prescriptive energy efficiency requirements that are slightly less stringent. Thus, the building and design industries have the option of taking an easier compliance path, which reduces these codes’ impact on energy savings as compared to the IECC. For more information on these differences, please read:

- The Department of Energy (DOE) Comparison of the 2009 IECC and the 2009 IRC
Adoption: From Potential to Policy

Southeast Regional Summary

The Southeast region would benefit greatly from stronger energy code adoption policies. According to SEEA, the Southeast region has the highest per capita electricity consumption in the country. A recent study on Energy Efficiency in the South by Georgia Tech University, Duke University, and SEEA argues that energy efficiency policies, including energy codes, could reduce the region’s energy use up to 13 percent for the residential sector and 18 percent for the commercial sector by 2030. For more information on energy efficiency in the Southeast, please review:

- SEEA, Georgia Tech and Duke Universities [Energy Efficiency in the South](pdf)

An ICF International analysis of the energy and cost savings of building to the 2009 IECC, as compared to the 2006 IECC, indicates that the energy cost savings for residential construction would be 13.2 percent and 13.4 percent for Zones 2 and 3, respectively, which cover much of the Southeast. For more information on the 2009 IECC, please review:

- ICF International [Energy & Cost Savings Analysis of 2009 IECC Efficiency Improvements](pdf)

No state in the Southeast currently has a residential energy code equivalent to the 2009 IECC; however, several states are on track to do so. What’s more, most of Alabama’s peers have adopted energy codes before. Alabama and Mississippi are the only two Southeastern states not to have a mandatory, statewide residential code in place. Arkansas, Tennessee, Texas, and West Virginia have adopted a residential energy code that meets or exceeds the 1998-2003 IECCs or equivalent, and the remaining seven states have codes equivalent to or more stringent than the 2006 IECC.

On the commercial side, Alabama is one of only three states in the region without a mandatory, statewide code (Mississippi and Tennessee are the others). Ten states have adopted a code: Arkansas, Texas, and West Virginia have Standard 90.1-1999-2001, Georgia, Kentucky, Louisiana, North Carolina, South Carolina, and Virginia have Standard 90.1-2004 or a state code with equivalent efficiency, and Florida's energy code is equivalent to Standard 90.1-2007.

Alabama Summary

According to the 2009 American Council for an Energy-Efficient Economy (ACEEE) [State Energy Efficiency Scorecard](pdf), Alabama came in 48th out of the 50 states and the District of Columbia. The state was also one of only five to receive a zero for the building energy codes category, in part because the state does not have an energy code. In fact, only 36 percent of Alabama citizens are covered by a residential energy code, and only seven percent are covered by a version of the IECC. That leaves 64 percent not covered by any residential building code at all, and an additional 29 percent with the IRC, which is less stringent than the IECC and seldom enforced in municipalities in the state.
On the commercial side, ten percent of the state’s population is covered by the IECC or equivalent, 43 percent is covered by the IBC, and 47 percent has no commercial code adopted. Relying on the conservative assumption that Chapter 13 of the IBC is eliminated in most municipalities, this means that only ten percent of the state is covered by a commercial building energy code at all, compared with 36 percent for the residential sector.
The adoption of a mandatory, statewide energy code will provide Alabama with an untapped resource for reducing energy use, lowering emissions, and, most importantly, saving money for residents and businesses. In the process, Alabama can also reduce electricity demand, thus allowing it to export more energy to other states within the region. It would be wise for the state to manage its energy resources by seizing the “low-hanging fruit” that building codes offer. In fact, the Alabama Profile of the SEEA Energy Efficiency in the South Report states that energy efficiency policies, including energy codes, could reduce the state’s energy use up to 12 percent for the residential sector and 18 percent for the commercial sector by 2030. For more information, please review:

- SEEA, Georgia Tech and Duke Universities Energy Efficiency in the South Alabama Profile (pdf)

BCAP is advocating for the adoption of the 2006 IECC with strengthening amendments, which will make the transition to future codes simpler. In March, Governor Bob Riley signed Act 2010-185, establishing the Alabama Energy and Residential Codes Board (the Board) and granting it the authority to review, amend, adopt, and implement the Alabama Energy and Residential Codes. This law puts Alabama on the path to adopting the 2006 IECC and eventually achieving 90 percent compliance with the model energy codes by 2017.
Implementation: From Codes to Savings

With the passage of Act 2010-185, Alabama took the first critical step towards establishing an energy efficiency baseline for all buildings in the state. Yet even the likely adoption of the 2006 IECC statewide will not change actual building practices. In the vast majority of cities and towns across the state, energy code compliance is subpar or, more likely, non-existent.

The crucial missing link between adopting energy codes and achieving energy and utility bill savings is implementation, a fluid term used to describe all of the activities needed to prepare local inspection departments and the building and design industries to ensure compliance with the energy code. Implementation includes education and outreach to all relevant stakeholder groups, on-site, classroom, and web-based training for code inspectors and building and design professionals, and the establishment of practical enforcement systems and tools, among other organizational efforts.

Education and Outreach

Although there are some exceptions, the majority of local inspection departments, design and building professionals, and other involved parties in Alabama view energy codes as a secondary concern at best and as another unnecessary government regulation at worst. The goal of energy code education and outreach is to counter these attitudes by providing stakeholders with an understanding of the importance of building energy efficiency, the true costs and savings associated with energy codes, what is required to build a successful energy code infrastructure, and similar topics.

Energy code education and outreach begins with building inspection departments. To devote the proper resources necessary to enforce the code—measured in time, training, and budget—inspection departments must believe in the value of energy codes. Inspectors will be more likely to incorporate them into their work if they see them as an integral part of traditional life, health, and safety concerns.

