Survey of Advanced Residential Building Techniques

Introduction

There is a distinct lack of knowledge on commonly used building practices that save energy in homes. However, energy codes need to advance by incorporating such practices, not by mandating new technologies and techniques. In spring of 2009, BCAP conducted a builder survey to collect data on what is common practice and uncover opportunities to "catch up" the code to energy-efficient technology and methods that have been proven in the field but are not in the code.

Courtesy of DOE/NREL—Warren Gretz

In distributing the survey, BCAP used a multi-level outreach strategy to acquire the data quickly and to ensure representation of leading building professionals. The RESNET conference in February 14 –18, 2009, was targeted for the advanced building professionals in attendance. Additionally, the survey was distributed to Building America partners, as well as the membership of the Energy and Environmental Building Association (EEBA) and several national and state home-builders associations.

A total of 127 anonymous participants answered vey ten questions providing information on which energy-efficient techniques or technologies they currently install or employ, obstacles encountered while doing so, and, most importantly, what opportunities would improve residential energy codes.

Energy-Efficient Technology

Understanding the type of technology and methods that survey respondents encounter in the field can provide insight into the opportunities to close the gap between the code and common practice. The following list describes survey responses to the question, "What type of technology do you install, consult, or advise on?":

- High performance insulation products and techniques represented the highest percentage of responses (46%). Answers varied from continuous insulation systems to high-performance foam products to high density batt insulation.
- Survey respondents identified full load and right--sized heating, ventilation, and air-conditioning (HVAC) systems, including high-efficiency condensing heating units and air-source heat-pumps, as the second most referenced technology (36%). HVAC systems maintain indoor temperatures and provide thermal comfort and represent the largest energy-consuming device or appliance in buildings. Consequently, HVAC systems pre-sent many opportunities to cut energy use; survey results confirm this notion as it nearly tops the list of seventeen reported energy-efficient technologies. HVAC systems also dominate opportunities for energy efficiency in homes in cooling climates where envelope improvements are often less cost-effective and have a lower impact. Design is important: proper unit sizing, duct installation, and sealing are essential.

- The use of SIPs (structural insulation panels) and ICFs (insulating concrete forms) jointly followed at 24%. Generally, after advanced insulation technologies, improvements in traditional envelope or enclosure techniques are the next logical step to achieving higher performance homes in terms of improved insulation.
- Advanced framing, also described as Optimized Value Engineered (OVE) framing, was identified as frequently installed in residential construction (23%).

Opportunities

The survey attempted to identify the leading opportunities to include energy efficiency technologies in residential energy codes. Survey results suggested that there would be a greater acceptance of energy -efficient techniques and technologies represented in energy codes at the state level if local officials had adequate resources. Respondents had a variety of recommendations:

- Many building professionals repeated that costly setbacks are created when contractors install new energy conservation products and code officials will not permit their use because they are not familiar with the new products. Some builders indicated that technical one-on-one assistance and continuing education is necessary as some code officials are not aware of contemporary technologies or do not understand the overarching building science. Continuing education and a broader understanding of the progressive technologies would solve this gap.

Courtesy of DOE/NREL, Credit—Warren Gretz

- Another item identified was adequate training for code officials. Code officials should have adequate training as well as experience so they understand what they are enforcing.
- Respondents also indicated states should invest more resources in local building departments to provide sufficient staff for effective enforcement.

Other opportunities building professionals see for advancing code is access to empirical data (i.e. results from advanced building programs):

- Many builders consider the success of advanced building programs, such as ENERGY STAR or LEED, will inflate the market and influence codes as performance-based data is made avail-able to code-creating bodies.
- Building professionals also believe that more popular advanced technologies, (i.e. insulating exterior sheathing, radiant-floor heating systems, or water management) should be addressed as an appendix chapter in the code so there are guide-lines available for both the installer and enforcer to reference. Not only would this drive code official's knowledge, but it would also create a progressive code.

