ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY

The Cost of Enforcing Building Energy Codes: Phase 2

Alison Williams, Sarah K. Price, and Ed Vine

Energy Analysis and Environmental Impacts Department
Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory
Berkeley, CA 94720

October 2014

This work was supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, Building Technologies Office under Contract No. DE-AC02-05CH11231.

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor The Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or The Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or The Regents of the University of California.

COPYRIGHT NOTICE

This manuscript has been authored by an author at Lawrence Berkeley National Laboratory under Contract No. DE-AC02-05CH11231 with the U.S. Department of Energy. The U.S. Government retains, and the publisher, by accepting the article for publication, acknowledges, that the U.S. Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this manuscript, or allow others to do so, for U.S. Government purposes.

The Cost of Enforcing Building Energy Codes: Phase 2

Alison Williams, Sarah Price, and Ed Vine

Lawrence Berkeley National Laboratory

October 15, 2014

Table of Contents

EXECUTIVE SUMMARY 1
1 INTRODUCTION 1
2 METHODOLOGY AND SAMPLE OVERVIEW 2
2.1 General Experts 2
2.2 Local Experts 3
2.3 Survey Instruments 5
2.4 Analysis and Limitations 6
3 COST OVERVIEW 7
3.1 National Code Compliance and Enforcement Cost Overview 7
3.2 Phase 2 Enforcement Cost Summary 8
4 LOCAL GOVERNMENT LEVEL COSTS 11
4.1 Traditional Process 11
4.1.1 General Survey 11
4.1.2 Local Survey 12
4.1.3 Phase 1 Comparison 15
4.1.4 Enhancements 16
4.1.5 Permit Fees 20
4.2 Supplemental and Alternative Processes 21
4.2.1 Third-Party Plan Review/Inspection 21
4.2.2 Performance Testing 25
4.2.3 Voluntary Programs 26
4.2.4 Commissioning 27
4.2.5 Licensing 27
4.3 Compliance-Related Investments 27
4.3.1 Training and Certification of Code Officials 27
4.3.2 Energy Training for Builders/Tradespeople/Construction Workers 28
4.3.3 Outreach 28
4.3.4 Information Technology 29
5 ROLES OUTSIDE OF LOCAL GOVERNMENT 29
5.1 Utility 29

5.2 State and National 31
5.2.1 Stakeholder Collaborative 31
5.2.2 Liability Structure 31
5.2.3 Auditing 31
5.2.4 Demonstration Programs 32
5.2.5 Training 32
5.2.6 National Role 32
6 KEY WAYS TO REDUCE COSTS AND INCREASE COMPLIANCE 33
6.1 Education and Training 34
6.2 Design Professional Improvements 35
6.3 Outreach and Messaging 35
6.4 Funding Increases 36
6.5 Third Parties and Voluntary Programs 36
6.6 Streamlining and Tools 37
6.7 Compliance Paths and Infrastructure 37
6.8 Buy-In of Key Stakeholders in Compliance and Enforcement 38
7 SUMMARY OF KEY FINDINGS/CONCLUSIONS 38
8 ACKNOWLEDGEMENTS 40
REFERENCES 42
APPENDIX A: ADDITIONAL SURVEY RESULTS A-1
APPENDIX B: SURVEY INSTRUMENTS B-1

List of Acronyms

ACCA	Air Conditioning Contractors of America
ACI	American Certification Institute
AEO	Arkansas Energy Office
ANSI	American National Standards Institute
ARRA	American Recovery and Reinvestment Act
BCAP	Building Codes Assistance Project
BPI	Building Performance Institute
CPA	Compliance Planning Assistance Program
DOE	U.S. Department of Energy
FTE	Full-time equivalent
GBPN	Global Buildings Performance Network
HERS	Home Energy Rating System
ICC	International Code Council
IECC	International Energy Conservation Code
IMT	Institute for Market Transformation
IT	Information technology
LEED	Leadership in Energy and Environmental Design
LBNL	Lawrence Berkeley National Laboratory
MPUC	Maine Public Utilities Commission
NAVLAP	National Voluntary Laboratory Accreditation Program
OCEAN	Online Code Environment and Advocacy Network
QA	Quality assurance
QI	Quality installation
WSDC	Washington State Department of Commerce

EXECUTIVE SUMMARY

Purpose and Methodology

The purpose of this study is to present key findings regarding costs associated with enforcing building energy code compliance–primarily focusing on costs borne by local government. Building codes, if complied with, have the ability to save a significant amount of energy. However, energy code compliance rates have been significantly lower than 100%. Renewed interest in building energy codes has focused efforts on increasing compliance, particularly as a result of the 2009 American Recovery and Reinvestment Act (ARRA) requirement that in order for states to receive additional energy grants, they must have "a plan for the jurisdiction achieving compliance with the building energy code…in at least 90 percent of new and renovated residential and commercial building space" by 2017 (Public Law 111-5, Section 410(2)(C)). One study by the Institute for Market Transformation (IMT) estimated the costs associated with reaching 90% compliance to be $810 million, or $610 million in additional funding over existing expenditures, a non-trivial value. [Majersik & Stellberg 2010] In this context, Lawrence Berkeley National Laboratory (LBNL) conducted a study to better pinpoint the costs of enforcement through a two-phase process.

Phase 1 was a literature review designed to identify the current breadth of information on compliance rates, barriers associated with non-compliance, strategies to overcome them, U.S. Department of Energy (DOE) and key stakeholder involvement in improving compliance, and, in particular, the local government costs associated with energy code enforcement for residential and commercial buildings. Phase 1 was conducted in early 2013, and a report on the findings from that study was published in April 2013. [Williams et al. 2013] The report reviewed more than 150 documents that discussed code compliance and enforcement. Costs included those associated with traditional plan review and inspection as well as supplemental and alternative processes such as third party enforcement, performance testing, Home Energy Rating System (HERS), commissioning, and licensing. The report also addressed costs of information technology (IT), training and education, and outreach. The costs from Phase 1 that have been revisited in Phase 2 are presented in this report for comparison. In many cases, data collected in Phase 1 were limited with only one source for a given cost metric. In other cases, cost data with disparate sources and assumptions were combined to create more useful estimates or comparisons; this compilation generated uncertainty.

For these reasons, in Phase 2, a survey of general and local experts was conducted to develop an overall range of enforcement costs and to identify more precisely the areas of focus for improving code compliance, including where money might be most effectively spent. General experts were surveyed as a way of gaining a big-picture view of the situation. The general experts were selected based on the Phase 1 literature review and on industry knowledge regarding experts in this field. Seventeen general experts were interviewed in May 2013, in order to capture regional distribution, people from key organizations, and experts (including consultants and some state code officials) who are familiar with code compliance in many jurisdictions.

Local experts were surveyed to gain information on specific experiences and to collect cost data associated with energy code enforcement. The original sample of local experts was developed based on

general experts' recommendations for local government contacts that would be well suited to respond to a survey about the costs of compliance with energy codes at the local level. This list was supplemented with recommendations from local interviewees, as well as local code officials listed in some of the Compliance Planning Assistance Program (CPA) gap analyses or jurisdictions prominent in other reports reviewed in Phase 1. Twenty three interviews were conducted in June-July 2013 to obtain regional distribution and responses from a variety of large cities, medium cities, and small towns.

Summary of Phase 2 Costs

Phase 2 provides energy code enforcement cost information for traditional plan review and inspection processes as well as additional means of compliance and enforcement such as use of third-parties for plan review, inspection, performance testing, or voluntary programs such as HERS. Phase 2 also reviews budgets for education and outreach.

This study found that the incremental cost of enforcing energy codes (compared to the cost of already-existing enforcement of other building codes) using a traditional plan review and inspection process (exclusive of overhead and travel) is typically $50 or less per home, but may range up to nearly $200, for residential energy codes; and $60 to $145 per building, but may range up to around $1,000, for commercial energy codes.

The typical values are fairly consistent with those presented in Phase 1, although toward the lower end. Therefore, annual incremental costs for a jurisdiction processing 5,000 residential permits per year would range from approximately $127,000 to $257,000. This range is significantly lower than that in Phase 1 (up to $531,000), because Phase 1 included more time for re-inspections, more homes re-inspected, and higher recommended time per home than the values estimated in Phase 2 surveys.

Third-party energy code enforcement was suggested by general experts as a way to increase compliance and reduce financial burden on local jurisdictions. Few local governments interviewed for this report used third parties for this purpose or would like to.

Local jurisdictions surveyed sometimes use third parties for plan review or inspection for all codes when jurisdiction staff are over-loaded, passing through all or part of the permit fees, but nothing additional. This may indicate that the costs for using third parties would be equal to or less than the costs of using jurisdictions' own staff – assuming that staff are primarily funded through permit fees. Therefore, Phase 1 estimates of $200 for a residential energy inspection and $750-$940 for a commercial energy plan review or inspection may be over-estimated.

Local jurisdictions or states also incur costs for administration of third-parties.

Annual third-party administration costs estimated by national experts in Phase 2 ranged from $25,000 to $500,000 (excluding one outlier in the millions), which is a higher, but not markedly so, range than that presented in Phase 1 ($23,000 to $300,000).

Potential methods of improving energy code compliance discussed in the literature include performance testing or programs such as HERS, which are mandatory in some jurisdictions. These services require expenditures by a local jurisdiction or state for administration, quality assurance (QA), and oversight, but fees are typically paid by builders or owners directly to third parties that provide the services.

Phase 2 estimated performance testing costs of $90 to $500 per home and HERS rating costs of $275 to $575 per home.

These values are consistent with the estimate in Phase 1 for performance testing ($300 to $400), but lower than the range for HERS ratings ($450 to $1,700).

Compliance and enforcement processes should include expenditures for training and outreach.

Phase 2 estimated training budgets of $0 to $5,000 per full-time equivalent (FTE) per year, with a median value of $350. Estimated outreach budgets were up to $6,000 per year per jurisdiction (excluding two high outliers).

The training budgets are consistent with attending one or more energy-related trainings a year or becoming ICC [International Code Council] certified, based on the costs presented in Phase 1, but only one jurisdiction's training budget meets or exceeds the $1,250 per FTE per year recommended by BCAP. The Phase 2 estimates of outreach budgets per jurisdiction are significantly less than the budgets estimated by BCAP ($39,000 per year).

These budgets should not be taken as an indication of what should be spent in these areas. In some cases, the budgets are either not adequate 100% compliance or, in the case of training, are avoided through training staff internally by energy experts or through subsidized state training. Experts repeatedly noted that education, training, and outreach are crucial for increasing compliance.