Moreover, proper energy code implementation requires the full support of the municipality. As the local authorities on all building codes, inspection departments play a key role in educating local policymakers and other municipal agencies on the benefits of energy codes, their roles in the implementation process, and the need for greater collaboration and funding. Without the advocacy efforts of a knowledgeable energy code champion, city governments will simply not devote enough attention and resources to inspection departments. Every municipality points to its budgetary constraints, but few accept that enforcement does not just happen; they only get back what they put in.

Finally, it is critical that inspection departments be on the same page as the building and design communities. In a weakened building market, building professionals have little choice but to save money wherever possible by cutting corners on energy code compliance—or ignore it completely. It is incumbent on code officials, then, to provide outreach to all building professionals to ensure that they are aware of code provisions, understand which materials and construction practices comply, and have access to training and resources. This will also eliminate any perceived competitive disadvantage to energy code compliance. Furthermore, outreach will help savvy building professionals market themselves to consumers who are largely unaware of the utility bill savings available to them.
Recommendations

Take Advantage of Existing Outreach Materials

- Use materials developed by BCAP, DOE, and Regional Energy Efficiency Partnerships, among others, for education and outreach efforts
  - BCAP Getting Started
  - BCAP Educational Resources: covers benefits of code adoption, costs and savings involved, funding mechanisms, code status and more on all energy code topics
  - DOE Why Building Energy Codes
  - DOE Building Energy Codes University: provides online energy codes training
  - DOE REScheck Basics video: tutorial of DOE’s free residential energy code compliance software
  - Southface Online Library: resources for codes and other green and efficient building information
  - Southface energy efficiency White Paper for Georgia (pdf): energy efficiency and best practices in Georgia
  - Energy-related brochures from West Virginia: multiple publications on a variety of topics

Tailor Your Message to Each Audience

- Various audiences will benefit and be affected differently by energy codes
- Help policymakers and the public understand the benefits of energy codes, as well as the importance of energy efficiency
  - Use BCAP’s Why Energy Codes Matter – What Policymakers Need to Know
- Address municipal concerns related to the allocation of funding for inspection departments during hard economic times
  - Stress that energy codes are an effective way to save municipalities money
- Learn from and share implementation best practices from other municipalities, such as BCAP’s Ten Places to Watch and Seattle
- Communicate to homeowners about the cost savings and benefits that energy codes ensure in the safety and comfort of their homes
  - Alabama Power Energy-Efficient House: features of an energy-efficient home
  - Energy saving tips for homeowners from Arkansas and South Carolina
- Show builders evidence that despite some extra costs of building, the incremental cost associated with implementing the 2009 IECC are relatively low with a very short payback period
  - BCAP’s Incremental Cost data in Alabama

Understand the Costs and Benefits of Outreach

- One-time marketing costs can be relatively high (upwards of $50,000)
- Investment in outreach will be much less than savings through energy code enforcement in the future
Certification and Training

The state does not have a uniform process for code official certification, leaving it up to the discretion of each municipality. Still, many inspection departments require ICC or other certification, training, and a minimum number of Continuing Education Units (CEUs) annually. The Code Officials Association of Alabama (COAA) and its seven chapters throughout the state offer members multiple statewide building code trainings per year, although energy efficiency is only one of the many building topics covered. Moreover, COAA has limited resources with which to host training sessions.

Even most experienced, certified code inspectors in Alabama are not familiar with the language or provisions of the energy codes—or the building science behind them. Once an inspection department understands their importance, training turns good intentions into good practice by providing code officials with the knowledge and skills needed to properly enforce the code.

Historically, there have been limited opportunities for energy code training in the state, as would be expected, given the state’s history with codes. However, recently a number of organizations have provided outreach and training on the energy code and advanced codes for code inspectors and building professionals, typically funded by the Alabama Department of Economic and Community Affairs (ADECA) through DOE. The Southface Institute, BCAP, ICC, and Auburn’s School of Building Science have each held workshops on a number of building science and energy code topics.

For many jurisdictions, the cost of attending a training session has proved prohibitive in the past, particularly among rural jurisdictions with smaller budgets and larger travel costs. The sharp reduction in building permit fees from 2008 to today makes energy code training budgets an even greater issue.

This is where the state can provide local jurisdictions with much needed assistance. With an influx of State Energy Program (SEP) funds through the Recovery Act to improve energy code enforcement and compliance across the state, ADECA is sponsoring a series of energy code training workshops in 2010 and 2011 through Southface (see sidebar above). Local municipalities should take advantage of this extensive, low-cost opportunity to prepare for the likely statewide adoption of the 2006 IECC.

Southface Training

Four separate topics
- Residential
- Commercial
- High Performance Building – Design
- High Performance Building – Commissioning, Operations, and Maintenance

They are intended to provide attendees with an overview of basic building science, the provisions of the 2006 IECC, ICC terminology, compliance paths available, and the major changes in the 2009 IECC. CEUs are available for the AIA, GBCI, BPI, CSI, ICC, and the Alabama State Board of HVAC Contractors.

Each workshop costs $50. Attending both High-Performance workshops is $75.

Multiple workshops have already been held in Birmingham, Mobile, and Huntsville, with more scheduled in each city, as well as additional trainings in Auburn, Dothan, Madison, Montgomery, and Tuscaloosa.

