RESIDENTIAL BUILDING
ENERGY CODES - ENFORCEMENT & COMPLIANCE STUDY

October 2008

Developed by the
Building Codes Assistance Project
Prepared for and funded by the
North American Insulation Manufacturers Association
(NAIMA)
Residential Building Energy Codes – Enforcement and Compliance Study

Final Report
October 2008

Developed by the Building Codes Assistance Project
Prepared for and funded by the North American Insulation Manufacturers Association (NAIMA)

Introduction

- Summary of Key Findings
- Summary of Recommendations

Part 1: Survey Report

1.1 Project Description & Methodology
   1.1.1 Project goals
   1.1.2 Literature review
   1.1.3 Project and survey design
   1.1.4 Survey distribution
   1.1.5 Sample size and accuracy
   1.1.6 Data analysis

1.2 Understanding Energy Codes
   1.2.1 Background
   1.2.2 Key findings

1.3 Understanding Staffing Issues
   1.3.1 Background
   1.3.2 Key findings

1.4 Education and Training
   1.4.1 Background
   1.4.2 Key findings

1.5 Tools
   1.5.1 Background
   1.5.2 Key findings

1.6 Outreach Methods
   1.6.1 Background
   1.6.2 Key findings
Part 2: Budget Considerations

2.1 Introduction

2.2 Staffing Consideration
  2.2.1 Annual Cost of an Energy Code Calculation
  2.2.2 Adequate Staffing Calculation
  2.2.3 Optional Alternative Compliance Consideration Calculation

2.3 Education and Training Budget Consideration
  2.3.1 Basic Training Cost Calculation
    2.3.1.1 Average Hourly Training Budget Calculation
    2.3.1.2 Training Frequency and Employee Downtime Budget Calculation
    2.3.1.3 Total Basic Training Budget Calculation

2.4 Outreach Methods Budget Consideration
  2.4.1 Resource Material Budget Calculation
  2.4.2 Website Budget Calculation
  2.4.3 Presentation Budget Calculation
  2.4.4 Total Annual Cost of Basic Outreach Strategy

2.5 Conclusion

Appendix A
  - Literature review references

Appendix B
  - Survey Questions and Results

Appendix C
  - BCAP 2005 Residential Survey Table

Acknowledgements: BCAP would like to extend special thanks to NAIMA, state chapters of the International Code Council, state chapters of the Building Code Official Association, National Governors Association, National Association of Counties (NACo), National Association of State Energy Officials (NASEO), International Council for Local Environmental Initiatives (ICLEI–Local Governments for Sustainability), Midwest Energy Efficiency Alliance (MEEA), Southeast Energy Efficiency Alliance (SEEA), the Northeast Energy Efficiency Partnership (NEEP), the Southwest Energy Efficiency Partnership (SWEEP), and the Northwest Energy Efficiency Alliance (NEEA), as well as many individual state contacts in assisting us in distributing the survey portion of this study.

Primary Author: Kym Willock, BCAP
Introduction

New buildings account for one-third of the total energy use in the United States and two-thirds of our electricity, and represent a unique opportunity for energy savings. New construction is the most cost-effective point in the life of a building to incorporate important energy efficiency elements that save energy throughout its lifetime. It is critical that energy efficiency is a fundamental part of the building design and construction process for all new buildings.

Building energy codes are the foundation of energy efficiency policy for the buildings sector. They are intended, at minimum, to ensure good current practice is addressed in the design and construction of buildings. Furthermore, they establish the energy efficiency of new buildings, thereby reducing peak energy demand, air pollution, and greenhouse gas emissions. With growing national concern over the cost and availability of energy resources and the reliability of energy distribution, building energy codes serve as logical starting points for cost-effective policies that capture energy savings.

State adoption of a building code does not guarantee energy savings. The largest issue and most essential element associated with achieving the benefits of a successful energy code is ensuring compliance in each building. Despite the lack of definitive national-level studies regarding building energy code compliance, and existing state studies which are difficult to compare and contrast, the available data signals a significant and widespread lack of compliance. A 2005 Building Codes Assistance Project (BCAP) review of state compliance studies reported relatively low compliance with energy codes in all states, with the possible exception of those in the Pacific Northwest (Montana, Oregon, and Washington) and California.\(^1\) The BCAP review also documented a lack of consistency in state report methodology, making an exact comparison between states problematic.

With the understanding that energy code compliance is low, this project was designed to identify the characteristics of cost-effective enforcement (i.e. staff adequacy, tools, and enforcement methods) for residential building energy codes. The goal was to provide details on effective enforcement methods, along with data on associated cost.

The survey was used to gather data on compliance tactics deemed effective by code officials and determine the most important investments for improving residential energy codes enforcement. This report is divided into two sections. Part I contains the survey specific findings while Part II outlines budgetary considerations estimated from the survey results.

---

Summary of Key Findings
Below is a summary of the key findings from the survey:

Finding #1 - The 2006 IECC had the highest rate of compliance.

Finding #2 – Code officials reported a high level of knowledge of the codes they use.

Finding #3 - “Lack of manpower” was the third largest barrier to enforcing residential building energy codes.

Finding #4 - The typical profile for a code official was one who not only enforced both the residential and commercial codes, but also enforced mechanical, electrical, and/or structural codes.

Finding #5 – Code officials reported insufficient time available to spend on project sites to inspect for energy code compliance.

Finding #6 - Because it does not qualify as a life-health safety code, the energy code was reported to be a lower priority, receiving less attention from inspectors resulting in a lower likelihood of compliance.

Finding #7 - Code officials wanted to improve their enforcement but report they have been limited by their workloads.

Finding #8 – Overwhelmingly, code officials believed energy code training is essential to effective energy code enforcement.

Finding #9 – The majority of code officials indicated their jurisdiction has a mandated program for certification/licensing that includes continuing education for energy.

Finding #10 - Building code officials indicated inadequate time for training needed to ensure that the provisions of an energy code are complied with.

Finding #11 - Code officials preferred information delivered through in-person workshops but also want more state-specific on-line workshops.

Finding #12 - Code officials requested state-specific in-person training on codes

Finding #13 - The majority of code officials use cell phones and about half use computerized inspection documents, both of which are viewed as useful tools.

Finding #14 – Most code officials indicated compliance rates will increase if building departments make guidance documents and other information materials more readily available to builders, contractors, and tradespeople.
Finding #15 - The most effective outreach method for the public was reported as providing educational material and guidance in the form of pamphlets through the internet/website.
Part I: Survey Report

I. Project Description & Methodology

Project Goals
As mentioned above, studies at the state and regional levels have shed light on the lack of compliance with energy codes. This is particularly problematic because codes are mandatory and generally assumed to establish baseline energy use for incentive and voluntary programs and are also used as a proxy for determining minimum energy efficiency performance over time in the building sector. If compliance is significantly poor in some locations, then the building sector is using a great deal more energy that is assumed by local policy makers, utilities, and others involved in managing energy demand and use.

Compliance numbers are best tracked at the state and local levels through studies that collect significant, uniform data tied to specific jurisdictions. Lacking specific data on compliance rates, this project is based on the understanding that compliance needs to be improved. This report provides information on effective enforcement methods that reduce non-compliance at the state and local implementation levels.

The project (based on a national survey and related analysis) was designed to provide a comprehensive assessment of code officials’ perspectives on enforcing residential building energy codes. Project objectives include:

1. Identifying and assessing effective residential energy code enforcement methods and characteristics.

2. Evaluating and estimating the cost of implementing a new or updated code to the building department/taxpayer.

Literature Review
BCAP identified and reviewed studies developed at the national and local levels on energy code compliance. Studies on commercial codes were included since early review indicated that the majority of code officials are responsible for enforcing the code in both building sectors. Therefore, both types of studies had potential to provide valuable background in designing this project on residential energy codes. The studies were reviewed for:

1) Gaps in code compliance research,
2) Insight into compliance issues, and
3) Findings that could be further explored in more detail.
The literature review began with the BCAP’s 2005 Residential Compliance Study\(^2\). The 2005 analysis of separate compliance studies completed at the state level turned up a lack of consistency in report methodology such that it prevented accurate comparison between results. In spite of issues with consistency, a significant and widespread lack of compliance with energy efficiency requirements was clearly identified.\(^3\) The literature review also included more recent commercial and residential sector state studies in Rhode Island and New Hampshire, and regional studies in the Pacific Northwest and Northeast. A residential-only study from Arizona was also included. Because state studies generally make an attempt to report only on compliance rates, there is a gap in the understanding issues that cause non-compliance. Below are a few of the primary findings from the literature review which highlighted specific areas for questions about compliance in the national market:

**Building Department Activity** – The Arizona study\(^4\) highlighted the importance of training and education, involving the building industry in writing amendments, providing advanced notice of code changes, and developing energy champions. However, due to the small sample size of officials in the study (11), it is difficult to translate these recommended practices to the national building sector without further information.

**Expertise on Codes** – The 2000 study in Rhode Island and New Hampshire\(^5\) by the Peregrine Energy Group showed code officials reporting a higher level of knowledge of residential energy codes as compared to commercial energy codes. This may be consistent across the US and, if true, may indicate an opportunity to improve enforcement with education.