Conclusions

The costs reported in this study are presented to inform a national dialogue about the investment needed to improve compliance with building energy codes. They are not intended to be representative of the nation as a whole, and the cost numbers in this report do not address the many jurisdictions without any code enforcement infrastructure at all.

As determined through experts interviewed for this study, successful local jurisdictions appear to have the ability to conduct energy code plan review and inspection in a reasonable amount of time, with shorter times when well-trained contractors and code officials are involved. Experts noted that actions such as educating code officials, training industry to design and build to code, providing outreach to consumers to increase demand, giving code officials the proper tools to streamline and prioritize enforcement, and requiring design professionals to provide adequate information on plans all have the ability to increase compliance while reducing plan review and inspection time. These activities could be key contributions from utilities, states, and the federal government.

Finally, experts suggested that In order to get the energy and carbon savings that codes are expected to save, key stakeholders must make long-term commitments to code compliance and enforcement and that there must be a cultural change that prioritizes energy efficiency, along with life and safety.

1 INTRODUCTION

The purpose of this study is to present key findings regarding costs associated with enforcing building energy code compliance–primarily focusing on costs borne by local government. Building codes, if complied with, have the ability to save a significant amount of energy. However, energy code compliance rates have been significantly lower than 100%. [See Williams et al. 2013 for summary.] Renewed interest in building codes has focused efforts on increasing compliance, particularly as a result of the 2009 American Recovery and Reinvestment Act (ARRA) requirement that states implement a plan to achieve 90% compliance by 2017 in order to receive additional energy grants (Public Law 111-5).[1] The U.S. Department of Energy (DOE) Building Energy Codes Program offers several tools and resources to address energy code compliance.[2]

Although the incremental cost of the construction measures needed to comply with building energy codes has been well documented, particularly by the Building Codes Assistance Project (BCAP) (Pacquette, Miller, and DeWein 2011), the cost of enforcement and other activities that may improve compliance has received little attention. However, the estimated cost is thought to be significant. For example, one study by the Institute for Market Transformation (IMT) estimated the costs associated with reaching 90% compliance to be $810 million, or $610 million in additional funding over existing expenditures, a non-trivial value.[3] [Majersik & Stellberg 2010] In order to further inform a national dialogue about the investment needed to improve compliance with building energy codes, Lawrence Berkeley National Laboratory (LBNL) conducted a two-phase study to better pinpoint the costs of enforcement with a goal towards 100% compliance.

Phase 1 was a literature review designed to identify the current breadth of information on compliance rates, barriers associated with non-compliance, strategies to overcome them, DOE and key stakeholder involvement in improving compliance,[4] and, in particular, the local government costs associated with energy code enforcement for residential and commercial buildings. Phase 1 was conducted in early 2013, and a report on the findings from that study was published in April 2013. [Williams et al. 2013] More than 150 documents that discussed code compliance and enforcement were reviewed. Costs

[1] In Section 410, in order for states to receive additional energy grants, the states, or the applicable units of local government that have authority to adopt building codes, will implement "a plan for the jurisdiction achieving compliance with the building energy code or codes … within 8 years of the date of enactment of this Act in at least 90 percent of new and renovated residential and commercial building space. Such plan shall include active training and enforcement programs and measurement of the rate of compliance each year."

[2] See www.energycodes.gov/compliance for more information.

[3] IMT estimates the $810 million from the following components: 1) plan review and inspection cost based on best-practice level of enforcement: $660 million; 2) implementation and training cost based on best practices (training, outreach, distribution of guides and manuals, compliance evaluation, development of alternative compliance methodologies): $125 million; and 3) national level support: $25 million.

[4] Key activities to date have included DOE's Building Energy Codes Program (see www.energycodes.gov), which offers tools and technical assistance to states, has developed compliance evaluation methodologies, and has researched alternative compliance paths. The non-profit Building Codes Assistance Project (BCAP), with funding from DOE, provides support on code adoption and implementation to state and local governments. BCAP's Compliance Planning Assistance Program assisted 22 states with gap analyses and 10 states with strategic compliance plans.

included those associated with traditional plan review and inspection as well as supplemental and alternative processes such as third party enforcement, performance testing, Home Energy Rating System (HERS), commissioning, and licensing. The report also addressed costs of information technology (IT), training and education, and outreach. The costs from Phase 1 that have been revisited in Phase 2 are presented in this report for comparison. In many cases, data collected in Phase 1 were limited with only one source for a given cost metric. In other cases, cost data with disparate sources and assumptions were combined to create more useful estimates or comparisons; this compilation generated uncertainty.

For these reasons, in Phase 2, a survey of general and local experts was conducted to develop an overall range of enforcement costs and to identify more precisely the areas of focus for improving code compliance, including where money might be most effectively spent. General experts were surveyed as a way of gaining a big-picture, often national perspective, while local experts were surveyed to gain information on experiences in specific geographic areas and to collect cost data associated with energy code enforcement.[5] Thus, Phase 2 brings together both of these perspectives as a supplement to the information available in the literature.

This report begins with an overview of the survey methodology and sample. A summary of findings on costs is then followed by details on the costs associated with the local government enforcement process, including alternative and supplemental means of enforcement and other strategies to improve compliance. This section mirrors a similar section in Phase 1 and provides comparisons between the findings in each phase. Next, an overview of potential roles for utilities, states, and the federal government is presented, although costs are not available in this section. Near the end, as a supplement to the primary cost information, methods suggested by experts to increase compliance and reduce cost are described.[6] Finally, key findings and conclusions are summarized.

2 METHODOLOGY AND SAMPLE OVERVIEW

This section presents the samples of general and local experts as well as a brief discussion of survey instruments, the methodology used for the analysis, and the study's limitations.

2.1 General Experts

General experts were selected based on the Phase 1 literature review and on industry knowledge regarding experts in the field of building code compliance and enforcement. In addition, an effort was made to solicit experts from every regional energy efficiency organization[7], as well as Texas and

[5] DOE now offers a web-based State Energy Code Jurisdictional Survey that asks some questions similar to those in the local survey used for this report and can be used by states in evaluating compliance. (See www.energycodes.gov/compliance-evaluation)

[6] This list of suggested methods is not comprehensive; many more thorough studies on this matter exist, particularly focused on individual jurisdictions. See Williams et al. 2013 for extensive references.

[7] Regional energy efficiency organizations are organizations that were created to meet the particular needs of the states in their region – each with its own energy mix, political climate, program delivery structures and maturity of policies and programs. For more information, see: http://www.neep.org/neep-supporters/regional-energy-efficiency-organizations-network/index.

California. The original goal was to interview 10 experts, but this number was increased to 17 in order to capture regional distribution, people from key organizations, and experts (including consultants and some state code officials) who are familiar with code compliance in many jurisdictions. Only one person declined to be interviewed, because he was not the most appropriate contact. In other cases, an alternate or additional contact was recommended from the same organization. In cases where multiple respondents from the same entity were interviewed together, only one numeric response for each question was recorded. Interviews were conducted in May 2013, and the final list of interviewees is shown in Table 1.

Table 1. General Experts Interviewed

Contact	Organization	Region
Maureen Guttman	Building Codes Assistance Project (BCAP)	National
Ryan Meres	Institute for Market Transformation (IMT)	National
Harry Misuriello (with Rachel Cluett)	American Council for an Energy-Efficient Economy (ACEEE)	National
Isaac Elnecave	Midwest Energy Efficiency Alliance (MEEA)	Midwest
Joseph Cassidy	State of Connecticut	Northeast
Ian Finlayson	State of Massachusetts	Northeast
Don Vigneau	Northeast Energy Efficiency Partnerships (NEEP)	Northeast
Robert Wirtshafter	Wirtshafter Associates, Inc.	Northeast
David Baylon	Ecotope	Northwest
David Cohan	Northwest Energy Efficiency Alliance (NEEA)	Northwest
Roxanne Greeson	Southeast Energy Efficiency Alliance (SEEA)	Southeast
Brian Henderson	National Association of State Energy Officials (NASEO)	Southeast
Jim Meyers	Southwest Energy Efficiency Project (SWEEP)	Southwest
Pat Eilert	Pacific Gas and Electric Company (PG&E)	California
Rob Hammon	BIRAenergy	California
Doug Mahone	Heschong Mahone Group (HMG)	California
Dub Taylor (with Alison Nathan)	State of Texas	Texas

2.2 Local Experts

The original sample of local experts was developed based on general experts' recommendations for local government contacts that would be well suited to respond to a survey about the costs of compliance with energy codes at the local level. This list was supplemented with recommendations from other local interviewees, as well as local code officials listed in some of the Compliance Planning Assistance Program (CPA) gap analyses or jurisdictions prominent in other reports reviewed in Phase 1.[8] As in the general survey, an effort was made to obtain regional distribution. In addition, responses were sought from a variety of large cities, medium cities, and small towns.

Initial contact with the local experts was made primarily through email. When necessary, at least one email follow-up was sent, and, in some cases, a follow-up phone call was made. While not everyone responded, only two people declined to participate in the survey. In some jurisdictions, the initial contact referred an alternate person to take the survey. Table 2 shows the number of local experts that

[8] For more information on the Compliance Planning Assistance Program, see: http://energycodesocean.org/compliance-planning-assistance-program

were initially contacted and their associated responses. In summary, twenty three interviews were conducted in June-July 2013. Each local expert interviewed represented a different jurisdiction.

Table 2. Local Interview Responses

Responses to Request for Interview	Number of Responses
Positive initial response and interview	23
Positive initial response, no response to scheduling follow-up	3
Suggested alternative point of contact at same jurisdiction	4
Declined	2
No response	13
Willing to be interviewed, but not the correct person for our study	1
Total Number of Local Experts Contacted	46

For this study, the United States was divided into seven regions or states and at least one expert was interviewed in each of the following regions: Midwest, Northeast, Northwest, Southeast, Southwest, California, and Texas. The local experts interviewed held a variety of positions relating to building codes such as: Code Enforcement Officer, Inspector-Plan Reviewer, Building Official, Senior Codes Specialist, Director of Building Safety and Regulations, Senior Plans Examiner, and Energy Code and Energy Conservation Advisor. The 23 jurisdictions that participated were categorized into 3 different groups based on their populations:

- small (population ≤ 100,000 inhabitants);
- medium (population >100,000 ≤ 800,000 inhabitants); and
- large (population > 800,000 inhabitants).

Roughly 50% of the jurisdictions fell into the medium-sized category, 30% of the jurisdictions were considered small, and 20% were considered large. Table 3 shows the 23 jurisdictions where our the interviewees worked and their associated population, size, and region.