- Southface AL training website
- Schedule of upcoming trainings (pdf)

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Recommendations

Hire Staff

- Must be well-versed in all building codes
- Require inspectors to become certified energy inspectors through the ICC or an equivalent program, usually through a national trade association
- Require inspectors to demonstrate understanding of basic energy code provisions

Purchase Code Books

NOTE: DOE is partnering with ICC to make the 2009 IECC and Standard 90.1-2007 available online free of charge, although as of this writing, it is unknown when this will occur

- Code inspectors should familiarize themselves with the provisions of the energy code
- Purchase the 2006 IECC with commentary, available on the ICC website for $49 for the soft cover and eCodes versions or $39 for the CD-ROM
- ASHRAE Standard 90.1-2007 is available on the ASHRAE website for $119 in both a print and PDF version
- While somewhat burdensome, particularly for jurisdictions without large budgets, this cost is the minimum requirement needed to enforce and comply with the code

Attend Trainings

- Attend training on energy code requirements, terminology, structure, etc.
  - Southface AL training website
  - Southern Energy Efficiency Center trainings
- Support classroom and on-site training with additional training resources:
  - Auburn Code College 2006 IECC training videos
  - ASHRAE Learning Institute – Self-Directed Learning and Online Seminars
  - DOE Residential Requirements of the 2006 IECC video
  - DOE Standard 90.1-2007 envelope requirements video
  - DOE Standard 90.1-2007 mechanical and service water heating requirements video
- Require inspectors to maintain CEUs for energy efficiency topics
  - ICC Online University
  - The Energy Center University online courses
  - Green Builder Media Green Builder College

Enforcement

Inspection departments cannot take compliance for granted. While this might not be a revelation for code officials—many of whom used to work on the other side of the process—achieving compliance requires genuine commitment. Once code officials understand the value of the energy code and have received sufficient training on its requirements, inspection departments must then establish a viable enforcement infrastructure that compels the building and design communities to abide by code regulations, yet still maintains flexibility regarding the practical limits to reaching 100 percent compliance in the near- and medium-term.
According to Alabama code officials, a number of common issues emerge for why energy code enforcement falls far behind the enforcement of other building codes, such as insufficient resources, a lack of familiarity with the energy code, and the need to place greater priority on energy efficiency. For a more detailed explanation, please review:

- BCAP Alabama Gap Analysis Report

**Recommendations**

**Outline a Uniform Enforcement Process**

- Follow the example outline of a thorough plan review and inspection process
- Make sure architects, engineers, developers, builders, and subcontractors all understand what is expected of them

**Review Enforcement Resources**

- Review and understand existing resources on energy code enforcement, such as technical requirements and best practice strategies, tips, and tools from other states, cities, and organizations
  - BCAP enforcement resources: browse OCEAN’s online library for all types of resources on energy code enforcement
  - BCAP technical resources for hot-humid and mixed-humid climates: browse OCEAN’s online library for technical enforcement and compliance resources specifically for hot-humid climates
  - DOE Building Energy Codes University: webcasts covering aspects of the last few iterations of the model energy codes, divided into residential, commercial, training, and self-paced guides
  - Energy Design Resources Design Guidelines and Design Briefs
- Review and understand compliance resources and software for the design and building industries, such as REScheck
  - DOE REScheck for the 2006 IECC video
  - Building America Best Practices for Hot and Humid Climates: covers best practices for different members of a residential building team
  - DOE Technical Code Notes: specific technical overviews covering a number of building energy efficiency features for residential and commercial construction

**Conduct Plan Review**

- Mitigate as many potential issues as possible during the design phase, when making corrections
is less costly and time-consuming than during construction

- Seattle Dept. of Planning and Development Client Assistance Memos: handouts for commercial design and construction teams that cover FAQs and important information for common energy code issues
- Do not allow architects, engineers, and others to demonstrate compliance using their professional stamps, which will reduce the incentive to comply with the energy code

Conduct On-site Inspections

- Construction should adhere to the site plans that the inspectors and building professionals have already negotiated and approved rather than what becomes most convenient or practical on the construction site
- Check certain energy efficiency requirements prior to further construction
  - Building America Quality Assurance Checklists: best practices for on-site inspection with checklists for each step

Establish Strong Relationships

- Establish strong relationships with the building and design sectors
- All parties have same expectations and are comfortable with the requirements
- Make staff available at every step of the process
  - Share compliance resources
  - Responding to complaints
  - Encouraging questions
- Particularly important in locations that are adopting energy code for the first time

Compliance Tracking

Code enforcement happens on the micro level; inspectors review site plans and inspect each new construction project to ensure compliance with the energy code. On the macro level, inspection departments, state energy offices, and regional and national energy code technical and advocacy groups then measure compliance and verify it through a sampling of actual building performance to establish local, state, regional, or even national baselines. Taken one step further, compliance tracking is the process of collecting and amalgamating these measurements over time to determine how the area in question is progressing towards its goals.

Compliance tracking allows stakeholders to measure the success of energy code enforcement and quantify the energy and financial savings achieved through codes, which is the reason for adopting codes in the first place. Without a uniform method for tracking quantifiable data within a jurisdiction over time, energy code practitioners would be unable to analyze the outcomes of energy code implementation, which would prohibit them from measuring success, determining best practices, and identifying areas of greater need. In other words, compliance tracking is the only way to ensure that energy codes are working.