**Attitudes** – A 2005 study for the Northwest Energy Efficiency Alliance (NEEA)\(^6\) found that only a very low percentage of code officials expressed no knowledge of the energy code. The study also determined that trainings had a high impact on the practices of code officials who attended. If basic awareness and understanding are issues across the country, the activities supporting codes in the Northwest which were evaluated in this study may provide proven recommendations for other states.

---


\(^3\) Please see Appendix X for the BCAP 2005 residential compliance study table that shows state-reported compliance data for the residential sector from a 2005 study.


\(^5\) The Peregrine Energy Group – studied New Hampshire and Rhode Island to determine if specific factors (e.g. community size, level of building, level of building activity, training, etc.) affect energy code compliance (November 2001)

**Enforcement Process** – A 2004 report for Maine investigated compliance and enforcement in order to determine recommendations for possible enforcement methods.\(^7\) The report described six commonly used enforcement models and outlined advantages and disadvantages of each method. It also evaluated costs associated with each method. The findings from the Maine report provided a basis for budget considerations for Part II of this report.

In 2002, the Palm Beach County Management and Program Analysis Section conducted a study to determine the adequacy of the County Code Enforcement Division’s staffing.\(^8\) The study found that basic operational workload data was not always available and that there were no real performance measures in place. Information from this study was used as a starting point to develop the staffing budget consideration section of this report.

A small 2007 national study on commercial code compliance\(^9\) suggested that a significant number of code officials do not verify compliance by inspecting projects. It went on to also suggest that engineers consider inconsistent and variable code enforcement as a critical barrier to code compliance. This is a significant finding and was deemed important to verify on a larger scale.

**Levels of Compliance** – The BCAP meta-study\(^10\) summarized 16 state-level residential code compliance studies and revealed a lack of consistency in state report methodology that prevented exact comparison between results. Nevertheless, all states reported relatively low compliance for energy codes, with the possible exception of those in the Pacific Northwest (Montana, Oregon, and Washington) and California. The conclusion was that these states had enjoyed relatively large levels of support from utilities or the state energy offices or both, and that there was a great deal of training, outreach and “above code” program work that helped push energy code efficacy.

The methodology of the state studies also prevented BCAP from determining the “energy savings gap” – the opportunity lost due to low compliance levels. This was due largely to wild inconsistencies in how code compliance was measured, actual modeled energy savings vs. baseline, pass or fail via REScheck/ COMcheck software, a lack of consistent criteria for measurement, and other survey characteristics.

---

\(^7\) Maine Public Utilities Commission - *Investigation of Building Code Compliance and Enforcement Methods*, (December 2004). This report was presented to the Utilities and Energy Committee.

\(^8\) Palm Beach County Planning, Zoning and Building Department - *Code Enforcement Division Staffing Adequacy*, (September 2002).


Project & Survey Design
BCAP designed this residential study as a national survey targeted at building code officials. BCAP leveraged its concurrent commercial compliance survey as a means to increase the reach of both surveys and to ensure code officials would only be contacted once for different but related response requests. The survey instrument was developed to identify and assess compliance methods within the codes enforcement community. During the development phase of this survey, BCAP capitalized on its established relationships with state energy and building code offices, along with other local and national organizations to solicit input.

In consideration of the timeline established for the project, and to improve participation, BCAP selected an automated process to host and collect the survey results. The survey link was available and distributed between March 3 and May 9, 2008 via email to track results.¹¹

Survey Distribution
In sending out the survey, BCAP used an outreach strategy to acquire the data quickly and to ensure representation of a wide cross-section of the country. Early on in the survey development phase, BCAP recognized the importance of reaching out to a large variety of building code officials and inspectors to represent the diversity of the country’s code enforcement population. The outreach strategy included maximizing collaboration with relevant organizations. Therefore, potential inspectors, or “enforcers”, were comprised of contacts and membership lists of the following:

- International Code Council (state chapters)
- Building Code Official Association (state chapters)
- National Governors Association
- National Association of Counties (NACo)
- National Association of State Energy Officials (NASEO)
- International Council for Local Environmental Initiatives (ICLEI—Local Governments for Sustainability)

BCAP also capitalized on its own state contacts and the regional energy efficiency organizations, including the Midwest Energy Efficiency Alliance (MEEA), Southeast Energy Efficiency Alliance (SEEA), the Northeast Energy Efficiency Partnership (NEEP), the Southwest Energy Efficiency Partnership (SWEEP), and the Northwest Energy Efficiency Alliance (NEEA). In addition to sending the survey to members and contacts, many organizations involved in the outreach effort posted the survey in on their websites, highlighted it in their newsletters, and distributed information at code trainings and conferences.

¹¹ Surveymonkey.com was selected as the survey vendor.
BCAP used its own newsletter and website to publicize the survey and also announced it in presentations, trainings, and at conferences.

- **Website/newsletter:** BCAP posted the survey internet link on March 3 on its homepage and highlighted it in its April code newsletter that has a distribution list of approximately 5,000 subscribers.
- **Trainings:** New York and New Hampshire code trainings by BCAP in March and April included information on accessing the online survey. Information was also provided at various ICC trainings in the southwest and southeast by NAIMA and GreenFiber staff.
- **Conferences:** BCAP hosted a booth at the 2008 GreenPrints conference expo in April and had laptops available for attendees to take the survey in real time. BCAP also provided the Arizona Building Officials (AZBO) with 750 postcard-announcements of the survey which were included in the materials for all attendees at their April *Education Institute*.

**Sample Size and Accuracy**

As a result of these efforts 734 participants logged into the survey over nine weeks. Based on an estimated population of 1,000,000 or greater, BCAP obtained 669 completed surveys resulting in 95% confidence level that the results are accurate to within +/- 4%.\(^{12}\)

The survey participants represent all regions of the US and almost every state. While there is not sufficient state-level participation to draw assumptions about local deviations from the collected data, there is adequate data to develop high-level conclusions about code officials across the US.

**Data Analysis**

A strategic approach to data analysis was needed to accommodate the large amount of survey participants and length of the survey. BCAP capitalized on a flexible survey vendor and specialized survey data analysis application to maximize the validity of the survey results and to ensure statistically sound results.

An important goal of the survey was to provide a comprehensive assessment of compliance issues. To reach this goal, BCAP recognized the need for developing a survey that included a variety of multiple-choice, rating scales and open ended questions. BCAP selected *SurveyMonkey* as the survey vendor, in part for the vender’s capability to provide real-time results during the time in which the input was collected. This was beneficial in assessing preliminary results to develop interview questions and use in forming hypotheses for detailed analysis.

---

\(^{12}\) The mathematics of probability proves the size of the population is irrelevant, unless the size of the sample exceeds a few percent of the total population you are examining. This means that a sample of 500 people is equally useful in examining the opinions of a state of 15,000,000 as it would a city of 100,000.
In order to analyze the valuable insight available in the collected survey data, BCAP used the features of MarketSight® to simplify and streamline the analysis. For example, cross-tab analyses were used to look at important relationships in responses, as well as to investigate hypotheses proposed from the preliminary results. Statistically significant differences were identified by running various data tests to test and form new hypotheses.

II. Understanding Energy Codes

Background
As a result of many factors, several different versions of energy codes exist across the US. For example, although the national model energy code for residential buildings (the International Energy Conservation Code - IECC) is updated approximately every three years, there are a variety of subsequent actions at the state and local levels that must take place for it to affect building construction. States have individual processes set up that govern local adoption and enforcement. Therefore, energy codes may vary greatly from state to state and also among jurisdictions within a state because of changes between editions of the code. This is further complicated in “home rule” states where the responsibility of adopting codes resides in local jurisdictions, rather than with the state.

Another complication arises from the action of states to develop their own codes. The efforts of the International Code Council (ICC) ensure that states do not have to incur the full cost of developing their own energy code; however, some states still choose to write their own. A state-developed code can take into account state-specific considerations such as the local economy, climate goals, energy supply issues, and the impact on local building practices. The West Coast states (Washington, Oregon, and California) are among those which have independently developed energy codes. All three states have progressive codes whose stringency often exceeds that of the national model codes. California, in particular, stands out as a model for effective update cycles and implementation success. Florida also has an independently developed code at least as stringent as the national model code. Although most states do not develop their own energy code and find that using model codes saves time and money, many use a review-and-modification process that amends the model codes to reflect state-specific considerations.

This section summarizes the residential codes in use and the expertise of the code officials.
Key Findings
The 2006 IECC was indicated as the most enforced residential code (36 percent of code officials reported enforcing this code). Twenty-one percent of code officials reported enforcing “Other” codes. Fifteen percent reported enforcing the 2003 IECC, 2 percent for the 2000 IECC and 1 percent for the 1998 IECC. This is supported by BCAP’s state code status information that reports 41 percent of states enforcing the 2006 IECC or an equivalent code. BCAP also reports 13 percent of states enforcing the 2003 IECC.

Code officials report a high level of knowledge of the codes they use. Of the 36 percent of code officials enforcing the 2006 IECC, most classified their knowledge of the requirements as “expert” or “competent” (34 and 41 percent, respectively). A low number of official (12 percent) selected “beginner” to describe their level of expertise.

III. Understanding Staffing Issues

Background
State and local government experience demonstrates that policy adoption is only a first step – proper implementation, evaluation, and enforcement are also necessary. In states where these components are missing, compliance rates fall short. Implementation of energy codes is a complex issue that is intimately tied to the legislative environment at the federal, state, and local level. However, even where state and federal resources are available to municipal code officials, cities are finding that staff coverage for code enforcement is often stretched thin. This section summarizes code officials’ work loads and their perspectives on barriers to enforcement.

