

Lessons Learned in Energy Code Education Across the Carolinas

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ABSTRACT

The single largest barrier to energy code compliance is a copy of the code. The second largest barrier to energy code compliance is the availability of quality and diverse education targeting all aspects of the building industry.

After more than a decade of energy code training and an intense two-year effort focused on the Carolinas, we have learned many lessons about training effectiveness and its importance in support of code adoption and implementation. Our experience and findings show that major parts of the building industry are being ignored, underserved or still don't have access to quality energy code education.

Assessment of market knowledge and interests in the energy code was conducted across a diverse audience of code training participants during the first half of 2011. The assessments sought input on code compliance, training methods, effectiveness and areas needing additional support. These assessments revealed the need for: multiple learning structures (classroom to field training), engagement of a wider audience (home builders to home buyers), development of tools for building officials and others to help ensure code compliance, expansion of consumer education, and other lessons.

As a result of these findings we believe that the efficiency community must dramatically change its training techniques, tools, and outreach if we are to achieve the goals of improved code adoption and on-the-ground compliance. We must redirect a greater share of limited resources toward more effective and aggressive education across all aspects of the building industry.

Introduction

Recent federal funding through the economic stimulus of the American Reinvestment and Recovery Act (ARRA) provided unprecedented funding to state governments for energy efficiency programs. As a stipulation to receiving these funds, states agreed to implement “a building energy code (or codes) for residential buildings that meets or exceeds the most recently published International Energy Conservation Code, or achieves equivalent or greater energy savings”. As well, “a building energy code (or codes) for commercial buildings throughout the State that meets or exceeds the ANSI/ASHRAE/IESNA Standard 90.1–2007, or achieves equivalent or greater energy savings” was required. In addition to energy code adoption, the states also are required to achieve compliance for “at least 90 percent of new and renovated residential and commercial building space” (ARRA 2009). Not only was the funding amount unprecedented, it also was disbursed and put towards new and existing projects on a narrow timeframe. This provided a challenging but unique opportunity to develop effective educational programs, enforcement tools and compliance assessments. However, the funding was sufficient only to create a foundation which the states will now need to refine and build upon. Mathis Consulting Company developed curricula and training programs on energy code education for

both North and South Carolina during the first six months of 2011 that were delivered through each state's energy office. This report details our lessons learned on the messaging, methodology, successes and failures in these two training programs.

North Carolina

Beginning in 2008, Mathis Consulting Company (MC2), through the NC State Energy Office (NC SEO), has provided energy code training to over a 1000 building professionals across North Carolina, many of which are "repeat offenders" and have attended multiple classes. Initially, the trainings were focused solely on building officials with just a few sessions for builders and architects. In 2011, the ARRA funding made it possible to ramp up the code education program and market the trainings more effectively towards a wide array of building professionals. These trainings involved all-day classes for a mixed audience of architects, builders, engineers and other building industry professionals in six locations around the state. The curriculum included a six-hour class for both the residential and commercial chapters of the North Carolina Energy Conservation Code (NC ECC) 2009. Each training sought sponsorship with local Home Builders Associations (HBA), American Institute of Architects (AIA) chapters and building inspections offices in an effort to encourage attendance, promote dialogue and increase outreach in each community. All classes were delivered in lecture style at conference centers across the state. It is also noteworthy that, in the midst of this project, the Governor signed into law the new, current version of the NC ECC, amplifying the importance of continued energy code education across the state and across all sectors of the building industry.

South Carolina

South Carolina, compared to its northern neighbor, is just beginning to embark on the road to energy efficient building codes. In 2008, the South Carolina Building Code Council adopted the 2006 IECC and set implementation for July of 2009. In April of 2012 the Governor signed the 2009 IECC into law with an implementation date of January 2013. Consequently South Carolina is starting to experience the benefit of these codes with regard to energy efficiency and conservation. Therefore, energy code education is critical now; energy savings cannot be fully realized until compliance and enforcement begins.