The Recovery Act stipulates that states must demonstrate 90 percent compliance with the model energy codes within eight years. To support this law, the DOE Building Energy Code Program (BECP) has taken the lead on defining compliance and creating resources to help states measure, verify, and track
Review DOE steps towards 90 percent compliance

- Use BECP’s original tools for states to assess compliance with their codes and follow recommendations that apply to local jurisdictions
  - **Step-by-Step Companion Guide** (pdf): Starting guide including compliance tracking steps and which acts as a companion guide to the State Compliance Evaluation document
  - **Measuring State Compliance Report**: Detailed guide to measuring statewide compliance
  - **Residential Compliance Presentation**: Provides the tools and specific training needed to evaluate residential compliance with the 2009 IECC, as well as general residential field inspection
  - **Commercial Compliance Presentation**: Provides the tools and specific training needed to evaluate commercial compliance with Standard 90.1-2007, as well as general commercial field inspection

Above-Code Enforcement

Before local jurisdictions can begin to conduct outreach, training, and capacity-building activities needed to properly enforce the energy code, they must wait for the Board to adopt one. Should the Board adopt the 2006 IECC with strengthening amendments—one of a number of options on the table—jurisdictions would not only need to prepare themselves for the challenges of implementing an energy code for the first time, but also for a code that was more stringent the current model energy codes.

Energy codes and above-code standards such as ENERGY STAR and LEED present cities with an opportunity to transform the urban environment and improve the quality of life for their citizens. As they become more stringent, however, code inspectors carry more of the burden of ensuring that
building professionals understand the requirements and that construction projects comply with the code or standard in place. This often includes performance testing, such as blower door and duct blaster tests. Code officials should familiarize themselves with a number of different options for receiving training on these skills and establishing appropriate infrastructure and funding mechanisms. Local jurisdictions can learn from the cities, states, and organizations across the country that are already working with such codes and programs.

Recommendations

Review Literature on Above-Code Best Practices

- BCAP National Listing of Above-Code, High Performance, and Green Building Programs: listing of voluntary and mandatory programs nationwide as of August 2009
- BCAP list of reports on costs of building green
- San Antonio Sustainable Buildings Ordinance: case study on the city’s 2009 adoption of an energy code 15 percent more efficient than the state code and with green building features
- Building Energy Efficiency in Kentucky’s Schools: presentation on 12 ENERGY STAR schools in the state
- Long Island ENERGY STAR for Homes Program: case study on how utility and local governments work together to offer residential builders incentives to construct NY ENERGY STAR homes
- New Mexico Exploring Green Alternatives: case study on how the state is incorporating green features into its energy code, such as recycled and alternative materials and P2000 insulation
- SWEEP Going Beyond Code Report: report to help state and local governments design and implement successful “beyond code” programs for new commercial and residential buildings

Review Above-Code Enforcement and Compliance

- RESNET How to Become a Certified Rater: covers the RESNET accreditation process and provides supporting information
- Find a certified HERS Rater in Alabama
- ENERGY STAR Building Option Packages for Alabama: checklists and guidelines for building to ENERGY STAR qualifications in each county in Alabama
Technical Guidance: Know the Code

2006 IECC

Residential

Chapter 4 of the 2006 IECC applies to all new residential buildings three stories or less in height and regulates the design and construction of buildings for the effective use of energy. The residential chapter of this code establishes minimum thermal performance requirements for building envelope components such as windows, walls, ceilings, doors, and air leakage. Using the prescriptive approach in Alabama’s climate zone 2, ceilings must have a minimum value of R-30, walls R-4, and floors over unconditioned space R-13. The 2006 IECC prescriptive approach also requires fenestration to have a maximum SHGC of 0.40 and a U-factor of 0.65.

Exceptions: The 2006 IECC does not apply to existing buildings unless there are additions, alterations, renovation or repairs or there is a change in occupancy that increases the demand for energy. In the case of an addition or renovation, the code only applies to the portion of the building that is altered, not areas unchanged by the renovation. The code does not apply to buildings registered with the State or National Register of Historic Places or when adding storm windows, glass only replacements, existing ceiling, wall or floor cavities exposed during construction provided that these are filled with insulation, construction where existing roof, wall or floor cavity is not exposed.

Compliance

There are three compliance paths available for the 2006 IECC. The first is the prescriptive path, which is simplified and requires the strict following of mandatory requirements outlined in Chapter 4 of the 2006 IECC. It includes insulation and fenestration R- and U-values outlined in Tables 1 and 2 below. When using the prescriptive path, basic mandatory requirements such as duct sealing and pipe insulation are also required, also listed in Table 1 and 2 below.

- 2006 IECC Prescriptive Compliance Guide - [Alabama]

Table 1: Maximum Fenestration Requirements by Component

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Fenestration U-Factor</th>
<th>Skylight U-Factor</th>
<th>Glazed Fenestration SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.75</td>
<td>0.75</td>
<td>0.40</td>
</tr>
<tr>
<td>3</td>
<td>0.65</td>
<td>0.65</td>
<td>0.40</td>
</tr>
</tbody>
</table>
Table 2: Insulation Requirements by Component

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Ceiling R-Value</th>
<th>Wood Frame Wall R-Value</th>
<th>Mass Wall R-Value*</th>
<th>Floor R-Value</th>
<th>Basement Wall R-Value</th>
<th>Slab R-Value &amp; Depth</th>
<th>Crawlspace Wall R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>30</td>
<td>13</td>
<td>4</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>13</td>
<td>5</td>
<td>19</td>
<td>0</td>
<td>0</td>
<td>5/13</td>
</tr>
</tbody>
</table>

The second option is to follow the simulated performance alternative, Section 404. This performance path allows for the interaction of all energy systems and equipment and compares overall energy performance to a baseline goal, which usually requires the use of performance software. Even when the performance path is used, there are several basic mandatory requirements that must be met.

Alternative energy modeling software includes REM/Rate, EA-Quip, and NEAT.