Key Findings
In examining the survey results, respondents indicated “lack of manpower” as the third largest barrier to enforcing residential building energy codes. “Lack of funds” was cited as the fifth largest barrier; it is important to note that budgetary constraints for building departments in some jurisdictions can lead to staff vacancies and inconsistent enforcement of regulations.

Much of the discussion around energy code requirements and enforcement focuses on the time, or perceived lack of time, spent by code officials in enforcing the code. A 2001 survey in New Hampshire and Rhode Island 13 found that 96 and 100 percent of code officials, respectively, are responsible for enforcing both commercial and residential energy codes. The dual responsibility occurs across the US, as confirmed by this study, which found a rate of 83 percent of officials enforcing the energy code in both the commercial and residential sectors.

13 The Peregrine Energy Group – studied New Hampshire and Rhode Island to determine if specific factors (e.g. community size, level of building, level of building activity, training, etc.) affect energy code compliance (November 2001)
The typical profile for a code official is one who not only enforces both the residential and commercial codes, but also enforces mechanical, electrical, and/or structural codes. They report a consistent inability to spend sufficient time on project sites to inspect for code compliance. The energy code is also reported to be a lower priority and is thus edged out by other codes when time is short. In general, code officials want to improve their enforcement (95 percent want more training and resources) but they are limited by their workloads.

Only a small number of total code officials surveyed (8 percent) work outside their local building department as third party inspectors. Although this type of enforcement is gaining interest in the market, it is not yet widely used. Making up the 8 percent were thirteen states with between 1 and 3 third party inspectors each, and Pennsylvania which reported 38 third party inspectors (of 88 total code official participants).

One of the most oft-cited reasons why code enforcement officials struggle to implement or enforce energy codes is that they are short of resources for their primary charge: the enforcement of life-health safety codes. In addition, the energy codes are cited as subservient to the interests of those life-health-safety codes in Section 100 of the code:

101.3 Intent. This code shall regulate the design and construction of buildings for the effective use of energy. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve the effective use of energy. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes, laws or regulations.

In our experience, code officials refer to this section as the explanation for why they can downplay the enforcement of the energy code in lieu of applying their limited resources to these “more important” codes.

The fact that most code officials enforce codes for different building systems and different types of buildings means that there is no specialized enforcement of energy codes or other codes. In short, we cannot infer for this survey that any building department code official is solely responsible for the energy code anywhere in the country.

Education and Training

Background
Training brings direct benefits to building code departments and can be calculated as a return on investment. Training keeps staff motivated and up-to-date with industry trends and with new technologies that are essential to improving compliance. Staff
members benefit from learning new skills while increasing productivity which is essential to an enforcement department’s overall level of efficiency and effectiveness.

Building code officials have a mix of technical knowledge, experience, and education. Many have a combination of certifications and previous experience in various construction trades. Many states and local jurisdictions require some type of license or certification for employment as a building inspector. (Note: Each state and local municipality is unique and requirements may vary.) Some states have individual licensing programs for inspectors, while others may require certification by such associations as the International Code Council. As the field of building energy code enforcement increases its professional capacity, higher levels of training, greater professional career development opportunities and expanded activities for developing technical skills will see increased demand. Establishing continuing education requirements and requiring submittal of attendance credits, encourages and supports professional advancement, and thus enhances the proficiency capability of the individual and the professional capacity of both the code enforcement community and the locality. A 2005 study for the Northwest Energy Efficiency Alliance (NEEA) found only a very low percentage of code officials who expressed no knowledge whatsoever of the energy code. The study also determined that trainings had a high impact on the practices of code officials who attended. Local building officials interpret and enforce the intent of codes for builders and designers. Therefore, a consistent level of understanding of the techniques and requirements of a new code throughout the jurisdiction directly impacts compliance and enforcement.

Various entities, such as the US Department of Energy, state energy offices, local building official organizations, and regional and national energy efficiency groups train building professionals in energy code compliance and energy efficiency. These workshops also provide information about new products and advances in energy efficient design and building science to help building professionals keep pace with changes in the industry. This section examines the code official’s perspective on available educational and training opportunities.

Key Findings
Overwhelmingly, the survey results indicated significant shortcomings in the area of training – not simply the lack of training, though more are needed, but in how code officials are trained. The majority of respondents (99 percent) believe energy code training is essential to effective energy code enforcement. In addition, BCAP’s 2008 Commercial Building Energy Codes survey reported 81 percent of end users cited building code department enforcement as a strong motivator for them to comply with energy code requirements.¹⁴

¹⁴ BCAP’s Commercial Usability and Compliance Study 2008. End-users surveyed were referencing commercial building energy codes but for reasons detailed in this report, the same results were assumed for the residential sector.
Respondents described training requirements in the following ways:

- 83 percent of survey respondents indicated their jurisdictions have a mandated certification/licensing program for code enforcement officials;
- 37 percent indicated continuing education on energy was not included in the certification/licensing program;
- 48 percent of respondents indicated that continuing education on energy was included in the certification/licensing program;
  - 61 percent of those indicated that the city or local jurisdiction funded the training program.
- Another 12 percent reported that they were responsible for paying for their own continuing education on energy.

On frequency of training, building code officials indicated inadequate time for energy code training:

- 71 percent of code officials receive training 1 to 2 times a year;
- 11 percent have no training;
- 11 percent get training 3-4 times a year.

Although they report a high overall frequency for training, almost all code officials report a need for additional code information.

In-person workshops are used by almost all code officials (91 percent) and were rated as the most effective and most preferred method for code training. Documents and resources from the International Code Council (ICC) are the second most preferred method and are also widely used (by 84 percent of code officials), who rate them well on effectiveness. A little more than half of code officials use ICC self-paced courses (63 percent) and/or documents and resources from US DOE (54 percent). Less than half report participating in DOE web seminars or self-paced courses. In general, the most used methods are rated highest for effectiveness and preference, indicating that although code officials want more training, they are able to access the ones they prefer.

While there are generic trainings on the IECC available, states often contract with trainers to provide workshops for their constituencies which address state-specific issues. Many end users and code officials either believe that there are state-specific technical issues that need to be covered or that state amendments preclude the use of “plain brown wrapper” training and training materials. Many code officials specifically mentioned the state-specific aspect of training in discussing the need for additional resources.

Overall, interviews conducted by BCAP supported survey findings that highlighted the broad need for more education and training. Specifically, there is a shortage of training within the codes industry on the value of energy efficiency, high performance, and integrated design. Interviews also pointed to the related issue of staff shortages which
affect time available to attend trainings. Online training was not identified as a viable solution to this issue.

Tools

Background
Many building departments across America are confronted with overextended staffs and increased demand for services. Computer and information technologies play a key role in helping to address the personnel and budget constraints these departments typically face. Computer-based tools and services can help automate and streamline the building permit process. The intent of these tools is to reduce permitting time, improve customer service and staff efficiency, enhance quality, and make operating funds more productive. This section examines the use and effectiveness of a few basic tools available to code officials.

Key Findings
The survey results indicate that 59 percent of code officials use cell phones for work and most (83 percent) believe that the phones are useful in completing their work. Less than half of code officials (48 percent) use computerized inspection documents and over half (63 percent) find these to be useful tools. Computerized plan review documents are not widely used (by only 32 percent) and only a third of these code officials find them useful.

Outreach Methods

Background
Building energy codes for the residential and commercial sectors are developed at the national level, adopted at the state and local levels, and enforced by local governments. States often modify the national model codes, or develop their own, to account for local issues and energy-related goals. The result has been a wide variety of energy codes for residential and commercial buildings. Increasing the uniformity of building energy codes across jurisdictions makes it easier and more cost-effective for builders and contractors to construct residential buildings.

Builders, developers, and designers are responsible for implementing code language and ensuring that code requirements are met. States and municipalities are finding that active collaboration with these groups improves understanding, creates buy-in, and can lead to greater levels of compliance. Before active enforcement begins, state agencies (e.g., the State Planning Office, the Commission, and the relevant professional boards) should carry out proactive outreach and training for design professionals.

After adoption, energy codes are constantly under revision, often to improve clarity and stringency. Code changes affect builders, designers, developers, and code officials as
well as product manufacturers and suppliers, who need time to clear current inventories and ensure that newly compliant products are available when the code takes effect. Consequently, there is diversity among the building community that can present a major barrier to the diffusion of new technologies and practices. Proper communication between these groups can facilitate an increase in compliance.

Access to information is of crucial importance in successful compliance. Publishing information provides a means for stakeholders to become educated and effectively participate in discussions and decision-making. Given the diversity of the building code community, there are several outreach methods available that seek to more effectively educate and provide access to a dynamic building energy code. The most successful campaigns reach stakeholders in a sequenced and consistent manner. This approach creates an indirect benefit for the enforcement community by enhancing compliance. Building code departments can harness the power of effective outreach channels, produce more communication, and, as a result, capture the full benefits of the energy code. The following section discusses those outreach methods from the code officials’ perspective to determine the most effective outreach strategy.

Key Findings
Most respondents (79 percent) indicated compliance rates will increase if building departments make guidance documents and other information materials more readily available to builders, contractors, and tradespeople.