Table 3. Local Jurisdictions Interviewed

Region	Local Jurisdiction	Population, 2012 estimate[a]	Jurisdiction Size
Midwest	Sioux Falls, SD	159,908	Medium
Northeast	Kennebunk, ME	5,214[b]	Small
	Saco, ME	18,758	Small
	New York City, NY	8,336,697	Large
Northwest	Canyon County, ID	56,489[c]	Small
	Seattle, WA	634,535	Medium
Southeast	Culpeper County, VA	47,911	Small
	Chatham County, GA	98,805[c]	Small
	Norfolk, VA	245,782	Medium
	Atlanta, GA	443,775	Medium
	Fairfax County, VA	1,078,146[c]	Large
Southwest	Parker, CO	47,169	Small
	Gillette, WY	31,378	Small
	Salt Lake County, UT	146,209[d]	Medium
	Pima County, AZ	353,319[e]	Medium
	Tucson, AZ	524,295	Medium
	Las Vegas, NV	596,424	Medium
	Clark County, NV	888,314[f]	Large
California	Santa Clarita, CA	179,013	Medium
	Irvine, CA	229,985	Medium
	San Francisco, CA	825,863	Large
Texas	Arlington, TX	375,600	Medium
	Austin, TX	842,592	Large

[a] All population estimates are from the U.S. Census Bureau's State and County QuickFacts webpage at http://quickfacts.census.gov/qfd/index.html except where noted.

[b] The Census did not provide a 2012 Estimate for Kennebunk, ME; this is the 2010 population.

[c] Estimated unincorporated county population.

[d] Unincorporated county population from 2010 census. http://econdev.slco.org/demographics/population.html

[f] Unincorporated county population 2012 estimate: http://www.clarkcountynv.gov/Depts/comprehensive_planning/demographics/Documents/PlacePopulation.pdf

[e] Unincorporated county population 2010 official: http://www.pagnet.org/regionaldata/demographics/tabid/104/default.aspx

2.3 Survey Instruments

Two separate surveys were developed, one for general experts and one for local experts. These surveys were primarily qualitative in nature and were treated more as interview guides. The survey instruments were reviewed and approved by LBNL's Human Subjects Committee and are included in Appendix B.

As noted previously, the general experts were each familiar with energy code enforcement across multiple jurisdictions. The goal of the general survey was to utilize the experts' knowledge of commonality or variability across jurisdictions to gain a big-picture perspective on the cost of energy code enforcement, focused less on specific cost estimates and more on contextual information. For the general expert survey, information was collected on several topics, including: time needed for residential and commercial energy code plan review and inspection, reasons for variability in those estimates, options for increasing code compliance for local jurisdictions, and the role of utilities in code compliance and enforcement.

The main purpose of the local survey was to pinpoint energy code enforcement costs for individual jurisdictions. For the local expert survey, information was collected on several topics, including: time spent on traditional enforcement (including plan review and actual building inspection), salaries of plan reviewers and inspectors (in order to calculate cost of time spent), and costs for other enforcement methods, such as performance testing and use of third-parties.

2.4 Analysis and Limitations

The costs reported in this paper are presented to inform a national dialogue about the investment needed to improve compliance with building energy codes. They are not intended to be representative of the nation as a whole. Development of definitive costs and other related data would require a much larger survey effort and was not the objective of this research. The main analytical choices and limitations of the data and analyses are summarized below.

Particularly in the local survey, not all respondents were able to answer all questions due to the nature of their position or their jurisdiction. However, respondents were not excluded from the final analysis if they did not have a complete set of answers; whatever data were available for a given question was used. As a result, the sample size varies by question.

Many of the quantitative data (such as costs, time spent, and percent incidence) were provided by respondents as ranges; when this occurred, the average of the minimum and maximum were used as their single response value. In several cases, respondents provided only a maximum value, which was used as their single response value. The overall median and average values presented in this paper were calculated using the single values for each respondent, preserving outliers with a few exceptions noted in this report. Qualitative results were coded and grouped into like responses, where possible, in order to develop ranked lists of results.

The reported values could be skewed based on the analytical choices; for example, a provided range of 1 to 5 hours may not really average to 3 hours, if 90% of plan reviews take only 1 hour and the remaining 10% take somewhere between 2 to 5 hours. In addition, the costs presented are not necessarily indicative of the costs that could be expected in a jurisdiction with many large, complex buildings; high wages; or jurisdictions with limited building enforcement experience and infrastructure. In particular, obtaining costs by specific commercial building type rather than for the commercial sector in general would help estimate more representative costs beyond the jurisdictions surveyed. The costs for plan review and inspection are exclusive of benefits, overhead, and travel, which could potentially triple or

even quadruple the presented costs. In addition, the costs presented are incremental for jurisdictions that already enforce non-energy building codes; this report does not capture the costs associated with developing enforcement infrastructure in jurisdictions without any prior enforcement experience.

The local survey in Phase 2 was not intended to be a representative sample of local jurisdictions, states, or the country as a whole due to the small sample size. Furthermore, the nature of this survey and the sample development resulted in a sample bias toward energy code enforcement. Most of the contacts recommended for this survey, and others who responded to the solicitation, were generally supportive of, or even excited about, the energy code and, therefore, willing to spend time answering a lengthy questionnaire. In addition, the reported compliance rates of the jurisdictions surveyed seem to be higher than typical.[9] The sample of local experts should likely be interpreted as a best case scenario – indicative of the time and resources available in jurisdictions that value the energy code. It would not be representative of practices across the nation. However, in some ways, this is beneficial to this study, as it helps determine how much it should cost to enforce the energy code, rather than how much is being spent now.

3 COST OVERVIEW

This section provides a high-level overview of the assessment of the national investment costs for building code enforcement, as well as a comparison between the costs reported in Phase 1 and developed in Phase 2 for specific aspects of enforcement.

3.1 National Code Compliance and Enforcement Cost Overview

In 2010, a national study by IMT estimated that the total costs associated with reaching 90% compliance nationally would be $810 million annually, including $660 million for best-practice plan review and inspection, $125 million for implementation and training, and $25 million for national level support. [Majersik & Stellberg 2010] IMT estimated that currently $200 million is spent annually.

It is important to note that determination of 90% compliance is still unclear, and details about the IMT cost estimates are not publicly available. However, general experts were asked to provide feedback on the IMT estimates.

Some examples of responses:

- One expert who thought it was realistic noted: “If 1 million homes were built per year, this would be $600 per home. That is pretty close.”
- Another respondent felt it was realistic based on what happens now, “but we should be changing to do things in a more affordable way.”

[9] Reported compliance rates of the local jurisdictions interviewed ranged from 75 to 100%, which is significantly higher than many of the compliance rates identified in Phase 1. [See Williams et al. 2013 for summary.] However, many local experts were unable to provide their jurisdiction’s compliance rate. Three local experts reported having participated in studies to assess compliance. Of these, one reported 75% compliance, and another reported 80-85% compliance. These were the lowest numbers volunteered. A third interviewee speculated at least 90%, and probably closer to 97%.

- One expert who felt it was too low noted that this figure is "meaningless because it does not take into account the institutional development that has to occur [*i.e.,* places that do not even have code officials]."

While this cost was likely intended to be based on actual time spent and salaries of those who review and inspect buildings, it is clear that all respondents did not interpret this value in the same way.

- One expert noted: "Based on spending or planned spending in various locations that is expected to get to 90% compliance, $350M nationwide would be enough."
- Another respondent noted: "$660M would buy something useful, but if it only lasts a couple years, $60M per year is better."

Three experts specifically addressed the high costs of training required, although these presumably would be part of IMT's $125 million estimate for implementation and training rather than the $660 million estimate for plan review and inspection:

- One respondent noted that the value is "probably realistic. There is going to be significant cost of reviewers getting used to working with new, more stringent, energy codes."
- Another expert felt the amount seemed reasonable because "to get the good level of compliance, you're going to have to go building official to building official to each code agency. [That's a] hefty amount."
- Another respondent noted: "I haven't seen the level of training that extends down to the building trades that really is required to be able to get them knowledgeable in performing their jobs and understanding building science. Any of the funding that comes is concentrated at the top of the pyramid and doesn't filter down to the bottom."

IMT's analysis as well as the expert feedback indicates that costs for enforcing building energy codes may be considered to include not only plan review and inspection, but also institutional development, training for code officials and trades, and other outside funding used in various activities to increase compliance or reduce enforcement time. While this report focuses on the costs of plan review and inspection, opportunities and costs for some additional compliance and enforcement activities are also discussed.

3.2 Phase 2 Enforcement Cost Summary

Through the Phase 2 surveys, costs were developed to complement those identified in the Phase 1 literature. Costs to local governments are summarized in Table 4, with further details in subsequent sections. For traditional and alternative/supplemental compliance methods, Phase 2 typically has consistent or lower cost estimates than those in Phase 1. For training and outreach budgets per jurisdiction, Phase 2 also has lower costs than Phase 1 estimates. However, this is likely due to budgets that are not adequate rather than an over-estimation of costs in Phase 1.

Most of the costs in Table 4 represent typical or average costs across jurisdictions. These costs are not necessarily indicative of the costs that could be expected in a jurisdiction with many large, complex buildings or high wages, for example. Section 4.1.1 discusses factors that cause variability in these cost

estimates, and Section 4.1.2 reviews the full range of costs estimated by surveyed jurisdictions. The costs are exclusive of benefits, overhead, and travel, which could potentially triple or even quadruple the presented costs. In addition, the costs presented are incremental, or estimated costs for a jurisdiction that already enforces other codes. This report does not capture the costs associated with developing enforcement infrastructure in jurisdictions without any infrastructure.