- **DOE approved residential energy performance software**

**Basic Mandatory Requirements**

**Air Leakage– Section 402.4**: Buildings must be sealed completely to limit air-leakage, including: joints; seams; penetrations; site-built windows; doors, and skylights; openings between window and door assemblies; jambs and framing; utility penetrations; dropped ceilings or chases adjacent to the thermal envelope; knee walls; walls and ceilings separating a garage from conditioned spaces; behind tubs and showers on exterior walls; common walls between dwelling units; recessed lighting; and any remaining sources of infiltration.

**Fenestration Air-leakage – Section 402.4.2**: Windows, skylights, and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m²), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m²).

**Maximum Fenestration SHGC – Section 402.6**: Maximum fenestration SHGC permitted using trade-offs in all Alabama climate zones is 0.50.

**Systems – Section 403**: Buildings must follow basic system requirements regarding the insulation and sealing of ducts, ventilation dampers, equipment sizing, and controls.

**Certificate – Section 401.3**: All residential buildings are required to have a permanent certificate posted on or near the electrical panel that stipulates the R-values, U-values, SHGC-values, as well as the type and efficiencies of all HVAC equipment.

**Tools & Resources**

**Compliance Software**
The third compliance path available is REScheck, a free software program provided online by DOE. The software may be used to measure compliance and generate reports by inputting building components. This is particularly useful when a builder is using the building trade-off option. For example, if a builder
chooses to use a higher efficiency glass than is required prescriptively, they can decrease the required R-value in the ceiling, walls or floors. As with all compliance paths, basic mandatory requirements must be met.

- **REScheck**: Compliance with Performance Path
- **REScheck**: Prescriptive Package Generator

**Sample Checklists, Certificates and Reports**

- Alabama Residential Compliance Checklist for the 2006 IECC (Climate Zone 2)
- Alabama Residential Compliance Checklist for the 2006 IECC (Climate Zone 3)
- Optional Residential Air-Sealing Checklist for the 2006 IECC
- Sample REScheck Compliance Certificate for the 2006 IECC
- Residential Data Collection Checklist Instructions for 2009 IECC. Although this checklist is for the 2009 IECC—and some differences exist between the 2009 and 2006 codes—it provides a straightforward data collection tool.
- Example of Home Performance Report (includes compliance certificate) using REM/Rate

**Commercial**

Chapter 5 of the 2006 IECC applies to all commercial buildings and residential building over three stories in height and regulates the design and construction of buildings for the effective use of energy. The 2006 IECC also references ASHRAE Standard 90.1-2007 as an alternate compliance path. The commercial chapter of this code establishes minimum thermal performance requirements for building envelope components such as windows, walls, ceilings, doors, and air leakage, and sets minimum efficiencies for mechanical systems in buildings.

**Exceptions**: The 2006 IECC does not apply to existing buildings unless there are additions, alterations, renovation or repairs or there is a change in occupancy that increases the demand for energy. In the case of an addition or renovation, the code only applies to the portion of the building that is altered, not areas unchanged by the renovation. The code does not apply to buildings registered with the State or National Register of Historic Places or when adding storm windows, glass only replacements, existing ceiling, wall or floor cavities exposed during construction provided that these are filled with insulation, construction where existing roof, wall or floor cavity is not exposed.

**Compliance**

There are three compliance paths available for the 2006 IECC. The first is the prescriptive path that mandates strict envelope requirements outlined in Chapter 5 and shown in Tables 3 and 4 below. In addition, buildings must comply with basic mandatory requirements such as air and duct sealing, listed below. To comply with the energy code using the prescriptive path, the vertical fenestration area cannot exceed 40 percent of the gross wall area for each space-conditioning category and the skylight fenestration area must not exceed 3 percent of the gross roof area.
### Table 3: Maximum Fenestration Requirements by Component

<table>
<thead>
<tr>
<th>Fenestration Requirements by Frame Type</th>
<th>Climate Zone 2</th>
<th>Climate Zone 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fenestration Type</strong></td>
<td><strong>Frame Type</strong></td>
<td><strong>U-Factor</strong></td>
</tr>
<tr>
<td>Vertical Fenestration</td>
<td>Framing Material other than metal; with or without metal reinforcement of cladding</td>
<td>0.75</td>
</tr>
<tr>
<td>Metal Framing; curtainwall</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>Metal Framing; Entrance Door</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>Metal Framing; all other</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Skylights</td>
<td>Glass</td>
<td>1.05</td>
</tr>
<tr>
<td>Plastic</td>
<td>1.90</td>
<td>0.35</td>
</tr>
</tbody>
</table>

*PF=Projection Factor

### Table 4: Insulation Requirements by Component

<table>
<thead>
<tr>
<th>Insulation Requirements by Component</th>
<th>Climate Zone 2</th>
<th>Climate Zone 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roofs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation entirely above deck</td>
<td>R-15 ci</td>
<td>R-15 ci</td>
</tr>
<tr>
<td>Metal Building</td>
<td>R-19</td>
<td>R-19</td>
</tr>
<tr>
<td>Attic and other</td>
<td>R-30</td>
<td>R-30</td>
</tr>
<tr>
<td><strong>Walls, Above Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>NR</td>
<td>R-5.7 ci</td>
</tr>
<tr>
<td>Metal Building</td>
<td>R-13</td>
<td>R-13</td>
</tr>
<tr>
<td>Metal Framed</td>
<td>R-13</td>
<td>R-13</td>
</tr>
<tr>
<td>Wood Framed and Other</td>
<td>R-13</td>
<td>R-13</td>
</tr>
<tr>
<td><strong>Walls, Below Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below Grade Wall</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>Floors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>R-5 ci</td>
<td>R-5 ci</td>
</tr>
<tr>
<td>Joist/Framing</td>
<td>R-19</td>
<td>R-19</td>
</tr>
<tr>
<td>Slab-on-grade Floors</td>
<td>Unheated Slabs</td>
<td>NR</td>
</tr>
</tbody>
</table>
The second option is to follow the total building performance path Section 506. The performance path allows for the interaction of all energy systems and equipment and compares overall energy performance to a baseline goal. The performance path requires sophisticated software such as Energy Gauge or E-Quest. Even when the performance path is used, there are several basic mandatory requirements that must be met. In order to comply, written documentation must be provided by a registered design professional that outlines annual energy use and associated costs, energy-related features, input and output reports, and a written explanation that may appear in the simulation tools.