From the code officials’ perspective, the most effective outreach method for the public is to provide educational material and guidance in the form of pamphlets. Less than half (45 percent) of respondents indicated their building code departments used pamphlets as a means to communicate information regarding the building energy code. Many code officials surveyed (64 percent) believe that this is the most useful way to get the word out about the energy code. The internet/a website was the second most popular method, used by 41 percent of code officials surveyed, with 59 percent of code officials agreeing that this outreach mechanism is also useful. Presentations followed closely behind with 40 percent usage and with 53 percent of respondents indicating it is a useful outreach method. Newsletters were used 33 percent of the time, with 43 percent regarded them to be a useful outreach method. Newspapers were only used 28 percent of the time and only 26 percent regarded this medium as useful. Trailing behind with only 22 percent usage was TV/radio, with only 17 percent regarding it as a useful outreach method.
Part 2: Budget Considerations

Introduction

A major problem governments and policy-makers experience is how to cost-effectively allocate resources to building code administrations and services. When adopting a model code, states typically provide resources to municipalities to support implementation and enforcement. Local funds are used to help code officials and builders understand and comply with the code’s requirements. State and local policy makers must coordinate to ensure that code enforcement departments are provided with adequate resources and assistance to effectively function in the community. Understanding the different types of enforcement models can help in determining those resource needs.

There are generally four enforcement models used individually or in combination across the country to enforce building energy codes:

**Self-certification** – Requires the builder to provide certification of compliance to a local or state agency. This process requires minimal staffing or financing to support a code enforcement administration. However, without plan reviews and onsite inspections, the legitimacy of compliance depends solely on the individual’s expertise and ethics.

**State agency enforcement** – State inspectors enforce the state-adopted code. In this model, state inspectors supplement local code officials by conducting additional inspections. Traveling and coordination by state code officials to conduct inspections statewide involves greater costs that vary with the size of the state. While this process may strengthen enforcement by shifting it to the state, it may also result in weak enforcement if an insufficient number of inspectors are responsible for monitoring activity in a large geographic area.

**Third party enforcement** - An independent entity, trained on energy efficiency and approved by the building department or state, performs code enforcement tasks. The builder hires the third-party individual or entity to perform plan review and/or inspection services. This process requires less infrastructure and cost on the part of the state and local government and passes the costs of enforcement directly onto the builder.

**Local enforcement** – Code enforcement is performed by municipal or county officials. This process relies on an established enforcement administration within the municipality, usually the building department, and typically calls for modest increases in staff.
This report will primarily focus on the “local” enforcement model because 87 percent of survey respondents selected “local building code department official” to describe their enforcement role. Within this model, local governments collect a fee to support code-enforcement services. These fees and charges provide income to the general treasury to offset a percentage of the costs for performing this function. The costs of code enforcement, e.g. plan reviews, inspections and permit issuance, correlate with the amount of time and resources expended on each project, so the balance of costs can be charged to a particular user.

Many states wish to obtain a greater understanding of which services increase compliance at the local level so funding can be targeted towards those key services. The first half of this report assessed code enforcement activities and services from a code official’s perspective and identified the most critical investments for enhancing compliance. This section outlines the associated basic costs of staffing, training, tools and outreach for supporting effective enforcement of codes.

**Staffing Considerations**

In order for policy-makers to appropriate adequate funding for staffing needs, it is important to understand how a building code department operates. A municipality may employ code officials who perform both plan reviews and on-site inspections. Some employ multiple officials with specialized areas of expertise, while others employ one official who covers all functions. Regardless of which enforcement model is used, code officials and their work activity have specific associated costs. Additionally, how a building code department marshals its resources depends on its performance expectations. Staffing adequacy involves achieving a positive workload to staffing ratio in conjunction with performance targets. Workload is dependent on activity levels (i.e. field inspections and plan reviews) and performance targets. The following section outlines budget calculations that policy-makers may use to analyze the related basic considerations for staffing needs *(Annual Cost of an Energy Code and Adequate Staffing Numbers)*.

**Annual Incremental Cost of an Energy Code Calculation**

For municipalities with an established code enforcement department, the initial funding for enforcing a residential energy code could be small after proper training is introduced. The Annual Incremental Cost (EC$) estimates the added cost of a residential energy code based on analysis of performance targets and workload. To arrive at a rough estimate of annual incremental cost of an energy code requires the analysis of several factors listed below.
1. Permits – This factor represents the number of residential building permits from the previous year. This number provides a policy-maker with a valid estimation of the workload a municipality might face in the coming year.\textsuperscript{15}

2. Work Activity – This represents the total number of hour(s) needed to complete an energy plan review and inspection. The ability to estimate duration of work activity can provide a policy-maker with valuable insight into the operation needs of a building department as well as associate a performance target with budget calculations. The average time to consider energy in a residential plan review can range from 15 to 45 minutes depending on the level of competency of the code official. The average duration of an energy residential building inspection could range from 30 minutes to 1 hour, for each visit.\textsuperscript{16} BCAP estimates it would take 1.25 hours per building for a code official to consider energy in an inspection and plan review.\textsuperscript{17} This could also be used as a performance target. A municipality may require a specific method that dictates the amount of time needed to conduct a thorough review or inspection. This approach can eliminate/curb incomplete or faulty plan reviews or inspections.

3. Wage – This represents the hourly wage of a code official and provides the policy-maker with a numerical value for the code inspector’s work activity. The average annual salary of a code inspector in the US is $50,440.\textsuperscript{18} That is equivalent to $24.25 per hour. For this example, the figure was rounded up to $25.

4. Total Time (TT) – This represents the total annual time to complete all work activity for code officials including plan review and inspections. This figure is derived from the following formula (Permits \textbf{multiplied by} Work Activity).

The following outlines the developed budget calculation necessary to determine the annual incremental cost for an energy code with an example.

\textsuperscript{15} The US Census provides information on residential permits each year by metropolitan area or county. For more information please visit \url{http://www.census.gov/const/www/permitsindex.html}

\textsuperscript{16} Estimates were developed based on the Investigation of Building Code Compliance and Enforcement Methods Report by the Maine Public Utilities Commission December 31, 2004.

\textsuperscript{17} An energy plan review can take from 15 -45 minutes. This example uses 30 minutes as the range (45-15=30) for the plan review. An energy inspection can take between 30 minutes to 1 hour. This example uses 45 minutes as the average time. Plan review + Inspection= Hours needed (30+45=75 minutes=1 hour and 15 minutes =1.25 hours).

\textsuperscript{18} The Department of Labor provides statistics on wage earnings. \url{http://www.bls.gov/oco/ocos004.htm}
For example, in 2007 a municipality authorized 5,000 new residential building permits. If it takes a code inspector 1.25 hours\(^\text{19}\) to check energy requirements in a residential plan review and inspection, the total annual time needed to complete all inspector activity is 6,250 hours. The total time needed is multiplied by $25, the average hourly wage of a code inspector\(^\text{20}\), and the result is that $156,250 is needed to enforce the energy code in that jurisdiction. Policy-makers in this municipality now have a cost estimate that can be used to establish appropriations in conjunction with adopting an energy code for the first time, or for evaluating resources sufficient for enforcement of an existing or updated code.

**Adequate Staffing Calculation**

In addition to funding needs, providing adequate staffing numbers is also an important issue for policy-makers to consider. As noted from the survey results, code officials are often overburdened, so policy-makers must be mindful of adding responsibilities without evaluating staffing needs. To put the staffing need in perspective, the following budget calculation can help policy-makers determine whether it is possible to add additional responsibilities to existing staff or if additional staff are needed. The factors of consideration for this calculation are below:

\(^{19}\) An energy plan review can take from 15 -45 minutes. This example uses 30 minutes as the range (45-15=30) for the plan review. An energy inspection can take between 30 minutes to 1 hour. This example uses 45 minutes as the average time. Plan review + Inspection= Hours needed (30+45=75 minutes=1 hour and 15 minutes =1.25 hours).

\(^{20}\) The average salary of a code inspector in the US is $50,440. That is equivalent to $24.25. For this example, the figure was rounded up to $25.
1. Total Time (TT) – This represents the total time required each year for code officials to complete plan reviews and inspections. This figure is derived from the formula (Permits multiplied by Work Activity), both of which are discussed in more detail in the above section “Annual Incremental Cost of an Energy Code.”

2. Work Hours – This represents the amount of time per business day that is dedicated to plan reviews and inspections. This figure is a performance target of the building code department. Each building code department is unique. For instance, a municipality may require the code official to spend the first 2 hours of a work day returning phone calls and doing administrative paperwork.

3. Work Days – This is number of work days per year that all work activity will be conducted. This figure is also a performance target. This number should take into account work weeks, time for training requirements, outreach activity, holiday schedules and sick time.

4. Full-Time Employees (FTE) – This number represents the number of full-time employees needed to enforce the energy code. It is a result of the following formula (The result of {TT divided by Work Hours} divided by Work Days).