Table 4. Comparison of Phase 1 and Phase 2 Typical/Average Costs to Local Government

Expenditure Type	Sub-Type	Sector*	Cost Phase 1**	Cost Phase 2	Cost Comparison Notes
Traditional Enforcement [costs do not include overhead or travel]	Plan Review and Inspection (energy incre-mental)	R	$31-$106/home (average/recommended) *[BCAP 2008, MPUC 2004, OCEAN 2010(a)]*	$25-$51/home (typical); $192+ maximum	High end in Phase 1 contains higher estimates of time spent per home and re-inspections
		C	$13-$1,000s/building (full range) *[DNV KEMA et al. 2012, MPUC 2004, Smith & Nadel 1995]*	$61-$145/building (typical); $1,000+ maximum	Consistent estimates between Phase 1 and Phase 2
	Annual per Jurisdiction (5,000 permits)	R	$156,000-$531,000 (average/recommended) *[BCAP 2008, OCEAN 2010(a)]*	$127,000-$227,000 (typical)	Phase 1 has higher range due to higher recommended time per home, more time for re-inspections, and more homes re-inspected
	Pre-Application Meeting	R, C	N/A	$20-$25/home or building (typical; not just energy)	N/A
Alternative/ Supple-mental Enforcement	3rd Party Review or Inspection	R	$200 (estimated) *[MPUC 2004]*	All or part of permit fees	Phase 2 indicates that 3rd parties may not cost more than using in-house staff
		C	$750-$940 (estimated) *[Cohan 2011]*		
	3rd Party Admin. [including overhead]		$23,000-$300,000 (full range) *[IMT 2011(b); IMT & GBPN 2011(a), 2012; Kunkle 1997; MPUC 2004]*	$25,000-$500,000 (full range excluding 1 high outlier)	Phase 2 is higher range, but fairly consistent
	Perform-ance Testing [payments]	R	$300-$400/home (typical) *[IMT & GBPN 2011(a), 2012; Meres et al. 2012]*	$90-$500/home (full range); $325 median	Consistent estimates
	HERS Rating [payments]	R	$450->$1,700/home (full range) *[OCEAN 2010(b), WSDC 2011]*	$275-$575/home (full range); $400 median	Consistent with low end of Phase 1 estimates
Training	Training per FTE	R,C	$1,250/year/FTE (ex. 29 hours/year each, including downtime) *[BCAP 2008]*	$0-$5,000/year/ FTE (full range); $350 median	Phase 2 typically less than budget estimated in Phase 1; in some cases attributable to in-house or state training
Outreach	Outreach	R,C	$39,000/year (ex. 4 FTE including downtime) *[BCAP 2008]*	$0-$6,000/year (full range excluding 2 high outliers)	For typical jurisdictions, Phase 2 less than costs estimated for Phase 1; not necessarily adequate

*R = Residential; C= Commercial.

** See References section for publication listings. Some Phase 1 costs estimated based on the cited sources. See [Williams et al. 2013] for further details.

4 LOCAL GOVERNMENT LEVEL COSTS

This section mirrors a section from the Phase 1 report that reviewed the processes and resources associated with enforcing building energy codes, primarily at the local level. In Phase 2, information gained from surveys with both general and local experts is discussed, and the cost data are compared to that gathered in Phase 1.

4.1 Traditional Process

As mentioned in Phase 1, local governments typically enforce building codes primarily through a plan review and inspection process. This section discusses details and costs of these processes, obtained from both the general and local surveys.

4.1.1 General Survey

Residential

General experts were provided with an anchor point of 1.25 hours for residential plan review and inspection on average, as estimated by BCAP. [BCAP 2008] There was no consensus as to whether this estimate was appropriate. Eight respondents felt this value was reasonable. Seven felt the time was too low. One felt it was too high in general, and another felt it was too high only for prescriptive code compliance but about right for performance code compliance.

Those that believed the time was appropriate added several caveats that, if not true, would make the estimate higher: (1) few problems occur in the review process, (2) the most appropriate measures are prioritized for review, (3) appropriate tools are available, and (4) houses are conventional and are at code minimum. If these assumptions were not true, then the estimates would likely be higher. One general expert reported that the 2009 and 2012 model building codes require more time than do past codes and that the time requirement may need to double from 1.25 to 2.5 hours. On the other hand, one general expert noted that the industry must figure out a way to expedite this time.

The general experts noted that the time required depends mainly on the following variables:

- provision of plans and drawings (*i.e.,* better plans make for shorter reviews) [mentioned by 7 experts];
- education of plan reviewer and inspector (*i.e.,* the more educated, the less time it takes to conduct plan review and inspection appropriately) [5 experts];
- size and complexity of building (*i.e*., smaller and simpler buildings take less time) [4 experts];
- quality and training of the building industry [2 experts];
- availability of tools for code officials [2 experts];
- cooperation with contractors and scheduling [2 experts]; and
- type of code, errata in the code, and clarity of state codes [2 experts].

Commercial

General experts had more trouble answering questions regarding commercial plan review and inspection time. They were provided with the cue of: "One study estimated that commercial energy code *plan review* time ranged from 10 minutes to 2 hours and for *field inspections*, 15 minutes to 4

hours."[10] Five experts indicated that this seemed appropriate. Four did not give an answer. The remaining eight experts felt that the 10-minute figure was too low and that the range expanded beyond 4 hours on the high end.

On the commercial side, the most prevalent reason for variability, cited by 13 experts, was the type, size, and complexity of building. The experience and knowledge of the code inspector was mentioned by 5 respondents. One expert noted that the variability was based on the code official's "sense of probability and fear. They don't check anything, but rely on whether the stamped drawing meets code."

4.1.2 Local Survey

Residential

Plan Review

For residential new construction, nearly all jurisdictions conducted plan reviews. However, one jurisdiction did not, and another jurisdiction simply reviewed items as they came in at the counter but not as part of a formal review. The local expert from the jurisdiction that did not conduct plan reviews would like to add this task in addition to building inspections, but to do so the jurisdiction would need additional funding.

Many plan reviews primarily focused on architectural and structural items and not on interior building components such as electrical and plumbing that impact energy use in buildings. Therefore, the envelope may be the only energy-related item checked in the plan, with reporting of U-values and R-values often required. However, many jurisdictions noted more extensive reviews, including the Air Conditioning Contractors of America (ACCA) Manuals J, S, and D[11]. A few jurisdictions required RES*check*™[12]. One jurisdiction also required the design drawings to include values that were produced by code compliance software tools (typically RES*check*), as well as a list of all the code-required inspections that have to take place during construction. For this jurisdiction, a professional inspector must sign off that the values in the completed buildings were the ones approved in the energy analysis.

All local experts noted that their jurisdiction generally relied on integrated plan review, where energy code is reviewed at the same time as other codes, such as mechanical. However, one local expert noted that complicated projects went to an energy specialist, and another local expert said that one plans examiner had primary responsibility for energy review, but that other examiners could do it for less complicated projects. A third local expert noted that Manual J calculations were reviewed separately from the rest of the plan review.

---

[10] Values based on DNV KEMA et al. 2012.

[11] The ACCA Manual J Residential Load Calculation standard allows mechanical contractors to properly size HVAC systems based on loads. [ACCA 2011(b)] ACCA Manual S Residential Equipment Selection provides information on selecting and sizing equipment to meet Manual J loads. [ACCA 2011(c)] ACCA Manual D Residential Duct Systems standard allows mechanical contractors to design residential duct systems based on sizing principles and calculation methodologies. [ACCA 2011(a)]

[12] RES*check* is a software tool developed by DOE to "simplify and clarify" energy code compliance for residential building projects. Designers and contractors use this tool to demonstrate energy code compliance to code officials based on project inputs. [USDOE: Building Energy Codes Program 2012(b)]

The plan review time for energy code varied, as did the time spent on overall plan review. Two local experts noted that prescriptive compliance took a lot less time to verify than RES*check*–approximately 15 minutes as opposed to 30-45 minutes. As noted by the general experts, other reasons for variability in responses may include typical building size and complexity in the jurisdictions, as well as experience of designers, contractors, and code officials in each jurisdiction. Other jurisdictions not surveyed may have different conditions that would result in different ranges.

- Time for energy code review ranged from 2-3 minutes (for plans coming from production builders) to 2-4 hours for checking all Manual calculations.
- The median time for energy code review was 30 minutes, and the average time was 43 minutes.
- The total time spent on plan review ranged from 10-15 minutes to 20-30 hours.
- The median time for plan review was 2 hours, and the average time was 5.3 hours.
- The total time spent on energy code review was approximately 20% of the total time spent on plan review.

Residential plan reviewer salaries ranged from $30,000-$113,000, with a median salary of $52,000 and an average of $56,000. The median salary equates to approximately $25 per hour.

Inspection

All jurisdictions required on-site inspections for residential starts except in a few cases where inspections were superseded by the use of ENERGY STAR. While one jurisdiction did not perform inspections themselves, instead requiring the owner to hire a professional inspector (a licensed architect or engineer), the remaining jurisdictions performed inspections with in-house staff. Nearly all jurisdictions had integrated energy inspections, aside from the insulation inspection, which only applies to energy and was often conducted separately. Only two jurisdictions conducted entirely separate energy inspections. The number of site visits including energy inspection ranged from 1 to 15, with a median of 3 and an average of 4.[13] The time for inspections varied significantly as shown below:

- Energy code inspection times ranged from 10-12 minutes to 4-5 hours.
- The median time for energy code inspections was 30 minutes, and the average time was 68 minutes.
- Total time for all inspections of a single home ranged from 1-2 hours to 18-20 hours.
- The median for all inspections was 5 hours, and the average was 7.1 hours.
- Time for an energy code inspection was typically less than 20% of total inspection time.

The salary of a residential inspector ranged from $30,000 to $100,000. The median and average were around $54,000. This equates to approximately $26 per hour. For a given jurisdiction, the salaries were

[13] Inspections including energy code requirements may include foundation, framing, trade rough-ins (e.g., mechanical, plumbing, electrical), insulation, drywall, trade final, and building final (BCAP, SEEA, and Southface 2012). Not all jurisdictions may require all these inspections, as they can be difficult to schedule and each site visit results in increased costs; some inspections may be combined into one site visit. Some jurisdictions may also be reporting site-visits for re-inspections where noncompliance was found on the first visit.

typically the same or lower than those for plan reviewers. Comparing the medians shows a slightly different picture, because not all jurisdictions reported both values.

Commercial

Plan Review

On the commercial side, all of the jurisdictions interviewed conducted plan reviews, although not always for all trades. Eight jurisdictions required COM*check*™[14], while others only required documentation and sometimes load calculations. The documentation required may have various levels of review and verification. One local expert noted that forms with envelope information were not verified, and one indicated that there was not as much review as there used to be. Almost all jurisdictions conducted integrated plan reviews, although one jurisdiction had an exception of a separate energy code review for large projects. One local expert noted that it took the longest amount of time to get compliance on energy code as compared to other parts of the code, and another local expert said that the mechanical reviewer spent almost all of his time on the energy code. The reasons for variability are the same as for residential, although the range is exacerbated due to the wide variety of commercial projects (in terms of building type, size, and complexity) within and across jurisdictions.

- The time spent on energy code review ranged from a few minutes to 2 days.
- The median time for energy code review was 1 hour, and the average was 2.3 hours.
- The total time for plan review ranged from 1 hour to 3 months.
- The median time for overall plan review was 8 hours, and the average was 20 hours.
- For a given jurisdiction, energy code inspection was typically under 20% of total inspection time.

The salary for a commercial plan reviewer ranged from $30,000 to $100,000. The median salary was $55,000, and the average was $59,000. For the median, this equates to approximately $26 per hour.