Building energy software tools directory

- **DOE approved building energy software tools**

Alternative energy modeling software includes TREAT, EA-Quip, and NEAT.

- **DOE approved large multi-family energy performance software**

**Basic Mandatory Requirements**

**Air Leakage** – Section 502.4: All air leakage requirements are mandatory including the certification of window and door assemblies, testing curtain wall/storefront glazing, completely sealing the building envelope, installed leakage-rated dampers, loading dock weather seals, and sealing vestibules and recessed luminaires.

**Systems** – Section 503: Heating and cooling loads must be calculated and equipment sized accordingly. In addition, HVAC systems must meet certain minimum performance requirements as outlined in Tables on pages 34-42 of the 2006 IECC code book. Also, thermostatic controls are required in HVAC systems and are outlined in sections 503.2.4.1-4. Certain specifications are required as well, including duct and piping insulation. Buildings must follow basic system requirements regarding the insulation and sealing of ducts, energy recovery ventilation for certain size systems, equipment sizing, and system controls.

**Service Water Heating** – Section 504: Minimum efficiency of water heating equipment must be met as well as requirements for piping insulation, temperature and system controls, and heat traps. Efficiency requirements are listed in Table 504.2 on page 48 of the 2006 IECC code book.

**Electrical Power and Lighting Systems** – Section 505: Lighting controls and lighting power limits are required as described in Section 505 for both interior and exterior lighting. Buildings with individual dwelling units must be provided with separate meters to determine electrical energy consumed by each tenant.

**Tools & Resources**
Compliance Software

The third compliance path available is the tradeoff approach utilized in COMcheck, a free software program provided online by the DOE. The software may be used to measure compliance and generate reports by inputting building components. This is particularly useful when a builder is using the building trade-off option. For example, if a builder chooses to use a greater area of glass, COMcheck can identify what increased level of efficiency will be necessary.

- **COMcheck**: Compliance with performance path
- **COMcheck**: Prescriptive Package Generator

Sample Checklists, Certificates and Reports

ASHRAE Standard 90.1-2007

ASHRAE Standard 90.1-2007 applies to all commercial buildings and residential buildings over three stories in height and regulates the design and construction of buildings for the effective use of energy. This code applies to new buildings and their systems, building additions and systems, and new systems and equipment in existing buildings. ASHRAE 90.1-2007 sets minimum requirements for the efficiency of building envelopes, HVAC equipment, and lighting. For example, using the prescriptive approach, all fenestration (except skylights and doors) is required to have U-factors between 0.65 and 0.75, depending on the frame type and an SHGC of 0.25. Changes in space conditioning are also subject to regulation, such as the modification of an unconditioned or semi-heated space to a conditioned space.

**Exceptions**: Buildings that do not use either electricity or fossil fuel, or equipment and portions of building systems that use energy primarily to provide for industrial, manufacturing or commercial processes are exempt.

Compliance

Standard 90.1-2007 allows for three compliance options. All buildings must meet mandatory insulation, fenestration, and air-leakage requirements and follow the prescriptive building envelope option, the building envelope trade-off option, or the Energy Cost Budget Method. To comply with Standard 90.1-2007 using the prescriptive path, all requirements outlined in sections 5.4 and 5.5 must be met. In addition, the vertical fenestration area cannot exceed 40 percent of the gross wall area and the skylight fenestration area must not exceed 5 percent of the gross roof area.
### Table 5: Fenestration Requirements by Frame Type

**Maximum Allowable U-Factor and SHGC by Window Frame Type - ASHRAE 90.1-2007**

<table>
<thead>
<tr>
<th>Frame Type</th>
<th>Climate Zone 2</th>
<th>Climate Zone 3</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U-Factor</td>
<td>SHGC</td>
<td>U-Factor</td>
<td>SHGC</td>
</tr>
<tr>
<td>Non-Metal</td>
<td>0.75</td>
<td>0.25</td>
<td>0.65</td>
<td>0.25</td>
</tr>
<tr>
<td>Curtainwall/Storefront</td>
<td>0.70</td>
<td>0.25</td>
<td>0.60</td>
<td>0.25</td>
</tr>
<tr>
<td>Entrance Door (metal)</td>
<td>1.10</td>
<td>0.25</td>
<td>0.90</td>
<td>0.25</td>
</tr>
<tr>
<td>Metal Framing (other)</td>
<td>0.75</td>
<td>0.25</td>
<td>0.65</td>
<td>0.25</td>
</tr>
</tbody>
</table>