The following formula outlines the budget calculation a policy-maker can use to determine how many FTE are required to properly enforce an adopted or updated energy code.

\[
\text{FTE's Needed} = \frac{\text{TT} \div \text{Work Hours}}{\text{Work Days}}
\]

\[
\begin{align*}
\text{Example:} & \quad \frac{6250 \text{ hours}}{6} = 1042 \\
& \quad \frac{1042}{255} = 4.08 \text{ FTE's needed}
\end{align*}
\]

In the example municipality above, the total annual time needed to complete all inspector activity (TT) is 6,250 hours. The TT is divided by 6 work hours per day equaling 1,042 work hours per day. That total is then divided by 255 work days in a year, resulting in 4.08 fulltime employees needed to enforce the energy code.
Alternatives for Annual Incremental Cost of an Energy Code with Compliance Consideration Detailed

Despite the lack of definitive national-level studies regarding building energy code compliance and difficulty in comparing state studies, the available data signals a significant and widespread lack of compliance. A study undertaken by the Building Codes Assistance Project (BCAP) in 2005 pulled together results of state studies on residential code compliance from around the country. Although the studies were different in their methodology and size, the general conclusion was a 40 – 60 percent average rate of compliance. More recent studies point to continued levels of low compliance.

An essential element associated with achieving the benefits of a successful energy code is ensuring compliance in each building. Essentially, the success of the code is determined by the local government’s ability to ensure compliance and enforcement.

Local jurisdictions hold the key to greater energy efficiency results because compliance and enforcement actions take place at this level. In fact, a 2008 nationwide study by BCAP found overwhelmingly that builders and designers suggest code enforcement as a strong motivator for code compliance.\(^{21}\) In recognition of this, below is an alternative for the budget calculations presented above. The goal of this alternative is to provide a level of detail sufficient to inform an effective fiscal response to code compliance through performance targets. The additional factors considered are highlighted below:

1. Compliance Performance Goal% - This factor allows a jurisdiction to consider a performance goal to address compliance in the field. It represents the assumed percentage of code compliance on the first round of plan reviews and inspections. By determining a performance target of how many homes should pass inspection on the first round, a jurisdiction can help ensure compliance as an important element for energy code enforcement. This number will vary depending on the jurisdiction’s motivation to ensure compliance.

2. Compliance Target % –This factor represents the percentage of houses that will require an additional inspection after the initial inspection fails. It will vary depending on the jurisdiction’s performance goal. As this number decreases it is assumed that a local government’s compliance level increases. Compliance Target % is derived from the following formula: (Compliance Target % = 100% minus Compliance Performance Goal %).

3. Extra Work Activity – This number represents the extra hours involved in repeated work activity. This is an estimate of additional time that would be required on a second visit to conduct a follow-up or repeated inspection or plan

\(^{21}\) BCAP Commercial Compliance and Usability Study, results are unpublished pending release.
review. The average time to consider energy in a residential plan review can range from 15 to 45 minutes depending on the level of expertise of the code official. The average duration of an energy residential building inspection could range from 30 minutes to 1 hour, for each visit. This number will vary depending on the level of noncompliance for each project.

4. ADD Time – is the additional time needed annually to improve compliance. The number is derived from the formula: ADD Time = Compliance % multiplied by Permits multiplied by Extra Work Activity.

5. TT & Compliance – This represents the total annual time to complete ALL plan review/inspections including time needed to address compliance. It is derived from the following formula: TT & Compliance = TT + ADD time.

6. Full-Time Employees (FTE & CC) – This number represents the number of full-time employees needed to enforce the energy code with compliance consideration detail. It is a result of the following formula: FTE & CC = {TT & Compliance divided by Work Hours} divided by Work Days.

The formula below outlines alternative budget calculations that policymakers can use to estimate the Annual Incremental Cost of an Energy Code and Number of Full- Employees needed with code compliance consideration detail included.

### Optional Alternative Budget Calculation for Annual Incremental Cost for an Energy Code with Improved Compliance Detail

<table>
<thead>
<tr>
<th>Step 1a: Determine Code Compliance Target%</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Compliance Target %</th>
<th>Code Compliance Goal</th>
<th>Example: 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>70%</td>
<td>30%</td>
<td>100%</td>
</tr>
<tr>
<td>70% Compliance Target</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Using the information from the example municipality above, Step 1a requires estimation of the performance compliance target. It determines the percentage of houses that will require an additional inspection after the initial failed inspection. For this example, the municipality wants to achieve 30 percent compliance for all houses as a compliance goal. The first step (1a) subtracts 30 percent from 100 percent to determine the percentage of houses that will require an additional inspection after the initial failed inspection (70 percent).
**Step 1b:** Determine additional annual time needed to improve compliance (ADD time)

<table>
<thead>
<tr>
<th>Compliance Target %</th>
<th>Permits</th>
<th>Extra Work Activity</th>
<th>ADD Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>70%</td>
<td>5000</td>
<td>1.25 hours</td>
<td>4375 hours of ADD time</td>
</tr>
</tbody>
</table>

Step 1b helps to determine the additional time needed to improve compliance. For example, the jurisdiction determines 70 percent of the 5,000 new residential building permits from 2007 will not pass inspection on the first round (3,500). If it takes the code official 1.25 hours for a second plan review or inspection per visit, an additional 4,375 hours of work would be required for the code official to fully enforce the code.

**Step 1c:** Determine Total Annual Time need to complete ALL inspection (TT)

<table>
<thead>
<tr>
<th>Permits</th>
<th>Work Activity</th>
<th>TT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>1.25 hours</td>
<td>6250 hours needed (TT)</td>
</tr>
</tbody>
</table>

Step 1c helps determine the total annual time needed for all work activities. If there are 5,000 permits and it takes a code official 1.25 hours to consider energy in a residential plan review and inspection, the total annual time needed to complete all inspector activity is 6,250 hours.

**Step 1d:** Determine Total annual time to complete ALL code official activity and address compliance (TT & Compliance)

<table>
<thead>
<tr>
<th>TT</th>
<th>ADD time</th>
<th>TT &amp; Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6250 hours needed (TT)</td>
<td>4375 hours of ADD time</td>
<td>10625 hours (TT &amp; Compliance)</td>
</tr>
</tbody>
</table>

Step 1d determines the total annual time needed to complete all code official activity (plan reviews and inspections) to address compliance. The total time of 6,250 hours is added to the additional time required for repeated activities, resulting in 10,625 total hours.
**Step 2:** Determine Annual Incremental Cost for the Energy Code (EC$)

TT & Compliance  x  Wage  =  EC$

**Example:**

10,625 hours  x  $25.00  =  $265,625.00 EC

The final step determines the annual incremental cost of the energy code including compliance target consideration. If the total time needed (10,625 hours) is multiplied by $25 (the average hourly wage of a code inspector), the result is $265,625 needed to enforce the energy code in that jurisdiction. Local policy-makers now have an estimated foundation to establish appropriations in conjunction with adopting or updating an energy code, in addition to addressing compliance challenges.

**Optional Alternative** Budget Calculation to Determine the Number of Full-Time Employees Needed to Enforce the Energy Code with Compliance Consideration Included (FTE & CC)

TT & Compliance  +  Work Hours  =  Work Days  =  FTE & CC needed

**Example:**

10,625 hours  +  6  =  1771  /  255  =  7.9 FTE & CC needed

The above budget calculation can estimate the number of full-time employees needed to enforce the energy code while taking compliance into account. From the previous steps, the total annual time needed to complete all code official activity (plan reviews and inspections) to address compliance is 10,625 hours. The formula requires the municipality to estimate how much time a code official would spend in a given work day conducting plan reviews and inspections. For this example, consider using 6 hours out of an 8 hour workday leaving 2 hours for administrative paperwork, phone calls and meetings. The result is 1,354 hours. The next part of the equation requires the policy-maker to evaluate how many work days out of the work year the code officials will be expected to work. For this example, assume 255 work days out of 365 days in the year. Divide total work hours by number of annual work days. The result indicates that it would take 7.9 full-time employees working 6 hours a day to enforce the energy code and address compliance needs.

While these estimates establish a foundation to determine budgetary needs, actual funding needs for a specific local government will depend upon anticipated increases and decreases in construction. They will also depend on whether additional employees are hired or if energy code enforcement is absorbed into the work of existing staff. As
addressed above, there are many factors surrounding a budget within a specific jurisdiction, these calculations attempt to create a basic framework to present those considerations to policy-makers.

**Education and Training Budget Consideration**

Adoption of the national model codes in a state or local jurisdiction confers additional advantages – access to a network of training opportunities and implementation materials developed to support the code nationwide. The US Department of Energy and others make training and compliance tools available at no charge to help the construction industry utilize these codes more effectively. An example includes the website and software developed by DOE to support the REScheck™ system for residential buildings. These tools are free and sophisticated, but simple to use. Additionally, a uniform code allows localities to pool limited resources and combine personnel to form county-wide or regional enforcement training programs. Many agencies and organizations, including ICC\(^22\), mandate continuing education units, learning units or health, safety and welfare credit to maintain certifications, licenses or membership for professionals in the building industry.

**Basic Training Cost Calculation**

There are two primary considerations needed to calculate the budgetary costs of training for building code personnel. The first step is to breakdown the Average Hourly Training Cost for each employee. This calculation will consider the two forms of training for code officials recommend from the survey results (In-Person and State-specific Online Training). In terms of In-Person training, this is a two-fold approach. It will consider the total amount of money required to provide this type of training for a group of code officials only including labor and travel for the instructor and materials, books and food for the employee. This will be explained in more depth below. In terms of the State-specific Online Training, this will be broken down into hourly cost based on estimates of ICC webinar training. This will also be explained in more depth below.