Inspection

All jurisdictions required on-site inspections for all buildings, but in one case these were done by third parties. Inspections were typically integrated, except for the insulation inspection, which was often conducted separately. The number of site visits that include energy inspections ranged from 1 to 20, with a median of 4 and an average of 5. One local expert reported that inspections focused on the envelope and insulation, because if mechanical system issues are not caught in the plan review, it is too late to make changes in those systems upon inspection.

- The time dedicated to the energy code inspection ranged from 30 minutes to days or months, depending on the type, size and complexity of the building and its mechanical systems.
- The median time for energy code inspections was 1.3 hours, and the average time was 2.7 hours (excluding two outliers of “days” and 6 months).

[14] COM*check* is a software tool developed by DOE to “simplify and clarify” energy code compliance for commercial building projects. [DOE: Building Energy Codes Program 2012(a)]

- The total time spent on all inspections of a commercial building ranged from 30 minutes to 100 hours.
- The median time for all building inspections was 15 hours, and the average time was 24 hours.
- For a given jurisdiction, time spent on an energy code inspection was around 15% of total time spent on inspections.

The average salary for a commercial inspector ranged from $30,000 to $100,000. The median was $55,000, and the average was $56,000. The median hourly wage for an inspector was approximately $26 per hour.

4.1.3 Phase 1 Comparison

Residential

In Phase 1, incremental costs for residential energy code review and inspection typically ranged from an average of $31 up to $100, based on time estimates of 1.25 hours up to 3 hours[15] and wages of $25 to $30 per hour. [BCAP 2008, MPUC 2004, OCEAN 2010(a), Williams et al. 2013]

In Phase 2, the median times for residential energy code plan review and inspection were 30 minutes each, resulting in a total time of 1 hour, about 20% less than the amount BCAP estimated. [BCAP 2008] The median salaries in Phase 2 were $25 to $26 per hour, which is consistent with BCAP's estimate. [BCAP 2008] This resulted in a median estimate of approximately $25 per home. Using average values, we estimated 1.9 hours per home at $26 to $27 per hour, or a total of $49 per home. These costs are exclusive of fringe benefits, overhead, and travel.

The maximum cost calculated for any individual jurisdiction in this survey (maximum time for plan review and inspection times average salary) was $168.[16] One large jurisdiction has a maximum cost for inspection of only $192, but was unable to provide an estimate for plan review. Across all jurisdictions, the maximum times reported ranged up to 4 hours for plan review and 5 hours for inspection, resulting in 9 hours dedicated to plan review and inspection at a cost of $26 per hour, or a maximum per home cost of about $234. The range of costs is not strictly dependent on jurisdiction size.

In Phase 1, costs for a jurisdiction processing 5,000 permits per year ranged from $156,000 to $531,000. [BCAP 2008, OCEAN 2010(a), Williams et al. 2013] Using Phase 2 median and average values for time spent and salary, a typical range estimate was $127,000 to $246,000. The discrepancy in the high end of these estimates is due to BCAP's 2.5 hour recommendation per home [OCEAN 2010(a)], which is higher than the average in the Phase 2 survey, as well as BCAP's estimate of the percent of homes receiving re-inspections (70%) and the time spent per re-inspection (the same time as for the original review and inspection). [BCAP 2008] Phase 2 estimates shown here do not necessarily fully capture re-inspections. This is discussed further in Section 4.1.4.1.

[15] A DOE report not available at the time of the Phase 1 study reported average residential plan review at 1.4 hours and average residential field inspection at 1.6 hours, for a total of 3 hours, based on 130 jurisdictions in Utah and Georgia. [DOE 2013]

[16] The maximum referred to here is the high end of the range provided to us by a respondent. It does not always indicate the absolute maximum in the jurisdiction; it may be the maximum of their best estimate of average.

Commercial

In Phase 1, incremental costs for commercial building plan review and inspection ranged from $13 to $1,000s per building, based on salaries from $30 per hour (code officials) to $135 per hour (professional engineers (PEs)). [DNV KEMA et al. 2012, MPUC 2004, Smith & Nadel 1995, Williams et al. 2013] The time range associated with those costs was from 25 minutes to 6 hours.[17]

In this Phase 2 survey, a median time of 1 hour was calculated for commercial energy code plan review and 1.3 hours for inspection at a median salary of $26 per hour. This equates to $61 per commercial building. Using average values, 2.3 hours was calculated for plan review and 2.7 hours for inspection, for a total of 5 hours. At $27 to $28 per hour on average, this equates to approximately $139 per commercial building.

The average cost is very similar to, but less than, the MPUC 2004 estimate of 6 hours at $30 per hour for small, common buildings. It was noted in the same source that complex buildings cost more, partly due to using professional engineers (PEs). However, in this survey, few general or local experts indicated that PEs would be used for inspections.

It is very difficult to identify the top end of spending for commercial buildings given the wide range of building type, size, and complexity. The maximum calculated cost in any jurisdiction (maximum time for review and inspection times average salary) was approximately $1,000. However, certain projects may require months of an inspector's time, resulting in several thousands of dollars for energy code alone. It is expected that these would be very rare, expect in jurisdictions with many large, complex buildings.

Overall

Phase 2 results regarding time, wages, and costs for plan review and inspection seem to be similar to that available in the literature.

Typical energy code plan review and inspection costs for jurisdictions surveyed in Phase 2 are $25 to $49 per home and $61 to $139 per commercial building, exclusive of overhead and travel time. It is important to note that jurisdictions with large, complex buildings or high wages are expected to have much higher costs, and that overhead and travel time expenses could triple or quadruple the bare costs.

4.1.4 Enhancements

4.1.4.1 Conducting Re-Inspections

General experts were asked about the importance of several ways to increase compliance.[18] Three-quarters (76%) of general experts rated "conducting re-inspections where necessary" as very

[17] A DOE report not available at the time of Phase 1 shows commercial plan review averaging 1.9 hours and inspection averaging 2.5 hours, for a total of 4.6 hours, based on 130 jurisdictions in Georgia and Utah. [USDOE 2013]

[18] Question: "I am going to read several potential ways for local jurisdictions to increase compliance. Some of these actions will lead to increased costs, but we are interested in how you rate the importance of each activity (in terms

important.[19] One respondent added, "This means that jurisdictions can tell builders that they care about energy code: best thing that they can do – sending a signal to builders." Local experts estimated that anywhere from 2-3% to 85% of homes received re-inspections related to energy. The median was 10%, and the average was 21%. Two local experts noted that the percent of re-inspections was reduced since the energy code was first enforced in their jurisdiction; one expert reported that the percent of re-inspections fell from 60% to 10% over 3 years.

The estimated time required for re-inspection of homes ranged from 10 minutes to 2 hours. The median was 15 minutes, and the average was 26 minutes. Using the median salary calculated for residential inspectors, this resulted in a median cost for re-inspection per home of $6.40 for the 10% of homes re-inspected, or $0.64 per home overall. The average cost (based on the average inspector salary) was $11.30 per home for the 21% of homes re-inspected, or $2.30 per home overall.

On the commercial side, local experts reported a range of re-inspection rates from 0% to 100%. The median was 10%, and the average was 22%. One local expert who stated that their jurisdiction conducted zero re-inspections noted that, instead, they relied on design professionals to sign off on the project.

The time spent on re-inspections of commercial buildings ranged from 15 minutes to 2 hours. The median was 30 minutes, and the average was 66 minutes. Using the median salary calculated for commercial inspectors, this resulted in a median cost of $13 per building for the 10% of buildings re-inspected, or $1.30 per building overall. The average cost (based on the average inspector salary) was $29.80 per building for the 22% of buildings re-inspected, or $6.70 per building overall.

Caution should be taken in adding these values to the overall costs for plan review and inspections, because not all jurisdictions were able to provide estimates of inspection time exclusive of re-inspections. Re-inspections were often treated as part of the standard process. Despite this, residential values provided in Phase 1 seem to over-estimate both the incidence of re-inspections and the time spent for re-inspection, at least compared to Phase 2 results. It is possible that the jurisdictions surveyed conduct fewer re-inspections than would be the national average.

If Phase 2 re-inspection estimates are added to the average Phase 2 values shown in Section 4.1.3, this would result in an average cost of $51 per home and $257,000 per jurisdiction processing 5,000 permits a year, which is still significantly less than the high-end Phase 1 estimates accounting for re-inspections. On the commercial side, including re-inspection costs increases the average cost per building from $139 to $145.

---

of increasing compliance) regardless of cost. Please rate each statement from 1 to 7 where 1 means "not at all important" and 7 means "extremely important." How would you rate…". Full results are presented in Appendix A.

[19] Very important represents a rating of 6 or 7 on a seven-point scale. Full response distributions are available in Appendix A.

Jurisdictions often have the ability to charge extra fees for re-inspections to recoup their costs, at least after more than one re-inspection, and the fees are sometimes escalated after multiple re-inspections. Residential re-inspection fees ranged from $25 to $220, with a median of $60 and an average of $74. For commercial buildings, fees ranged up to $840 ($187/hour for an average of 4.5 hours on re-inspection). The median was $62, and the average was $131. However, most local experts indicated that their jurisdictions rarely, if ever, applied these fees, and often only did so if the builder was being particularly uncooperative.

4.1.4.2 Withholding Occupancy Certificates

Three-quarters (76%) of general experts ranked withholding occupancy certificates until the building is compliant as very important. One expert noted that this is "the only lever that a building official has." However, another respondent noted that "in theory they already do this, but in practice, people squawk at this."

Nearly all local jurisdictions surveyed withheld certificates of occupancy, although at least one local expert noted that they had never had to do this. One jurisdiction simply marked a deficiency on the certificate. Two issued notices of violations or citations, and one did not allow more permits to be pulled in a case of non-compliance. Finally, one utility withheld service for non-compliance.

On the commercial side, certificates were mostly withheld. One jurisdiction marked the certificate of occupancy, several issued stop work orders, and one had no penalties but had never had an issue gaining compliance.

4.1.4.3 Pre-Application Meetings

Approximately 60% of the general experts rated improving the compliance process as very important. One potential way to improve the process is to offer pre-application meetings, in which jurisdictions can review requirements with builders or owners before plans are submitted.

Nearly all jurisdictions surveyed offered or allowed (if requested) pre-application meetings for residential projects, and some encouraged it. Some of these were simply informal meetings with counter staff. Three jurisdictions did not offer or allow pre-application meetings at all. One jurisdiction required it for homeowners. Overall, very few meetings were held. The median and average numbers of meetings held were 10% of applicants. Some of this was due to the large presence of tract builders in many jurisdictions. When held, these meetings typically lasted 15 minutes to 1 hour.[20] The median was 45 minutes.