### Table 6: Skylight Requirements

**Maximum Allowable U-Factor and SHGC by Skylight Type - ASHRAE 90.1-2007**

<table>
<thead>
<tr>
<th>Frame Type</th>
<th>Climate Zone 2</th>
<th>Climate Zone 3</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U-Factor</td>
<td>SHGC</td>
<td>U-Factor</td>
<td>SHGC</td>
</tr>
<tr>
<td>Skylight with Curb, Glass 0%-2% of Roof</td>
<td>1.98</td>
<td>0.36</td>
<td>1.17</td>
<td>0.39</td>
</tr>
<tr>
<td>Skylight with Curb, Glass 2.1%-5.0% of Roof</td>
<td>1.98</td>
<td>0.19</td>
<td>1.17</td>
<td>0.19</td>
</tr>
<tr>
<td>Skylight with Curb, Plastic, 0%-2% of Roof</td>
<td>1.90</td>
<td>0.39</td>
<td>1.30</td>
<td>0.65</td>
</tr>
<tr>
<td>Skylight with Curb, Plastic, 2.1%-5% of Roof</td>
<td>1.90</td>
<td>0.34</td>
<td>1.30</td>
<td>0.34</td>
</tr>
<tr>
<td>Skylight without Curb, All, 0%-2% of Roof</td>
<td>1.36</td>
<td>0.36</td>
<td>0.69</td>
<td>0.39</td>
</tr>
<tr>
<td>Skylight without Curb, All, 2.1%-5% of Roof</td>
<td>1.36</td>
<td>0.19</td>
<td>0.69</td>
<td>0.19</td>
</tr>
</tbody>
</table>
### Table 7: Opaque Element Requirements

<table>
<thead>
<tr>
<th>Element</th>
<th>Climate Zone 2</th>
<th>Climate Zone 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roofs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation entirely above deck</td>
<td>20 c.i.</td>
<td>20</td>
</tr>
<tr>
<td>Metal Building</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Attic and Other</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td><strong>Walls, Above-Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>5.7 c.i.</td>
<td>7.6 c.i.</td>
</tr>
<tr>
<td>Metal Building</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Steel-Framed</td>
<td>13</td>
<td>13 + 3.8 c.i.</td>
</tr>
<tr>
<td>Wood-Framed and Other</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td><strong>Walls, Below-Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>Floors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel-Joist</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Wood-Framed and Other</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td><strong>Slab-On-Grade Floors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unheated</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Heated</td>
<td>7.5 for 12”</td>
<td>10 for 24”</td>
</tr>
<tr>
<td><strong>Opaque Doors (u-factor)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swinging</td>
<td>0.70</td>
<td>0.70</td>
</tr>
<tr>
<td>Non-Swinging</td>
<td>1.45</td>
<td>1.45</td>
</tr>
</tbody>
</table>

Compliance using the performance alternative path requires using simulated energy performance analysis to demonstrate that a building meets certain energy performance standards as required by ASHRAE Standard 90.1-2007 as well as meeting basic mandatory requirements outlined in section 5.4. The Energy Cost Budget Method is then used to estimate energy use for the building. The designed energy cost must not exceed the energy cost budget for a building to comply. The building trade-off option allows for more flexibility and the optimization of interactions between building components.

Building energy software tools directory

- **DOE approved building energy software tools**

Alternative energy modeling software includes TREAT, EA-Quip, and NEAT.

- **DOE approved large multi-family energy performance software**
Basic Mandatory Requirements

**Insulation, fenestration and doors** – Section 5.4.1: When insulation is required, it must comply with requirements found in sections 5.8.1 and 5.8.2 found on pages 28 and 29 of the Standard 90.1-2007 code book.

**Air Leakage** – Section 5.4.3: Minimum air leakage requirements are outlined on page 18 of the code book and air leakage for fenestration and doors must follow guidelines determined by NFRC 400. In addition vestibules are required in building entrances that separate conditioned space from the exterior.

**Compliance Software**

COMcheck: free software program provided online by the DOE. The software may be used to measure compliance and generate reports by inputting building components. This is particularly useful when a builder is using the building trade-off option. For example, if a builder chooses to use a greater area of glass, COMcheck can identify what increased level of efficiency will be necessary.

- **COMcheck**: Compliance with performance path
- **COMcheck**: Prescriptive Package Generator

**Sample Checklists, Certificates and Reports**

- Sample COMcheck 90.1-2007 Compliance Certificate (Climate Zone 3a)
- ASHRAE Standard 90.1-2007 – Commercial Building Data Collection Checklist
Alabama Success Story

The City of Homewood

The City of Homewood is one of two jurisdictions in the state to adopt the 2009 IECC (Tarrant is the other), and it is making substantive efforts to implement it. As a city that is unique in its efforts to enforce the 2009 IECC, it is difficult to obtain feedback on best practices from other local jurisdictions, but Homewood is making every effort to take advantage of opportunities offered by the state and organizations that provide energy code support.

According to Homewood’s building inspection superintendent, the inspection department has participated in both the ADECA-sponsored Commercial and Residential Energy Code workshops run by Southface, which provide training on energy code basics and proper enforcement. These trainings can assist the city in overcoming obstacles, such as the lack of familiarity with Standard 90.1-2007 on the part of many mechanical and electrical engineers and insufficient access to education in the jurisdiction. In addition, Homewood has begun to educate local residential contractors and subcontractors on the provisions of the 2009 IECC. Homewood is also organizing local code officials and engineering groups from surrounding areas to increase the number of educational opportunities available.

In an attempt to promote the successful enforcement of the 2009 IECC, Homewood requires design professionals to provide documentation demonstrating that the new building or major renovation is in compliance with the code. Without documentation, the inspection department will not issue a Certificate of Occupancy. In addition, the inspection department meets with each architect and engineer involved in new construction or major renovation projects to remind them that the designs are required to meet the 2009 IECC. Although this is an important step, it will be important for jurisdictions to either provide an incentive or penalty for architects and engineers whose designs do not meet the required energy code.