Fortunately, the ARRA funding provided us with an opportunity to develop an energy code education program for building inspectors. The program in South Carolina, the first of its kind, comprised of numerous smaller trainings across the state that was geared more specifically towards the audience in attendance. In this training program, we reached out to inspections offices and local HBA chapters, and coordinated with statewide conferences for both of these organizations. Local hosts chose the subject matter of the training from a list provided to them. Available topics included prescriptive requirements for residential and commercial compliance, Manual J calculations, field trainings, ResCheck and ComCheck. In a four month period, MC2 conducted 26 trainings across the state of South Carolina, four of which were conducted in the field.

Lessons Learned

While the North Carolina and South Carolina programs differed on training curriculum and delivery, both shared key messaging and best practice principles. In both states, education was identified as the number one tool to increase compliance and enforcement by the class participants. Based on audience participation, direct feedback, review of course evaluations, and experiences with similar trainings, we developed a list of education “Lessons Learned” to be considered for future energy code trainings.

Lesson 1: Make Energy Efficiency and Code Compliance Important

Getting professionals into the classroom is the initial hurdle. The second, and perhaps the most challenging, is delivering energy efficiency in a language that aligns with participants’ personal values in an effort to instill a greater sense of fulfillment in their work. Energy efficiency often gets labeled as an environmental issue which, unfortunately, has a negative connotation in some circles. One technique used successfully during these trainings was to kick off each session with some perspective on why our buildings matter and why building energy efficiency matters. Showing students that building energy use dominates our nation’s total energy demand and how even small decisions about building construction can have a huge impact on issues from national security to the economy and local job market was effective at grabbing their attention. By identifying building professionals as a “national guard” of energy efficiency, attendees are more likely to pay attention to the code details presented later. It is vital when referring to the energy code to emphasize that it is the minimum standard: it’s the least safe, least strong and least efficient building allowed by law.

Lesson 2: Create Diverse Learning Structures

People learn in different ways. Some are visual, some are tactile, some learn by reading, others by experiencing. For energy code training to be more effective, each type of learning and teaching technique must be employed, including: classroom lecture, field days, web-based training modules, and video. Additionally, audiences for energy code education are not homogenous; trainings need to be tailored to meet the needs of audiences with varied experience with the residential and commercial provisions of the code. Based on our experience to date, we believe the following four priorities should be addressed in future trainings:

- *Develop web-based modules for convenience learning.* Many building professionals, especially builders, do not have regular access to energy code training at all or the ability to miss a day of work to attend such educational programs. Also, many people find it difficult, based on our course evaluations, to sit through 6 hours of classroom training, especially when there are other tasks and projects demanding their attention elsewhere. The creation of 20- to 30-minute web-based modules that they could watch at their desk would make training available “on demand” and has the potential to increase participation and retention. It creates a mechanism for “refresher” learning and easy material updates especially for the participants who were involved in our training programs. Web-based modules could also provide some travel budget relief for state and local departments with limited funding.

- *Plan review training.* Many energy code compliance issues most easily can be recognized and resolved before the building official ever gets to the job site. Quality plan review for energy code compliance is essential. Specific training sessions should be developed targeting both architects and building officials to spark a discussion outside of the deadlines or budgets of an actual project. To entice and ensure participation, the class should be approved for continuing education for both architects and officials through the American Institute of Architects and through a state agency that handles continuing education requirements for building inspectors.
- *Energy code visual library.* We recommend the creation of a web-based, visual library. This library would show compliant and non-compliant constructions to assist building professionals in better understanding the requirements of the code. In training evaluations, one way attendees suggested to improve the seminar was to show more pictures like this. This visual library would pair well with the web-based modules, providing examples of what to- and not to do.
- *Create job-site based training and demonstration.* Testing compliance and performance is becoming more common in energy codes. In addition, feedback from many building professionals indicated that they wanted to visit an actual job site. Field trainings have the potential to act as an excellent bridge between the code requirements, classroom lessons and on-the-job realities, and should include both residential and commercial buildings. Coordinating with local building departments and inviting architects, developers, engineers and others will integrate the requirements of the energy code into the marketplace more rapidly. It is also important to develop an incentive for builders to participate in field trainings, something that does not currently exist in the Carolinas. Bringing builders, HVAC contractors and inspectors together so they can see and test diagnostic equipment often removes the mystery behind the recent and upcoming energy code requirements. It is also an opportunity to discuss, compare and contrast projects on both the prescriptive and performance paths. Field trainings should contain the following elements:
 - demonstration of best practices and problem areas
 - use of diagnostic equipment and mockups to quantify typical issues and improvements
 - use of an infrared camera to demonstrate thermal bypass and air leakage
 - interactive techniques