The second consideration in developing a comprehensive training budget is also a two-fold approach. First, it will consider frequency of training for each code official in terms of continuing education requirements from the certifying body as well as additional required training time from the municipality. The second consideration will account for employee down-time for all required training hours. The resulting Average Hourly Training Cost for each employee will then be applied to the second considerations of Frequency and Downtime to obtain the Total Basic Training Cost. These considerations all have associated factors that are needed to develop steps for a comprehensive training budget calculation.

---

\(^{22}\) ICC submits requests for continuing education recognition for ICC education to applicable approving bodies. As new offerings are developed, requests for continuing education recognition are submitted and information is updated upon receiving notification of recognition from the specific agency/organization.
**Average Hourly Training Budget Calculation**

The following are all of the factors that need to be considered in developing a budget calculation to estimate an Average Hourly Training Cost (AHTC) for each employee:

1. **Average Cost of an In-Person Training Workshop (ACIPW)** – This factor represents the costs of one-day training for an In-Person Workshop. While the costs for training vary for each session, and because each session can be customized to meet the needs of the audience, BCAP has estimated basic industry costs for a one–day 6 hour training to be $2,500.23

2. **Optimal Class size** – This factor represents the optimal class size to facilitate discussion and participation. While this figure will vary based on the training goal to be accomplished, based on training experience and interviews BCAP has determined 40 students to 1 instructor as optimal class size for in-person trainings.24

3. **Cost of Materials** – Represents the average cost of materials per employee for an in-person workshop. This figure includes power-point presentations printed out, as well as specific workbooks for each student. This is an estimated figure of $12.50.25

4. **Average Cost of Food** – Represents the average cost of food as $12 per student.26

5. **Average Webinar Cost** – This figure represents the average cost of a webinar as $60 per student.27

6. **Duration of Webinar** – This figure represents an estimate of 2 hours for the duration of a webinar.28

---

23 Many states and municipalities try to leverage meeting rooms, etc. to keep costs down. This figure was developed based on interviews from industry trainers and ICC contract fees ([http://www.iccsafe.org/training/contract/contract_fees.html](http://www.iccsafe.org/training/contract/contract_fees.html)). This figure includes only Labor and Travel. It excludes the training design, facilities rental, equipment rentals (such as overhead projectors), production downtime (including employee time off the job, which is included in second part of the formula), specialized computer equipment, administration (such as registration procedures or confirmation notices).

24 There are several different types of training all with different class sizes. Optimal class size will vary based on the municipality’s goal and the type of trainer. The more students that attend a class the more cost effective training will be.

25 This figure was obtained through an interview with a trainer and verified by the ICC website. The figure was $10-$15 per employee. The average of that range is $12.50. This number could vary based on type of materials needed for the training.

26 This figure will vary depending on the type of food contracted with the food vendor. This estimated figure was provided by an experienced trainer.

27 A Webinar is short for Web-based seminar, a presentation, lecture, workshop or seminar that is transmitted over the internet. A key feature of a Webinar is its interactive elements–the ability to give, receive and discuss information. The ICC website prices their online train between $59 and $69 per person. The fee varies depending on membership status of the student taking the training. This figure considers an online course costing $59 (round up to $60).

28 This figure is an estimate based on the available online courses available at ICC. This figure will vary depending on the course. 2 hours was estimated for the sake determining a budget estimate.
7. Average Cost of a Webinar Training (ACWT$) – This figure represents the average hourly cost of webinar training per student. It is derived from the following formula: Average Webinar Cost divided by the Duration of Webinar.

8. Duration of a Full-Day In-person workshop – This figure represents the hours in a full-day In-person Workshop. Typically a full-day workshop will last 6 hours. This is used to determine the average hourly cost of a full-day in-person workshop.

The following formula describes how these factors are calculated to determine the Average Hourly Training Cost per employee.
Training Frequency and Employee Downtime Budget Calculation

To calculate the total frequency and employee downtime, it is important to identify the additional factors involved. The factors in the formula include the following:

1. Certifying Body CEU Requirements (CBCEU) – This factor represents the number of hours a certification body requires to maintain a certification. Through a certification body such as the ICC, practicing building code officials are evaluated, certified and recognized as qualified professionals. “Continuing Education Units” (CEUs) are required to maintain certification as a qualified professional. For instance, ICC requires 15 hours of CEUs over a 3 year period or 5 credit hours per year. (For each certified training hour an inspector can receive .1 credits).

2. State or Local Continuing Education Credits (S/LACEU) – This represents the State or Local CEU Requirements a state or local government requires in addition to the mandatory requirements of the certifying body (e.g. ICC).\(^{29}\) For the budget calculation purposes, BCAP estimates 24 additional hours. This will vary depending on the State or local jurisdictions commitment to continuing education.

3. Total Hours of Continuing Education (THCE) – This factor represents the total number of continuing education hours required per employee. This number is derived from the following formula (CBCEU plus S/LACEU= THCE).

\(^{29}\) A state or local municipality can require continuing education as a component of maintaining compliance with the state regulations relative to certain certifications granted by the governing body. This is in addition to the mandatory and/or periodic training required for certificate issuance and maintenance.
4. Total Training Frequency (TTF) – This factor represents the total number of training hours for all full-time employees for a specific municipality. This is derived by calculating the following formula (THCE multiplied by FTE).

5. Employee Down-Time (DC$) – This factor represents the total dollar amount of employee down-time for all training hours. This is determined by multiplying the total municipality training hours (TTF) by the average wage of an employee (Wage).

The following formula describes how these factors are calculated to determine the total cost of employee downtime.

**Budget Calculation for Total Training Frequency and Cost of Employee Downtime**

**Step 1A: Determine Total Hours Required for Continuing Education**

Certifying Body CEU Requirements (Hours) + Additional State or Local CEU Requirement (Hours) = Total number of CEU hours per employee

Example: 5 hours + 24 hours = 29 hours needed (THCE)

**Step 1B: Determine Total Hours of Training for Municipality (HTM)**

Total number of CEU hours per employee × Estimated number Full-time employees = Total Hours of Training for Municipality (HTM)

Example: 29 hours × 4 (FTE) = 116 (HTM)

**Step 2: Determine Financial Cost of Employee Downtime (DC$)**

HTM × Wage = DC$

Example: 116 × $25.00 = $2900 (DC$)
**Total Basic Training Budget Calculation**

The final budget calculation to determine the Total Basic Training Cost incorporates all of the above sub-calculations in a final budget formula. Essentially, the budget formula multiplies the Average Hourly Cost by the Total Training Frequency (in hours) for the municipality then adds the cost of Employee Downtime. The following formula describes how these factors are calculated to determine the Total Basic Training Cost.

<table>
<thead>
<tr>
<th>Budget Calculation for Total Basic Training Cost (TBTCS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Hourly Training Cost per employee</td>
</tr>
<tr>
<td>Example: $46 $ 116 $2,900 = $8,236 (TBTCS$)</td>
</tr>
</tbody>
</table>

The ability to estimate the cost of energy code training will enable policy-makers to appropriate essential funding. These calculations generate estimates that inform policy-makers as to the costs associated with training. They are not meant to serve as exact calculations.

**Outreach Methods - Budget Considerations**

The critical element of effective outreach strategies lies in the design and execution of campaigns that coordinate among the full breadth of channels available to reach prospective building energy code end users. This requires strategic and tactical planning. When building code departments provide several channels for outreach, the effectiveness of campaigns is increased, thus increasing compliance. The challenge is to select an affordable outreach medium that is effective and allows for the broadest possible dissemination to key audiences.

The survey examined several outreach methods. Building code officials surveyed by BCAP indicated that the most effective outreach strategies included Resource Materials, Information Technology (websites), and Presentations. The following sections describe budget calculations for all three elements that can be used to determine the Total Annual Cost of a Basic Outreach Strategy (TCOS$).
Resource Material Budget Calculation
Survey respondents indicated that two forms of resource materials, pamphlets and newsletters, were most effective in communicating with the building community. Pamphlets communicate specific information on energy codes in a user-friendly way. They maximize awareness of code requirements by putting information at the user’s fingertips, making specifications within the energy code clear and accessible. A newsletter is a tool that can regularly convey up-to-date information about developments within the building energy code. It helps to establish and maintain communications between the building code official and building community and can also help establish the “brand” or program name associated with the local or state energy code initiative. The budgetary factors that should be considered in determining the Total Annual Cost of Resource Materials (ACRM$) are below:

1. Employee Time – This factor represents the annual amount of time an employee spends developing a resource for the public. While this factor is dependent on the capability of the employee and the amount of material, this can also be considered a performance goal for the building code department. The department’s outreach strategy can require a specific amount for time dedicated to developing resources. In BCAP’s experience it takes a total of 4 hours to produce a pamphlet or newsletter. For the purpose of this calculation, BCAP will estimate 4 hours.

2. Hourly Wage – Assuming resource development will be conducted by a code official; this factor represents the hourly wage of a code official and provides the policy-maker with a numerical value for the code inspector’s work activity.\(^{30}\) As previously stated in the sections above, the average hourly salary of a code official is $25.