Cost, particularly for conducting site plan reviews and on-site inspections, is a significant barrier to successful energy code enforcement, particularly given the difficult economic climate. With help from a number of local construction projects, including additions to the hospital and the renovation of a local mill, Homewood offers a great example of how to successfully fund inspections. The inspection department receives all of its funding through permit fees that are based on the cost of construction (currently at a rate of $8.50/$1,000). The fees cover the costs of administration, plan reviews and inspections. The inspection department currently consists of three inspectors, two clerks and the building inspection superintendent.
Calculating Permit Fees to Properly Fund Inspections

Although Homewood is able to fund its inspection department entirely through permit fees, this model may not work for larger cities in Alabama. The cost of inspections varies across jurisdictions and may be calculated by any individual inspection department by using ICC’s Building Valuation Data and the Permit Fee Multiplier. In Homewood, permit fee valuation is determined by the contract cost, but can never fall below ICC’s Valuation Table. The ICC Valuation Table is used to provide average cost per square foot to help determine permit fees for jurisdictions. Jurisdictions may use this table to determine their own permit fee valuation by following a few simple steps provided by the ICC.

1. Calculate the permit fee multiplier
   a. What is the percentage of the inspection department that will be funded by permits
   b. Find the total annual construction value for the last year in your jurisdiction
   c. Multiply step ‘a’ by total department budget and divide this by step ‘b’ to find the permit fee multiplier

2. Calculate the Permit Fee
   a. Determine the Gross Square Footage of Building to be Permitted
   b. Determine the Type of Construction by Group and identify Square Foot Construction Costs (Select # from Square Footage Construction Costs Chart)
   c. Multiply a x b x Permit Fee Multiplier

Permit Fee ($) = Gross Square Footage of Building to be Permitted x Cost Per Square Foot x Permit Fee Multiplier

Necessary Inputs

- ICC’s Building Valuation Table (BVT) (pdf)
- Inspection Department Budget
- Percent of budget to be covered by permits
- Average Construction Costs (may be provided by BVT)
- Annual Construction Value in Jurisdiction for Past Year
- Type of Construction

The building valuation data is updated every six months and will be updated again in August 2010.
Conclusion

In the last several years, energy codes have gone from afterthought to priority in state after state. With the need to save energy and money increasingly vital to the health and prosperity of the state’s economy, Alabama is ready to join its peers in adopting and enforcing the model energy codes. 90 percent compliance by 2017 is an ambitious goal that will require new approaches to energy code implementation, including increased collaboration between the state and local jurisdictions and some drastic changes to business-as-usual energy code enforcement and compliance practices. This Implementation Action Kit gives local jurisdictions the strategies and tools to address all aspects of energy code compliance, as well as regional and national resources for additional guidance and support on best practices around the country. Now it is up to the state to take advantage of the opportunity to significantly reduce energy use in its buildings and improve the economic wellbeing of its citizens and businesses.
Glossary

Building envelope - any material that separates conditioned space from unconditioned space (the separation between the interior and exterior of the structure), such as exterior walls, a structure’s roof, or windows and doors

Commissioning - a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria. It ensures energy efficiency by using peer review and in-field or on-site verification that building components are working correctly.

Envelope Components - Consist of floors, walls, roofs, etc. that serve to separate conditioned space from unconditioned space.

Fenestration - The opening of a building that allows light, air, or people to pass through (such as a window or door).

HVAC System - The equipment, network, and terminals that make up a heating, ventilating, and air-conditioning system in a building.

Model Energy Code (MEC) - Specifies energy efficient regulation for new buildings and additions. MEC is presented by the International Code Council (ICC) as the International Energy Conservation Code (IECC).

Lighting Power Density - The maximum lighting power per unit area of a building classification or space function.

Low-Rise Residential Building - A single/multi family house that maintains a maximum of three levels above grade.

Multi-Family Building - A residential building maintaining no more than three stories and at least three attached housing units. (This excludes hotels and motels).

Non-Residential - All buildings which do not serve as living quarters, such as an office building.

Opaque Elements - The building envelope, except for building openings, such as vents.

Prescriptive approach - Maintains a documentation of the minimum R-values/maximum U-factors required for each component or material that makes up a building.

Performance Method - requires using simulated energy performance analysis to demonstrate that a building meets certain energy performance standards required by the code.

Performance Testing – an engineering or functional evaluation where emphasis is placed on the final measureable performance characteristics. Performance tests such as blower door and duct blaster tests help to assure compliance with residential energy code provisions. Other forms of testing could include pressure testing or infrared imaging.
An engineering or functional evaluation where a material, product, system, or person is not specified by detailed material or component specification: rather emphasis is on the final measurable performance characteristics, either qualitative or quantitative. For example, the Duct Testing requirement in the 2009 IECC for ducts outside the conditioned space is that they perform no worse than 7CFM at 50 pascal.

**R-Value** - Serves to measure the material’s ability to insulate and resist heat flow. Higher R-values represent better, more efficient insulation.

**Solar Heat Gain Coefficient (SHGC)** - Measures solar energy transmitted through glazed surfaces, and thus determines how well that surface can block out heat from the sun. The lower the value (ranging from 0 to 1), the less solar heat is being transmitted through the glazing.

**Trade-off Approach** - Trading one energy efficient element from one area, for a less energy efficient element in another area.

**U-Factor** - Measures how successful a building material is at conducting heat, and measures the heat transfer of building materials given the area of that material.

**Unconditioned Space** - Space which is not conditioned and without an automatic heating system. (See: Conditioned Space)

**Vertical Fenestration** - Refers to any and all fenestrations (minus skylights).
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