On the commercial side, all but one jurisdiction offered pre-application meetings, at least for major buildings, and one of these jurisdictions required the meetings. The range of applicants having a meeting was 0% to 100%, with a median and average of around 40%. Meeting times ranged from 20 minutes to 4 hours, with a median of 1 hour and an average of 1.3 hours.

[20] One jurisdiction required these meetings in development review for projects requiring use-permits, and these meetings ranged from 3 to 10 hours. These values were excluded from this range.

The values reported for these meetings were for any content, not just energy. In addition, it is unknown how many staff participated in these meetings. As a result, it was difficult to estimate an incremental cost that would be required to discuss energy in these meetings.

On a median basis, assuming one staff member participates, costs for pre-application meetings would be $20 to $25 per home or building, not just related to energy. This indicates that the incremental cost for adding energy to these meetings could conceivably be low.

At least two jurisdictions charged a fee for these meetings, ranging from $150 to $187 per hour.

Other means of improving the compliance process are discussed throughout the report, but cost information was not collected.

4.1.4.4 Increasing Time Spent

A little more than half (53%) of the general respondents rated increasing the time spent on in-house energy code plan review and inspection as very important. As mentioned previously, two respondents noted that more than 1.25 hours are needed to review and inspect the energy code well, especially under the more recent model codes. On the other hand, some respondents indicated that efforts need to be made to reduce the time required–that time is less of an issue if code officials are trained, have better tools, and good documentation is received from designers. One local expert, who had reported a low time for energy plan review, noted that this was because they had well-trained contractors in the jurisdiction.

4.1.4.5 Energy Specialization

About half of the general experts (47%) rated having plan reviewers and inspectors specialized in the energy code as very important. Some respondents indicated that this may be relevant for large jurisdictions, for commercial but not residential projects, or when the energy code is first put in place. However, others felt that code officials should be well-versed in all things.

As noted previously, very few jurisdictions surveyed had dedicated energy reviewers or inspectors. Local respondents differed over the value of this as well. In discussing compliance rates, one local expert reported that their jurisdiction's was likely higher than others, because energy is fully integrated into inspections instead of an add-on activity. He added, "Stand-alone processes are inefficient and therefore less effective." However, another thought that dedicated energy staff would help with compliance. When discussing what they would like to do with more funding, five jurisdictions noted an interest in hiring staff specifically for energy purposes. It is unclear whether energy specialization would affect cost in a positive or negative way.

4.1.4.6 Energy Code Champions

About half (47%) of general experts rated energy code champions as very important. Energy code champions generally receive additional training in energy codes and can be resources for the rest of the staff. General respondents noted that this happens by self-selection, not designation, and some felt that

all code officials should be familiar with the energy code. Many local respondents considered themselves energy code champions.

4.1.5 Permit Fees

Local governments charge permit fees to cover the cost of plan review and inspection. Typically, the fees are based on the estimated value of the construction or the square footage of the house or building. Sometimes, additional fees are charged if specialized disciplines/experts are used (e.g., a mechanical engineer). In the local expert survey, three types of estimates of permit fees for residential construction were reported:

- Value of construction
  - $7 per $1,000 of estimated cost of construction
  - $11 per $1,000 of estimated cost of construction
  - 2% of estimated cost of construction
- Size of home
  - $0.12 per square foot
  - $0.15 per square foot
  - $0.28 per square foot for single-family homes and $0.21 per square foot for multi-family homes
  - $0.50 per square foot of habitable space and $0.15 per square foot of non-habitable space
- Average estimate for a typical home
  - $141
  - $700 - $800
  - $2,200 - $2,700
  - $2,500 for a standard tract home
  - $3,000 - $5,000
  - $10,000 for a large custom home

For the commercial sector, local experts reported that their calculation methodologies were similar to what they use for the residential sector – but that they were more variable due to size, type, and use of the building:

- Value of construction
  - $7 per $1,000 of estimated cost of construction
  - $11 per $1,000 of estimated cost of construction
  - 2% of estimated cost of construction
  - 3.3% of estimated cost of construction for existing buildings
- Size of building
  - $0.14 - $0.18 per square foot for new buildings
  - $0.26 per square foot
- Average estimate for a typical building
  - $1,500 – tens of $1,000s
  - $2,000 - $100,000
  - $2,500
  - $7,500
  - $55,000

As one can tell, there is a lot of variation in both the calculation and quantification of permit fees. While many local governments thought that the permit fee covered all (or most – e.g., 70-90%) of their costs, several local experts were less sanguine and thought that they were lower than what they should be (as much as 50% in one case), were not covering the cost of site plan review and permit review and inspection in the last few years, and were in the process of revising them. And in some cases, other funds (grants, special funds, and the general fund) are used to supplement the permit fees.

It is important to note that raising permit fees is a non-trivial exercise. In particular, general experts noted that while there were not necessarily many limits on increasing permit fees to address the lack of time and funding, there were many political difficulties at the local level in raising permit fees or keeping the permit fees in the building department.

- "Often, the pressure is to keep fees down and to make sure building officials are not too picky."
- "When fees go up too high, [jurisdictions] are scared builders will not pull permits or move to another jurisdiction."
- Some jurisdictions "treat the building department fees as a cash cow, because they go into the general fund, and they don't come back to the department as a reasonable cost of doing business."

4.2 Supplemental and Alternative Processes

As noted in Phase 1, some local jurisdictions use alternative or additional methods of code compliance and enforcement, some of which are mandated in the most recent model codes and in certain jurisdictions. Several of these methods are discussed in this section.

4.2.1 Third-Party Plan Review/Inspection

Third-party energy code enforcement has been suggested in the literature and by general experts as a way to increase compliance and reduce financial burden on local jurisdictions, whose officials may not have enough time, or needed expertise, to focus on the energy code. Where third parties are used, jurisdictions may require builders to hire third parties for plan review and inspection, give builders the option to do so, or contract directly with third parties for work when needed.

Nearly two-thirds (63%) of the general experts rated third-party programs for energy code-specific plan review or inspection as very important. Respondents noted that this may be useful for large, complex buildings and that, moving forward with codes, third-party plan review may be necessary for commercial buildings because of the expertise required to review them. Others cautioned that successful third-party programs require a good infrastructure, including training, oversight, and quality assurance (QA).

Only a few local jurisdictions from this survey already used, or allowed, third parties,[21] and only two local experts whose jurisdictions did not already use them said they would be interested. Most local experts believed that their in-house staff could handle all of the code inspection and review. One

[21] A recently released DOE study showed that 12% and 15% of 130 reporting jurisdictions in Georgia and Utah used third parties for energy code plan review and inspection, respectively. [USDOE 2013]

respondent noted that it would not be worth it to use third parties because the in-house staff has to provide QA for all of the work anyway. Based on these local responses, there may be a disconnect between the general expert preference for third parties and the likelihood of them being implemented at a local level.

4.2.1.1 Third-Parties vs. In-House Resources

One argument made in the literature for using third parties is that local governments may not have the resources to fund enough staff and staff time to focus on the energy code (contrary to what the local experts noted in the previous section).

General experts had mixed feelings on whether increasing in-house resources or using a third party was a more appropriate choice for local governments. Many said it depended on the municipality and the economy. Seven experts chose the third-party option as appropriate. Three chose increasing in-house staff as appropriate. The remaining experts did not select either.

One general expert noted that third parties are "not universally better, but for a lot of things coming into code, like testing, the local inspection department is not qualified." One of the respondents who favored in-house staff noted: "If building departments make a commitment to hire staff with expertise, they could be more influential."

As noted by the general experts, the advantages of third parties included: their knowledge of the codes, the ease of implementing code review and inspection, and their ability to provide technical assistance. As noted by one general expert, third parties are "almost always going to be better versed and more experienced on the energy code; they can do it faster and better. They don't have to focus on all the other issues, so they have a tendency to catch nuances better." The general experts also noted the disadvantages for third parties, including the cost to the building owner, the loss of authority to the local jurisdiction, and concerns over consistency when using different entities.

As noted by the general experts, the advantages of in-house staff included reduced administration costs for the jurisdiction, being seen as a "go to" source for their community, having staff to work with builders and the trades both in the office and in the field, retention of authority, and the ability to control quality. The general experts also noted the disadvantages of using in-house staff, including budget instability (leading to hiring and firing of staff), the lack of budget to hire or train more staff, and the possibility that local inspectors may not understand the code as well as third parties and may not be available to provide guidance.

As shown below, some general experts indicated that there should be a balance between in-house and third-party services:

- "Have a core group and expand beyond with outside services. As workload fluctuates, bring on additional third-party folks."
- "Continuity/consistency of effort over time is critical for compliance and enforcement. If the building department gets better trained staff, they should be able to provide continuity over

time. But if funding is not there, and staff come and go, then you lose continuity. If that is the case, bring in a third-party plan inspector with an associated fee to do the work."

- "The better way to do it would be to have educated staff who are there and looking at it the way we look at everything else (building, wiring, framing). However, with the energy code specifically, you start to get into a lot more of the higher technological stuff, the testing, that sort of thing that you wouldn't expect the building official to have those tools or be certified to operate them, so that's where it starts to become more practicable to do that as a third party (like special inspections for structural stuff)."

Both general and local experts expressed interest in using third parties more as consultants rather than simply as providers of plan review or inspectors. General experts noted:

- "[Using third parties is] shifting support to builders rather than to code officials. Mandate technical assistance because they have to do modeling."
- "Third parties are HERS raters or BPI [Building Performance Institute] analysts and are qualified to provide guidance on energy efficiency of a home in general and will often do that for a builder."
- "It is more appealing to the construction industry to spend additional money not on regulatory expertise but on technical assistance and on people with energy credentials… It is too late once you go to code review. "
- "[Third parties] would extend staff capabilities and identify and solve a lot of problems before plan review and inspection."

One local expert would like 50% of third-party time to be used for outreach to contractors and do-it-yourselfers. Another local expert would like a third party to be involved throughout the whole process from development to inspection.

4.2.1.2 Use and Cost

Where third parties are used, jurisdictions may require builders or owners to hire third parties for plan review and inspection, give builders or owners the option to do so, or contract directly with third parties for work when needed.

On the residential side, four of the surveyed jurisdictions outsourced plan review or inspection to a third party if overloaded. In this capacity, third parties were most frequently used for all types of reviews or inspections, not just energy. One jurisdiction required owners to hire third-party inspectors and did not do any inspections themselves. Two others accepted ENERGY STAR, which uses third-party inspectors. The remaining jurisdictions did not use third parties in any way.

On the commercial side, five jurisdictions outsourced plan review to a third party as needed, while two others had done so in the past. Another local expert noted that their jurisdiction might use a third party if their staff saw something very complex. Only one jurisdiction had a third-party option available for commercial buildings, which was further described as a plan review program typically used by builders for bigger projects to expedite the process. Another jurisdiction required owners to contract with third parties for all inspections; none were done in-house.