3. Number of Resources – This factor represents the annual number of resources that a department will produce. This is an opportunity to associate a performance goal with resource development. A building code department can require that a newsletter go out monthly and/or that a Question and Answer fact sheet be released monthly. For the purpose of this paper, BCAP suggests requiring a frequency of 8 resources per year; a bi-annual newsletter and bimonthly fact sheets or pamphlets.

4. Total Time required to Develop Resources (TTDR) - This factor is derived from the following formula: Total Time required to Develop Resources = Number of Resources multiplied by Employee Time.

5. Cost of Developing Resources (CDR$) – This factor represents the total cost of developing resources in terms of a building code official’s time. It is derived

\(^{30}\) The Department of Labor provides statistics on wage earnings. [http://www.bls.gov/oco/ocos004.htm](http://www.bls.gov/oco/ocos004.htm)
from the following formula: Cost of Developing Resources = Total Time required to Develop Resources multiplied by Hourly Wage.

6. **Average Cost of Production** – This figure estimates the average cost of production for printed materials. The average cost of production for a printed resource is $.40. This figure will vary depending on the amount of printed material produced. For this calculation, BCAP estimates printing a total of 25,000 pieces each year. Therefore, the average production costs: 25,000 pieces @ $.40 each = $10,000.\(^{31}\)

The following formula describes how these factors are calculated to determine the Total Annual Cost of Resource Materials (ACRM$).

### Budget Calculation for Basic Total Annual Cost of Resource Materials (ACRM$)

**Step 1a: Determine Total Time required to Develop Resources (TTDR)**

<table>
<thead>
<tr>
<th>Employee Time per year (ET)</th>
<th>Number of Resources</th>
<th>Total Time required to Develop Resources (TTDR) in hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 hours (ET)</td>
<td>8 resources</td>
<td>32 hours(TTDR)</td>
</tr>
</tbody>
</table>

**Step 1b: Determine Cost of Developing Resources (CDR$)**

<table>
<thead>
<tr>
<th>Total Time required to Develop Resources (TTDR)</th>
<th>Hourly Wage</th>
<th>Cost of Developing Resources (CDR$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 Hours</td>
<td>$25</td>
<td>$800 (CDR$)</td>
</tr>
</tbody>
</table>

---

\(^{31}\) $.40 per is an average taken from the lowest HP cost ($0.5) to the typical cost of a print-shop job (.61) per page for 100 prints. These figures are only estimates. It is meant to provide a means of determining relative print costs with reasonable accuracy. Pricing found on hp.com, October 2008 and is based on HP printing cost and Quick-print shop costs (based upon data from InfoTrends Report - March 25, 2008). Standard size paper (8.5" x 11") and printing using a four-color process, printing on one side with no photos and approximately 10% toner or ink coverage was used to obtain the estimate.
Information Technology (Website) Budget Calculation

Internet technologies continue to gain importance as an essential component for multi-channel marketing by acting as a communications medium to inexpensively communicate important information. An innovative way to cut the print cost of pamphlets and newsletters is to consider making these "virtual items." There are no printing charges and the material can be updated by revising a single file. The pamphlets and/or newsletters are conveniently available on the website or emailed directly to the building community.

A website complements other outreach channels by providing an information-rich, low-cost means for the building community to interact with the building department. In terms of budgetary considerations, this is a wide ranging cost item because it is not a stand alone entity. A website is one component of a larger more complex information technology umbrella. Information Technology (IT) is a general term that describes any technology that helps to produce, manipulate, store, communicate, and/or disseminate information. This includes hardware (computers) and software (programs). Website cost should be considered on a case by case basis but also in relation to an overarching information technology strategy. While there is little information available regarding the average annual information technology expenditures for building code departments, there is information available for the business community that can be used here as benchmark to determine basic cost of a information technology system. The information technology management WEB (itmWeb) organization provides metrics and benchmarks for IT spending per employee by industry as a general reference for IT executives. The average IT spending benchmarks per employee across all industries is $6,918. The following formula describes how this estimate can be factored to determine the Basic Annual Cost of Information Technology (ACIT$).

\[
\text{ACIT$} = \frac{\text{Cost of Developing Resources (CDR$)} + \text{Average Cost of Production}}{\text{Annual Total Cost of Resource Materials (TCRM$)}}
\]

Example: $800 (CDR$) + $10,000 = $10,800 (TCRM$)

\[
\text{ACIT$} = \frac{800 + 10,000}{10,800} = \frac{10,800}{10,800} = 1
\]

32 E-mail campaigns are significantly less expensive to execute than the traditional direct mail campaigns. E-mail costs can range from $5 to $7 per thousand while direct mail costs range from $500 to $700 per thousand. “E-Mail Savings Threaten a $196.8 Billion Direct Mail Market,” GartnerG2 Research Report, March 2002

33 The itmWEB Site was established in 1996 by Russ Finney with help from an independent community of IT Executives, Consultants, and Educators. It is recognized as an award winning source for information technology reference, methodology, and technical content focused on IT departmental management, technology support, and project leadership. Designed for CIOs, Project Managers, IT Educators, & Students. The figure stated is periodically revised as additional data becomes available. It was last revised
It is important to realize that each building department is unique in size and function, and each may require resources which are significantly different from these figures. These benchmarks and metrics are only intended to be used as a baseline for budget appropriation and as a "sanity check" against current operations.

**Presentation Budget Calculation**
The survey results also indicated presentations to the building community as another effective outreach method. A building code department can require a code official to spend time clarifying compliance requirements to the building community. However, when a code official spends time giving a presentation, this reduces the time available to conduct inspections and plan reviews. This can increase the overall number of staff needed to support all building code activities and can increase the incremental cost of energy for a whole department. The budgetary considerations should include the following factors to determine the Total Annual Cost of Presentations (ACP$) as an effective outreach method:

1. **Duration of the Presentation (DP)** – This factor is the number of work hours a building code official will spend giving a presentation. For the purpose of this paper, BCAP estimates the average duration of a presentation at 2 hours.\(^{34}\)

2. **Preparation time of the presentation (PTP)** – This factor represents the time it takes for a building code official to prepare for a presentation. This includes development of the presentation. For the purpose of this calculation, BCAP estimates the average preparation time for a presentation at 4 hours.\(^{35}\)

3. **Total Work Hours (TWH)** – This factor represents the total time a code official spends on a single presentation. This is derived from the following formula:

\[ \text{Total Work Hours (TWH)} = \text{Duration of the Presentation (DP)} \times \text{Preparation time of the presentation (PTP)} \]

\(^{34}\) This estimate is solely based on BCAP’s presentation experience. BCAP frequently gives presentations to the building industry. This factor can vary depending on the amount of material that needs to be covered. BCAP estimates a total of 2 hours, including actual presentation time and discussion for questions.

\(^{35}\) This estimate is solely based on BCAP’s presentation experience. BCAP frequently gives presentations to the building industry. This factor is dependent on the capability of the presenter. BCAP estimates a total of 4 hours for preparation time for a presentation.
TWH = Duration of the Presentation (DP) plus Preparation time for the presentation (PTP).

4. Hourly Wage – This represents the hourly wage of a code official and provides the policy-maker with a numerical value for the code inspector’s work activity. As previously stated in the sections above, the average hourly salary of a code official is $25.

5. Presentation Cost (PC$) - This factor represents the cost of a single presentation in terms of code official time requirement (in dollars). This is derived from the following formula: Presentation Expenditure (PC$) = Wage multiplied by Total Work Hours (TWH).

6. Presentation Frequency Goal (PFG) – This factor represents an opportunity for the decision-makers to establish a performance goal for their building code department employees. This goal will vary depending on the goals and size of the outreach strategy. For example, as a new energy code is introduced into a jurisdiction, the outreach strategy may become more intense in the beginning. For the purpose of this report, BCAP estimates this frequency goal at 7 presentations in a given year.

The following formula describes how these factors are calculated to determine the Annual Cost of Presentations (ACP$).

---

36 The Department of Labor provides statistics on wage earnings. [http://www.bls.gov/oco/ocos004.htm](http://www.bls.gov/oco/ocos004.htm)

37 As stated, this is only an estimate and the frequency will vary depending on the code adoption and update process. For the purpose of this paper and in an effort to estimate appropriate outreach efforts BCAP’s recommendation of 7 presentations per year is based on the following logic: Code development organizations release a new code every 3 years, BCAP recommends states and municipalities to coordinate their code adoption process to align with the release of new codes. In recognition that every year before the release of a new code outreach efforts are going to increase, BCAP has developed an average frequency for presentations within a municipality. Within a 3 year period, one year will have 12 presentations (one per month), the other 2 years will have a quarterly frequency. The average of this frequency over a 3 year period equals 6.6. BCAP rounds up to 7.
These calculations are estimates that inform policy-makers as to the costs associated with presentations to the regulated building community. They are not meant to serve as exact calculations but rather to address basic needs.

Total Annual Cost of Basic Outreach Strategy
The following is the budget calculation to estimate the Total Annual Cost of Basic Outreach Strategy (TCOS$), including cost of resource materials, information technology and presentations to the building community.
Conclusion

Many states wish to obtain a greater understanding of which services increase compliance at the local level, so funding can be targeted towards those key services. Our research indicates that there is a wide range of resources available at the municipal level, largely depending on the socio-economic characteristics of individual municipalities, such as:

- Construction level within the municipality
- Geographic size of the municipality
- Current population and projected population of the municipality
- Ability to raise revenue based on the tax base
- Political priorities

Our research was unable to establish correlations between appropriation levels and program effectiveness. Drawing significant relationships between staffing numbers, staff competency levels, program effectiveness, and budget allocations was equally problematic. Instead, the first phase of the project assessed code enforcement activities and services from a code official’s perspective and identified the most critical investments for enhancing compliance. The second phase associated basic costs of staffing, education and training and outreach efforts for supporting effective enforcement of codes.