Lesson 3: Overcome Classroom Attention Challenges

PowerPoint presentations were used in all trainings conducted during this project. Although a great educational tool, it does not always provide enough stimulation to keep attendees' attention focused – this is often referred to as “death by PowerPoint.” Some of the more effective techniques that we employed (and should expand upon) include:

- *Capture and keep attention.* MC2 found that it is vital to keep PowerPoint materials very visual, limiting the amount of text content. This gives the attendee an engaging presentation and maintains focus on the speaker. Handouts or links to the information covered can reduce note-taking and slide-reading distractions.

- *Use anecdotal case studies supplied by trainer and students.* While we talked about making energy code compliance relevant, it is also important to make it personal. The text of the code is not highlighted with important issues or warnings. Anecdotal case studies tend to build a bridge from a simple code provision all the way through the builder, inspector, and finally to the experience of the homeowner.
- *Teach building science, not just the code.* We found that teaching the principles of science behind the energy code not only commanded a better attention rate but stuck with students beyond the training. In North Carolina, we have observed that taking the time to teach building science gained more energy efficiency advocates, diversifying our supportive stakeholder base in the next energy code adoption cycle.
- *Use interactive techniques.* During our South Carolina training, one session was focused on residential prescriptive provisions. A game was conducted to encourage interaction. Attendees were given a card that was red on one side and green on the other. They then were shown a series of pictures, raising their cards in order to red tag or give the green light. This proved to be one of the most effective tools of class interaction and a spark for questions. Side-by-side comparisons from actual inspections of “red-tagged” and “best practices” items reinforce code language. A picture might be worth a thousand words in keeping the image of what not to do sharp in every student’s mind. Methods other than those above might include votes and discussions, computer activities (including modeling), and Q&A.
- *Use of infrared camera to demonstrate thermal bypass and air leakage.* Pictures alone do not do justice to the impact thermal imaging equipment provides in the field. For example, seeing blue (cold) false color infrared stripes on a cold day between unblocked joists clearly shows the consequences of improper construction. Generally, after infrared camera demonstrations, students immediately want to go home and look for energy leaks. This hammers home the importance of inspection and compliance.

Lesson 4: Professionalize Energy Code Inspection

We recognize that building officials are focused on their own professional development. While there are independent energy code certifications (i.e. ICC), they are not required by either state. If we professionalize energy code inspection, at the state level (as we have for plumbing, electrical, etc.), we are more likely to get students in the classroom that really are engaged. If attendance and participation is part of their professional advancement, it emphasizes to the inspector the importance of this aspect of their job. This should have the derivative benefit of improving energy code compliance in the field.

- *Include energy code requirements where applicable.* In addition to the creation of a new certification, the energy code requirements should be added to each discipline as applicable (i.e. lighting requirements added to electrical certification, etc.).
- *Incentivize energy efficiency credentials.* The state should encourage and incentivize municipalities to have staff earn energy efficiency, auditing, and energy rating credentials in an effort to encourage staff to be more knowledgeable about energy use and to create a better understanding of building above code.