Cost Per Home/Building

The Phase 1 literature review indicated that third parties may cost more than in-house resources: one source estimated $200 per residential inspection for energy code (including overhead and travel) [MPUC 2004], and another estimated $750-$940 for a commercial energy plans examiner or inspector. [Cohan 2011, Williams et al. 2013] However, general experts were split on this issue. Six experts thought in-house review and inspection would be cheaper, and they primarily noted that this is because local jurisdictions would not increase the costs as appropriate or enforce everything. One general expert thought the cost per home would double if using third-party inspection. Seven experts thought third parties would be cheaper and cited inefficiencies in government processes and the potential cost-effectiveness of third parties. Two respondents noted that the costs should not be any different between the two options.

Local jurisdictions that outsourced plan review and inspection gave third parties either all, or a portion of, the plan review or permit fees. This indicates that third parties are often no more expensive than in-house plan review and inspection. One local expert specifically reported that it was cheaper for them to outsource. However, when not outsourced, but negotiated between the builder or owner and the third party, it is possible that fees may differ.

Administrative Costs

The general experts were given an anchor point of $131,000 to $250,000 per year for administration of a third-party program. These values were derived from Phase 1.[22] Most general respondents found this range reasonable, but again, there was no consensus.

- Only one respondent felt this number was too high, based on the fact that the administrative costs of the City of Austin's performance testing program were actually only around $25,000 (15% of the $131,000 value cited in Phase 1). [IMT 2011(a)]
- Nine of the respondents believed that this range was reasonable at the state and/or local level.
    - Some noted that it would cost less at the local level than at the state level, while others noted that it was reasonable at the state level but not affordable at the local level, and still others noted that it would be the same cost at both levels.
    - One general expert noted that this range was similar to the administration costs for a state building official licensing program that would likely be similar in nature.
    - One expert noted that the range is too high for only maintaining a database, but appropriate if it includes QA.
- Two general experts believed that the range would be higher on the high end, depending on the size of the jurisdiction.
- Three respondents believed that the entire range was too low.

[22] See Phase 1 references [IMT & GBPN 2011(a), 2012; Kunkle 1997; MPUC 2004]. Phase 1 also included an estimate of $23,000 for one jurisdiction's oversight of expedited plan review [IMT 2011(b), Williams et al 2013], but this was not included in the anchor points provided to Phase 2 experts.

- Two experts estimated that the statewide cost of a third-party program, including training, would be $500,000, although one of the experts noted that adding rebates to municipalities would add a large amount of cost.
- The third expert said it could be a few million dollars.

Overall, national experts offered a range of administration costs for a third-party plan review and inspection program from $25,000 to $500,000, with one outlier in the millions.

Very few local jurisdictions allowed builders or owners to use third parties, and, of those that did, they did not provide information on administration costs. Only one local expert indicated that there was any significant amount of administration effort in this area. Many jurisdictions just relied on builders or owners to hire third parties with acceptable certifications, which may be determined at the state level.

4.2.2 Performance Testing

Performance testing determines compliance through testing building envelope and duct leakage, along with other building features.[23] About half (53%) of the general experts rated performance testing as very important. One respondent noted that performance testing can do a lot of good, but it does not tell you the whole story. Another respondent noted that, while the potential is great, practicalities are difficult. To date, the respondent reported that one of these issues has been the cost of obtaining the equipment for conducting performance testing.

For residential buildings, 14 jurisdictions surveyed used performance testing for compliance. Some local experts noted it was only used in the performance approach, and one noted that performance testing was optional because their state allowed visual inspection as an alternative. Only five jurisdictions had no performance testing. One local expert noted that, if they had additional funding, they would like to add performance testing. Where performance testing was involved, it was done by third parties or the contractor themselves.

For commercial buildings, 10 jurisdictions had no testing requirements. Other jurisdictions had mandatory or voluntary performance testing. Building codes may only require performance testing in certain cases – for specific building types or alterations, for example.

Fees for performance testing are typically paid by the builder or owner to a third-party testing company. In Phase 1, the review of the literature reported an average cost of $300 to $400 per home tested. [IMT & GBPN 2011(a), 2012; Meres et al. 2012]

Five local experts offered estimates of the costs for performance testing, ranging from $90 to $500. The median was $325, and the average was $275.

[23] Performance testing is required by the 2012 International Energy Conservation Code (IECC) and therefore is mandatory in jurisdictions that have adopted that code, but it supplements, rather than replaces, traditional plan review and inspection.

Costs depend on the tests required and the inclusion of other inspections as are done in a full HERS rating. The low end would be for a single test such as duct leakage. Overall, the ranges in this survey are similar to those reported in Phase 1.

4.2.3 Voluntary Programs

Less than one-third (29%) of the general experts rated the use of existing voluntary above-code programs (such as HERS[24], LEED [Leadership in Energy and Environmental Design], ENERGY STAR, etc.) as very important.[25] Several general experts had significant concerns over the use of these programs:

- Most of the existing voluntary above-code programs do not perfectly align with the energy code (although another expert noted that you could have LEED plus mandatory requirements).
- A HERS rater would require specific training on the energy code.
- Programs may not be policed well.
- Local officials may tend to rely on them to the detriment of other projects that do not have to be above-code.
- The HERS program does not provide cost-effective public service, but rather is designed to sustain a business model.

On the residential side, four jurisdictions allowed HERS but used it only as a supplement and, at least in one case, only when required by state law. Four jurisdictions allowed ENERGY STAR, and, of these, three used it to replace inspections. One jurisdiction used LEED for expedited review. Two jurisdictions would accept voluntary programs, but they had never been used. Another jurisdiction would accept a local Net-Zero program. On the commercial side, there were no alternative compliance paths except in one jurisdiction where LEED expedited plan review. Another local expert noted that their jurisdiction would allow LEED or Green Globes[26] if it ever came up.

As with performance testing, fees for services like HERS are typically paid by the builder or owner to a third party. In Phase 1, the cost of a HERS rating per home was reported to be between $450 and $1,700. [OCEAN 2010(b), WSDC 2011]

Five local experts offered estimates of the cost of a HERS rating, from $275 to $575. The median and average costs were $400 per home, which is on the low end of that reported in Phase 1.

[24] A HERS rater can work with developers from start (building plans) to finish (occupancy), developing a HERS index to determine whether the building complies with code. Technically HERS is a rating and is not necessarily above-code, as a home that does not meet code can still acquire a HERS rating. However, many voluntary programs utilize HERS ratings and process as part of an above-code program.

[25] Some jurisdictions already mandate previously voluntary programs; the California Energy Code contains mandatory HERS rater requirements with diagnostic testing for certain buildings. [CEC 2008] The 2015 IECC will allow a HERS Index Score to be used as a voluntary performance compliance path.

[26] The Green Globes is an online building assessment and rating tool, with guidance for green building design and operation, which was developed originally by the Canadian Standards Association and later revised as it was adapted to different markets (e.g., the United States). www.greenglobes.com

One general expert speculated that true HERS costs per home should be in the $1,200 to $2,000 range, and that $400 is only possible when sampling is used for production homes – where all homes receive a rating but only a fraction are actually inspected and tested. Additionally, low costs may be a result of lack of quality, in which field work is not as thorough as it should be and there is not enough QA. However, others speculated that the high end costs noted in Phase 1 may simply be a locational anomaly.

4.2.4 Commissioning

Less than one-third (29%) of general experts rated the use of building commissioning as very important. Respondents said this would depend on the size and type of building. Some respondents noted that the commissioning agent currently was not responsible for knowing the code, that what they checked in commissioning may not be a code requirement, and that you cannot use commissioning to verify compliance−but it could be part of compliance. Commissioning with local jurisdictions was not discussed in Phase 2. In Phase 1, commissioning cost was reported as between 2% and 20% of project costs [OCEAN 2009; PCS et al. 2000]; however, commissioning cost information was not collected in Phase 2.

4.2.5 Licensing

In Phase 1, it was noted that local jurisdictions unable to financially support a code enforcement infrastructure could implement a licensing model in which a licensed design professional is responsible for compliance on plans and final construction, and licenses could be revoked if they were found to have signed off on non-compliant buildings. As one general expert suggested: “In every state, have licensure laws for design professionals include responsibility for building performance or code compliance. Train the people that design buildings and hold them responsible.” One local jurisdiction surveyed relied on design professionals to sign off on the final construction.

As noted previously, many general experts suggested that improving the education of design professionals could make great contributions toward reducing costs and increasing compliance. These experts were not necessarily suggesting a model dependent solely on the design professional, but such education would improve the licensing model as well.

Costs on this type of model were not collected in the Phase 2 survey, but, as noted by some experts, relying on design professionals could reduce costs to jurisdictions. Instead of complete plan review and inspections, jurisdictions could audit the design professionals in order to hold them accountable.

4.3 Compliance-Related Investments

This section reviews four core investments not directly related to the enforcement process but, as noted in the literature and by interviewees, likely critical to increasing compliance. Local jurisdictions may conduct these activities themselves but often have difficulty funding them. The next section will discuss roles that other entities can take in these activities and others to improve compliance.

4.3.1 Training and Certification of Code Officials

Seven in 10 (71%) general experts rated providing additional energy training opportunities for code officials as very important. One respondent warned: “…remember motivation and culture: they need to be concerned about the topic. If they care about it and don’t have the training, then they need training.

If they do not care about the code, training won't help." Some respondents noted that it had to be the right type of training, and others suggested that jurisdictions would be better off to hire trained people or to use third parties.

Two-fifths (41%) of respondents rated requiring energy certification as very important. Some respondents noted that this is not absolutely necessary as you could learn on your own. Thirteen jurisdictions surveyed had at least one employee with IECC energy code certifications. One jurisdiction based pay raises on the employees' acquired certifications (not all related to energy), allotting a 3% raise per exam, up to 6% per year.

In Phase 1, the per-student training costs were reported to be $60 to $93 for a webinar or in-person training [BCAP 2008], and $100 to $250 for International Code Council (ICC) certification for the energy conservation code. [BCAP & AEO 2010, BCAP et al. 2012] Total spending was estimated to be $5,000 per year for a jurisdiction with 4 FTEs for a recommended 29 hours of coursework per year including training costs and downtime. [BCAP 2008] This equates to $1,250 per year per FTE.

Of local jurisdictions surveyed, spending on energy code training ranged from $0 to $5,000 per FTE per year, although some values may include non- energy-related training. The median value was $350 per FTE per year, although this excludes three jurisdictions that reported spending very little (non-quantified).