The survey gathered data on compliance tactics deemed effective by code officials and outlined the most important investments for improving residential energy codes enforcement. The following summarizes those tactics:

Staffing Needs – In general, staffing adequacy involves achieving a positive workload to staffing ratio in conjunction with performance targets for enforcing the energy code. The survey indicated “lack of manpower” and “lack of funding” were the primary obstacles in enforcing the energy code.

Education and Training – The majority of survey respondents believe that energy code training is essential to effective energy code enforcement. The results indicated
significant shortcomings in the area of training – not simply the lack of training, though more is needed, but also in how code officials are trained. The respondents also indicated a mix of in-person workshops and state-specific on-line trainings as effective training methods.

Tools – Tools play an important role in allowing a building code official to work more efficiently. The survey identified a wide range of tools available for code officials. Future studies should assess the potential for expanding the use of technology to increase productivity - such as electronic permitting software.

Outreach Methods – The majority of respondents indicated that compliance rates will increase if building departments make guidance documents and other information materials more readily available to builders, contractors, and tradespeople. The survey indicated the most effective outreach methods for the public is to provide educational material and guidance in the form of pamphlets and newsletters.

Using the identified characteristics of effective enforcement from Part I, Part II of the report outlined budget calculations to determine an estimated baseline for appropriations for an energy code. Targeting funding to address staffing needs, education, training and outreach methods can allow decision-makers to cost-effectively allocate resources to building code administrations and services.

Each section detailed the specific budget considerations and calculations necessary to estimate associated basic costs for each enforcement element. The formulas developed used the previous year’s number of residential permits as the primary factor in estimating a baseline cost of the energy code. Previous year’s permit activity represents a validated estimation of workload within a specific jurisdiction. The following summarizes the budget calculations described in the report:
The budget calculations discussed throughout this report are all estimates intended to provide decision-makers with a baseline cost estimate to help determine how to properly appropriate funds for building code departments. The above budget summary only includes the basic features of the calculations. Part 2 of this report provides a more detailed explanation of the budget calculation as well as options for alternative calculations to include compliance goals discussed in the preceding pages. In 2007, the average number of residential housing permits authorized per state in the US was 27,424. Using this estimate of authorized building permits, it would take 22 full-time
employees in each state one year to conduct plan reviews and inspections. In addition, it would require at least $1,070,000 to minimally fund the building code department for staffing needs, education and training, and outreach methods. If a compliance rate of only 30 percent was considered, it would take a minimum of $1,702,174 to fund the department. (See pages 24-27 for more details on costs associated with specific compliance rates.)

In recognition of the complicated nature of these calculations and in an attempt to streamline the process for decision-makers, BCAP has also developed a Budget Estimation Tool. This tool incorporates all of the calculations from this report to assist decision-makers in determining appropriate levels of funding for a building code department when adopting or upgrading a building energy code. Future versions of this tool, the Budget Estimation Calculator, will be automated and located on the BCAP website. Until then, decision-makers are encouraged to contact BCAP staff to submit a request for these estimates. While each factor discussed in the budget calculation sections above have associated BCAP estimates, there are 11 adjustable factors that can be modified for more accurate estimations. To obtain more accurate estimations a decision-maker can provide answers to the questions below. The following table outlines each adjustable factor question, the goal and implication of the factor.

<table>
<thead>
<tr>
<th>Adjustable Factor Question</th>
<th>Goal</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Compliance Consideration: What percentage of homes should pass inspection on the first round?</td>
<td>This is a performance target to address compliance in the field. It represents the assumed percentage of code compliance on the first round of plan reviews and inspections.</td>
<td>Data suggests compliance rates are very low contributing to gaps in realized energy savings from energy codes. Addressing compliance is gaining momentum nationally. Setting compliance goals on the state or local level allows for greater energy savings.</td>
</tr>
<tr>
<td>2. Hourly Wage: What is hourly wage of your building code officials?</td>
<td>This represents the hourly wage of a code official and provides the policy-maker with a numerical value for the code inspector’s work activity. The average annual salary of a code inspector in the US is $50,440. BCAP estimates $25.</td>
<td>This factor contributes to the total cost of how much it cost to inspect a home.</td>
</tr>
<tr>
<td>3. Work Activity: What are the total number of hour(s) needed to complete an energy plan review and inspection?</td>
<td>The ability to estimate duration of work activity can provide a policy-maker with valuable insight into the operation needs of a building department as well as associate a performance target with budget calculations. BCAP estimates it would take 1.25 hours per home for a code official to consider energy in an inspection and plan review.</td>
<td>Using this approach as a performance target can eliminate/curb incomplete or faulty plan reviews or inspections.</td>
</tr>
<tr>
<td>Question</td>
<td>Description</td>
<td>Notes</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>4. Work Hours: How many hours per day are code officials expected to dedicate to plan reviews and inspections?</td>
<td>This factor recognizes each building department may have its own policies regarding dedicated time to plan reviews and inspections. This factor can be used as a performance target designed to organize overworked code officials work schedule and staff planning. BCAP estimates 6 hours.</td>
<td>Data suggests code officials are overburdened with work. The ability to target hours per day focused on reviews and inspections can be a useful in determining how many staff members are required to address energy within a specific jurisdiction. Essentially, balancing the workload employees.</td>
</tr>
<tr>
<td>5. Work Days: How many work days are projected for a given year?</td>
<td>Recognizing each building code department is unique this factor attempts to identify how much time is available for a code official to address energy in a given year, including vacation, sick, holiday time. BCAP estimates 255 work days.</td>
<td>Being aware of available work days in a given year is a key element in determining annual staffing needs.</td>
</tr>
<tr>
<td>6. State or Local Continuing Education Credits: How many continuing education credits are required in your jurisdiction?</td>
<td>This represents the State or Local CEU Requirements a state or local government requires in addition to the mandatory requirements of the certifying body (e.g., ICC 5 credits). Using this as a performance target can increase knowledge of code requirements and new technologies and building practices. BCAP estimates 24 additional hours.</td>
<td>Establishing continuing education requirements and requiring submittal of attendance credits, encourages and supports professional advancement, and thus enhances the proficiency capability of the individual and the professional capacity of both the code enforcement community and the locality. Essentially increasing work efficiency and ultimately compliance levels.</td>
</tr>
<tr>
<td>7. Employee Time: How much time will an employee spend annually for developing a resource for the public?</td>
<td>While this factor is dependent on the capability of the employee and the amount material, this can also be considered a performance goal for the building code department. The department’s outreach strategy can require a specific amount for time dedicated to developing resources. In BCAP’s experience it takes a total of 4 hours to produce a pamphlet or newsletter.</td>
<td>Setting time goals for developing resources can allow for more efficiency in the work day.</td>
</tr>
<tr>
<td>8. Number of Resources: What is the annual number of resources the department will produce as part of their outreach strategy for the building community?</td>
<td>This factor determines the number of resources (newsletter, Q&amp;A, Factsheets) released to the building community. BCAP suggests requiring a frequency of 8 resources per year; a biannual newsletter and bimonthly fact sheets or pamphlets.</td>
<td>Establishing and maintaining communications between the building code department and the building community in the form of resources is a key element in maximizing awareness of code requirements. Making specifications within the energy code clear and accessible is a contributing factor for increasing compliance rates.</td>
</tr>
</tbody>
</table>
9. **Average IT Spending Per Employee:** What was the previous years information technology expenditures (hardware and software)?

Determining the technology (website, computers etc.) that helps to produce, manipulate, store, communicate, and/or disseminate information is an important aspect of an outreach strategy. The average IT spending benchmarks per employee across all industries is $6,918.

Information technologies continue to gain importance as an essential component for multi-channel marketing by acting as a communications medium to inexpensively communicate important information.

10. **Presentation Frequency Goal (PFG):** How many presentation opportunities will the department conduct for the building community annually?

This factor represents an opportunity for the decision-makers to establish a performance goal for their building code department employees. This goal will vary depending on the goals and size of the outreach strategy. BCAP estimates this frequency goal at 7 presentations in a given year.

Builders, designers, and developers are responsible for implementing code language and ensuring that code requirements are achieved; while code officials are responsible for enforcement of the code. States and municipalities are finding that active collaboration between these groups improves understanding, creates buy-in, and can lead to greater levels of compliance.

11. **Duration and Preparation time of a Presentation:** How long will department presentations to the building community last and how much preparation time will an employee need?

This factor is the number of work hours a building code official will spend giving a presentation. For the purpose of this paper, BCAP estimates the average duration of a presentation at 2 hours and preparation time 4 hours.

When a code official spends time giving a presentation, this reduces the time available to conduct inspections and plan reviews. This can increase the overall number of staff needed to support all building code activities and can increase the incremental cost of energy for a whole department.

Once developed, the automated Budget Estimation Calculator will be released on the BCAP website at www.bcap-energy.org. A notification will also be sent via the quarterly newsletter once it is available. Interested parties can sign up for the newsletter on the website.