Lesson 5: Develop Energy Code Certification Programs for Building Industry Professionals

Energy code education must be integrated into ancillary trades, both upstream and downstream. This includes architects and engineers, framing, foundation, mechanical, electrical and other contractors, as well as raters in air sealing, duct sealing and other energy efficiency measures. This is essential to achieving code compliance and energy efficiency. The biggest challenge of the educational aspect of this project was outreach and participation. The largest group of building professionals in attendance was architects. One factor is that classes had been approved for continuing education credits for members of the AIA. Free food and free education is not enough. We suggest the following:

- *Creating Builder Incentives.* The development of an energy code certification for builders would entice builders to attend classes because it would enhance their marketability to customers. This could also improve the builder/inspector relationship. An inspector or utility could see this certification and know that they had the state energy office's, or other approved state agency's, stamp of approval for competence in energy code compliance. In addition, builders could take the opportunity to demonstrate their knowledge to the inspector. Certification should last until the new energy code is adopted. Re-certification institutionalizes continuing education.
- *Certify energy code training through established programs.* Energy code education should be approved for all existing continuing educational programs, such as the Professional Engineers of North Carolina and Green Builder Credits. Many attendees requested certificates of completion in order to self-report to these programs. Certifying energy code classes in advance not only provides a greater incentive to attend, but widens the marketing and outreach opportunities available to the education provider.
- *Expand certification for other members of the building community.* Certification for realtors, lenders, and appraisers would prove an effective way to educate potential homeowners about the power of energy codes. This certification program should include the principles of energy code performance along with maintenance, replacement, and utility savings. Educating realtors, lenders, and appraisers about the real cash value of energy code compliance and beyond code encourages capital support mechanisms and consideration for overcoming hurdles to initial investment.

Lesson 6: Develop Improved Enforcement Tools and Mechanisms Supporting Continued Learning

Provide the state's building officials with additional tools to aid in compliance assessment and continuing education. Additional compliance tools should include the following:

- *Copies of the code.* In an era of budget challenges it should not be too surprising that many building professionals do not have a copy of the Energy Conservation Code. We believe that making the code "open sourced" or web-available to every building professional is essential to its enforcement. This enables professionals, such as builders and architects to access to the most recent requirements. After attending these seminars, there were a significant number of requests for copies of the code.

- *Informational Survey.* Long-term strategies for improving enforcement and compliance are paramount. Building professionals should be surveyed regularly to capture detailed information about the perceived impediments to code enforcement and compliance. This survey needs to be on-going and interactive with the building community, maintaining channels for regular reporting and feedback.
- *Documentation of red- tagged items.* A recordkeeping system for inspectors to document violations more easily, communicate infractions, and show examples of good and bad construction/installation at work sites needs to be developed. A low-tech solution might be visual code notebooks, illustrated for the benefit of the builders and designers. High-tech options might leverage the influx of computer technology into the building and inspection industries. Such documentation provides a firm foundation for inspection offices to address both chronic problems, and problematic builders and designers. More importantly, it provides a feedback loop for improving education and communication coming from the inspection office. A higher-tech solution could include an on-line visual library, accessible to building officials and builders, showing proven examples of compliant and non-compliant construction. Such a library should be accessible at the job-site using a smart phone or notebook technology.
- *Create simple enforcement tools.* Access to enforcement tools and understanding of common reports will aid in code compliance. Simple tools such as checklists for different stages of construction (for example, an air leakage visual inspection checklist to be used before walls are finished), visual guides detailing prescriptive requirements of the code and step-by-step examples of how to read Manual J reports or load calculations would be great assets for code officials.

Lesson 7: Expand Trainings to Address Improvements to Existing Buildings

To ensure that energy codes have the intended impact on building stock, it is essential that building professionals have adequate training specific to renovations. Only one percent of the total building population is created each year – that’s 1% new versus 99% existing. Therefore, renovations are a rare opportunity to upgrade buildings built under past, less efficient codes, and to capitalize on some valuable and relatively untouched areas of energy conservation. In order for educational tools and training methods to be effective, they both need to be building type and category specific. These tools also need to be made readily available to building professionals. This topic was not one specifically addressed within the scope of this project but should be included in future educational efforts. In addition, an effort should be made to update the national existing building and rehabilitation codes. This would require energy updates to existing buildings whenever they are renovated significantly. Whenever mechanical systems or luminaries are replaced, envelopes exposed or interiors “gutted” in existing buildings, there is an opportunity to update systems, and add insulation and air sealing with relatively little additional effort.