Barriers and Obstacles

With the increasing interest in ecologically sound construction and "green" building requirements, the survey attempted to identify some common barriers or obstacles that respondents confront in building energy-efficient homes. The common barriers and obstacles in building energy-efficient homes that respondents recognized include:

- Up-front costs, coupled with the lack of incentives. With regard to cost and incentives, one respondent wrote, “The government, both Federal and State, has made it difficult to advance sustainability by providing "paperwork barriers" in order to take advantage of incentives. The re-cent lifting of tax-credit caps on solar and geo-thermal has helped, but there is a great deal more that could be done. While stimulus money is being provided to large corporations on the one hand and to individuals who are remodeling on the other, the homebuilder is being left behind. It is my opinion, however, that this will soon make no difference. The market is now demanding energy-efficient homes, and where the market is, the builders will follow. Eventually.”
- The enormous gap in education on code and building programs, as well as a surprising lack of knowledge, impedes attempts to develop an efficient housing stock. Deficient education is not role-specific; it’s a reciprocal malfunction among the consumer, builder and installers, and ends with the code officials.
- An often-repeated barrier was the need to reassess the method by which insulation is evaluated for performance; that the current R-value metric was not valid for all climates or weather considerations, and high-performance insulation products were not valued enough by the codes. “Everyone knows that R-values for high performance insulation schemes aren’t really the same as those for other technologies in real-time use…” was a summarizing comment.

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Recommendations

The survey contributes to a greater understanding of the market trends of energy-efficient technology being utilized, as well as attitudes of building professionals towards building energy codes and obstacles to those technologies in the field. Further, it indicated where energy codes, their implementation, and compliance might be advanced, such as through enhanced education for builders and code enforcers, and new requirements and product standards that promote more efficient technology. Opportunities that the residential code should follow up and bring to the residential code and building industry should recognize include the following:

- The energy and related codes need to be modified to promote the use of efficient technologies. Examples include:

1. Changing referenced standards for insulation performance measurement to reflect new findings in actual performance. New testing standards may need to be developed to allow these changes.
2. The impact of high-performance HVAC systems needs to be better analyzed and reflected in energy code requirements. In the same vein, stronger requirements for and enforcement of proper sizing, installation, and maintenance need to be added.
3. High-performance envelope systems, such as SIPS and ICFs should be addressed more specifically by the codes, in order that they may become more widely accepted by code officials in the field.
4. The advantages offered by using advanced, (or OVE) framing and the greater insulation levels it allows should

be better recognized by the codes. This practice is indirectly allowed currently, however the requirements to do so are in multiple places and chapters in the IRC, and should be organized to make accessing those requirements for the technology easier. Similarly, the insulation advantages should be recognized in the IECC by calling out the practice and assigning higher values for this technology.

- Training courses should be structured for a mixed audience wherever possible, such as code officials, builders, and designers, and fashioned to teach no more than a few focused topics during each course, (i.e. changes to the current code or strategies on construction and or enforcement). This would diminish the impacts of "silo" training that only delivers information to one audience rather than all the appropriate areas of the building sector. Mixed training improved the application of energy-efficient technologies in homes. Further, it would allow participants to walk away with an action items to proceed with from the learning material presented instead of being overwhelmed with excess information.
- On-site training at the construction site may also be more effective. This adapted approach would ensure that builders install measures that meet or exceed energy codes and code officials would also gain a broader knowledge of the current energy code and technologies that meet them.
- Training on specific advanced efficiency technologies should be promoted to all audiences, in order to expose them to these technologies and their application with respect to code requirements. The energy efficient industry would be very eager participants in this effort.

Additionally, BCAP also recommends further work for a more in-depth evaluation on current advanced technology. Follow-up workshops with builders, designers, and code officials would allow a thorough discussion of new technologies and barriers to building energy efficient homes, as well as complexities with code implementation and enforcement around those technologies. This expanded effort is likely to produce valuable new information in the effort to promote advanced energy efficiency in codes, both in development and, as important, implementation of those codes.

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