Lesson 8: Expansion of Training and Enforcement on All State-Funded Projects for Pull-Through Demonstration for the Private Sector

North Carolina is serious about energy efficiency and peak power reductions, and that the State government can have a large impact on energy use by leading by example. This is seen

clearly in NC Bill 668, passed in 2007, requiring all major facility projects of public agencies to be “designed, constructed, and certified to at least thirty percent greater energy efficiency than the standard under ASHRAE 90.1-2004. Energy codes are yet another arena where the State can and should lead by example, taking all steps necessary to ensure that all state-funded projects meet or exceed the current state code. This sends the clear message that the code can be met, gives local jurisdictions models for successful enforcement, and serves as an arena for teaching the private sector.

Lesson 9: Develop Energy Code Education Materials and Programs for First-Time Homebuyers

Many first-time homebuyers seek education and information when purchasing their first home, the largest purchase most citizens ever make. This is an opportunity for state governments to promote energy efficiency knowledge in their populations. It is vital that we make the connection between improved energy codes and monthly utility bills. States should provide information on energy audits, retrofits, and weatherization programs. Information should be included on state energy offices’ websites for repeat homebuyers as well. Educated citizens can support energy efficiency through informed purchases.

Lesson 10: Develop Communications Tools for the State Energy Office in Support of Code Development and Education

One of the greatest challenges of energy code education is dispelling the myth that energy efficiency sacrifices comfort and costs a fortune. State energy offices are functioning in most states and provide a great central “hub” to dispense energy conservation information. Each state’s energy office can provide valuable and defensible information to both lay and professional citizens involved in and affected by energy code decisions. The following are recommended for both North and South Carolina. We believe that this model can be easily extrapolated to other states nationwide. State energy offices should

- Offer more information. During these projects, we realized the overwhelming need for energy code education. To capture the benefits of the energy code, inspectors must enforce the code, and building professionals need to understand how to comply. These projects provided an introduction to energy code education. To increase compliance, education must continue. The state energy office should offer web-based information on upcoming educational opportunities, compliance and enforcement tools to update leaders in the enforcement community.
- Provide a venue for building professionals and others to request information or education on the energy code. We recommend an application, calendar, or contact on the state energy office website for trainings, energy audits and information.
- Provide a survey on the website so building professionals can submit their opinions on the energy code anonymously. Too often individual building professionals want to improve the built environment through better codes, but feel that their peers would disapprove of increasing regulation. This behavior affects both the development of national model codes and local adoption. Anonymous input is critical to get unfiltered participation.

- Champion the development of a cost model and database for use in building energy code development. This could bring a local and fair level of cost comparison to proposals for code improvement within the Building Code Council.

Conclusion

Our future energy landscape is uncertain. With electricity consumption increasing, more stringent building energy codes are essential. In order for building energy codes to be effective, they first must be understood. Our recent experiences in code education across the Carolinas have revealed a great need for consistent access to quality energy code education for all building professionals. In the classroom it is essential that we ground the energy code in real-world issues, create diverse learning structures, and cultivate an environment where discussion among professionals can take place. To achieve increased participation in code education we must set a high value on energy efficiency and code compliance. To that end, states should professionalize energy code inspection and install support structures for continued learning. In conjunction with adopting more efficient energy codes and improving training, we must develop improved enforcement tools, and leverage state-funded building projects as leadership opportunities. States can lead the way in developing energy code certification programs for a wider array of building professionals, who, in turn, can educate first time home buyers. Although these lessons were learned in the Carolinas, they are relevant to any jurisdiction and can be applied across the nation.

References

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