The per-FTE spending in many jurisdictions is fairly consistent with attending one or more energy-related trainings a year or becoming ICC certified. However, except for in one jurisdiction, the spending was generally less than that recommended by BCAP, although in many cases the reported spending may not include estimates for downtime. In some cases, jurisdictions that spent nothing or very little on training did so because the state provided the training, the jurisdiction utilized other free trainings, or the jurisdictions provided only in-house training at staff meetings. However, in some cases the jurisdictions had no energy-related training requirements.

4.3.2 Energy Training for Builders/Tradespeople/Construction Workers

Seven in 10 (71%) general experts rated providing additional energy training opportunities for builders/tradespeople/construction workers as very important. A few respondents noted that design professionals should be included in this group. Costs for this activity were not collected in Phase 1 or Phase 2, as local governments rarely undertake this activity. Section 5, Roles Outside the Local Government, and Section 6, Key Ways to Reduce Cost and Increase Compliance, discuss training for industry in more detail.

4.3.3 Outreach

Two-fifths (41%) of general respondents rated educating home and building owners about the value of energy efficiency and code compliance as very important. Two experts who thought it important noted that it was "foundational" and that the public thinks they already get an energy-efficient home when they buy a new home. As noted previously, many local experts viewed outreach as extremely important

and believed that external funding for this would be a good expenditure. Several jurisdictions noted that they relied on code official associations for outreach activities.

In Phase 1, BCAP's estimated annual outreach budget was estimated to be $39,000 based on a jurisdiction size with 4 FTEs. [BCAP 2008]

In Phase 2, some jurisdictions reported having no outreach budget; they might have a couple of handouts on building energy efficiency that never get revised. The most typical estimate given ranged from $100 to $2,000 per year, with one jurisdiction reporting $3,000-$6,000 per year. However there were two outliers: one local expert from a major city estimated $50,000 per year and another had a budget in the millions, but not just for energy-code related matters.

Setting aside the large cities, which would have more than 4 FTEs, the jurisdictional outreach budgets were considerably less than the spending recommended by BCAP.

4.3.4 Information Technology

One-quarter (24%) of general experts rated investing in information technology (IT) as very important. Respondents expressed concern that building departments could not afford it and would not know how to use it, that IT does not reduce costs to the building department (only to applicants), and that IT was not as important as the other options for increasing compliance.

The local jurisdictions interviewed for this study had a mixture of software programs. Almost all had some type of software, but most were used just for tracking. Five specified that they included electronic plan review, and only one jurisdiction was paperless. Several local experts expressed dissatisfaction with their software and a desire to upgrade.

In Phase 1, costs for software acquisition ranged from $1,000 to $4 million. [NCSBCS 2005] Costs were not collected in Phase 2. IT could be a significant cost to a jurisdiction, but IT may allow for cost reductions in the long run by speeding up the inspection and review process.

5 ROLES OUTSIDE OF LOCAL GOVERNMENT

Utilities, states, and the federal government can make a shared contribution to ensuring compliance with building energy codes. This section reviews some of these potential roles, as suggested by the experts surveyed in Phase 2, but Phase 2 did not collect costs in this area.

5.1 Utility

Overall, both general and local experts felt that the most appropriate energy code-related role for utilities is in providing training to both code officials and the building industry.

General experts suggested the following as appropriate roles for utilities in terms of increasing compliance:

- Training (for code officials, builders and industry) [mentioned by 12 experts];

- Technical support (computer systems, tool development, on-site education on complex mechanical systems and load-sizing, operating testing equipment, etc.) [5 experts];
- Above-code programs (with incentives) [4 experts];
- Program funding/management (third party or comprehensive) [2 experts];
- Code development and encouragement of adoption[2 experts]; and
- Advocacy on elected officials for adoption and enforcement [2 experts].

While two respondents mentioned tying utility hookups with compliance with the energy code, one of those respondents noted that one utility tried that a few years ago but stopped. Five other respondents noted that utilities should not or do not want to be involved in code enforcement. However, one respondent suggested: "Before they interconnect a home or business to their grid, that is one level of certification that they could provide outreach and training on to existing and potential customers."

National experts were also asked to rank several roles for utilities. As in the open-ended responses, experts ranked training as the most appropriate role for utilities, but also ranked highly a few other activities that had not been mentioned in responses to the open-ended question. At least 50% of respondents rated the following activities as highly appropriate for utilities[27]:

- Training for code officials [ranked as highly appropriate roles by 82% of respondents];
- Training for builders/tradespeople/construction workers [82% of respondents];
- Rebates for performance testing [65%];
- Code compliance studies [65%];
- Voluntary above-code programs [63%];
- Performance testing program [59%];
- Stakeholder processes such as building code advisory councils [59%]; and
- Outreach to home/building owners [56%].[28]

Local experts were asked a similar set of questions, and the top requested utility services included:

- External training (designers/builders/installers/contractors/advisors, etc.) [mentioned by 7 experts];
- Internal training (code officials) [4 experts];
- Incentives for contractors/builders/homebuyers (such as for high efficiency appliances) [3 experts]; and
- Funding staff [2 experts].[29]

[27] Ratings of 6 or 7 on a scale from 1 to 7 where 1 means "not at all appropriate" and 7 means "extremely appropriate" were considered to mean highly appropriate.

[28] Activities garnering highly appropriate ratings from between 40% to 49% of respondents include: fund/administer third-party programs; provide as-needed code assistance for complex systems; fund local jurisdiction staff; provide tools such as guidebooks or checklists; provide rebates for HERS ratings; and fund diagnostic equipment. The remaining activity, providing energy code plan review and inspection, was rated as highly appropriate by 12% of respondents.

Many local experts mentioned that their utilities already provided training, and two local experts reported that their jurisdictions received regular funding from their utilities for energy-related staff.

General experts indicated that the primary way to encourage utilities to get more involved in code compliance and enforcement was to obtain regulatory support that would authorize the utilities to claim savings for these activities. This would also require decoupling and additional work to establish ways to get credit. See Phase 1 references [Cooper & Wood 2011, Misuriello et al. 2012, Stellberg et al. 2012] as well as [Groshans & Lee 2013] for more information.

Phase 1 reported costs of utility code enhancement programs from $125,000 to $3.8 million per year. [Stellberg et al. 2012]

5.2 State and National

General experts were asked to rate ways to increase compliance that do not occur at the local level, and these methods did not receive much support. However, throughout the interviews, general and local experts suggested additional roles for state and national bodies, which are also discussed in this section.

5.2.1 Stakeholder Collaborative

About half (47%) of the general experts ranked "running a state stakeholder collaborative on energy code adoption and compliance" as highly likely to increase compliance.[30] In particular, two general experts suggested the use of a code collaborative as a way to reduce costs or increase compliance, and one local expert noted that if they had additional funding they would like to send staff to statewide collaborative efforts. One general expert noted that, in California, the stakeholders work together and make the process work rather than fighting one another. Another expert noted that an industry-wide advisory group is good, but it cannot be too large. One state's code compliance collaborative has been "valuable identifying the baseline situation of who is doing what, what level of compliance activities exist, where there are gaps, where there is nothing."

In Phase 1, an annual budget for a state energy code collaborative was reported to be $140,000. [CPAP 2011]

5.2.2 Liability Structure

Two-fifths (41%) of general respondents rated "developing a liability structure under which code officials could hold relevant parties accountable" highly likely to increase compliance. Respondents expressed concern over political backlash and the fact that code officials want to be helpers rather than police.

5.2.3 Auditing

One-quarter (24%) of general respondents rated "auditing local governments for compliance through random surveys" highly likely to increase compliance. Respondents noted that more pieces are needed to be effective, it could be a "hornet's nest", it could be defensive, and that getting building officials to

---

[29] Other activities suggested by one respondent include: providing performance testing; providing energy inspectors or third-party energy auditors; and helping with state collaboration to increase enforcement statewide.
[30] Responses of 6 or 7 on a seven-point scale where 1 means "not at all likely to increase compliance" and 7 means "extremely likely to increase compliance" were considered as ratings of highly likely.

cooperate would be difficult. However, one local expert recommended auditing; he said that his state used to do it before the recession, and they should be doing it again.

5.2.4 Demonstration Programs

Two in 10 (19%) general respondents rated "state or national demonstrations on code compliance best practices" highly likely to increase compliance. One respondent noted that, when done previously, no one paid attention, and that it would not have a big effect nationally. Two respondents noted this would be better done at a state rather than national level.

Most local experts said they would be interested in a state or national demonstration program if one existed. However, many believed that they would essentially be leading it. One noted that they had participated in one with their utility, and they did not really get any recommendations.

5.2.5 Training

A few states represented by local jurisdictions in the survey provided training for code officials. One general expert noted, "If there are state mandated minimum codes, the state ought to be charged and delegated with the function of certification and training, so that it is consistent and available, and generally that it gets written into the law that the municipalities have to allow the officials to get the training in order to be certified." Some states add a small surcharge to permit fees to run statewide training and certification programs. Code officials may have to take a minimum number of hours of training to perform functions such as issuing permits or certificates of occupancy. Experts suggested that this type of training could be required for third parties as well.

At least three local experts were Energy Code Ambassadors, part of a state-level train-the-trainer program piloted by BCAP and the International Code Council.[31] These respondents spoke highly of this program and their roles providing training and technical assistance to others. In Phase 1, the cost for this program was reported to range from $16,000 to $49,000 per state. [Williams et al. 2013; see Appendix A]

Four local experts mentioned that they have received state or federal grants for education.

5.2.6 National Role

Overall, many general experts, in particular, were wary of national programs and national involvement in code compliance and enforcement both because of the differences among state requirements and the public's dislike of national interference. However, some experts felt that an entity like DOE could serve a role in facilitating development of certification standards for code officials or third parties or in signing off on alternative programs as being code equivalent. For example:

- "Some sort of a certification program and ANSI [American National Standards Institute] standard for quality of services and all the necessary things that an organization has to do. Similar to NAVLAP [National Voluntary Laboratory Accreditation Program] for geotechs. A national accreditation body that develops exams, does minimum requirements for certification that the

[31] For more information about this program, see: http://energycodesocean.org/ecap.

state can point to and say that is what they have to do. That is even more preferable– consistency from state to state. Handled through an association of people who are interested in the work who would develop an ANSI standard similar to what ACCA has done with their QI [quality installation] standards."

- "If equivalent to a minimum, you could use [a compliance alternative], but DOE would need to sign off on the program as being code equivalent."
- Recognized national certification standard like ACI [American Certification Institute].
- Broader national certification program not linked to private programs like HERS or BPI.

6 KEY WAYS TO REDUCE COSTS AND INCREASE COMPLIANCE

Some ideas for increasing compliance and reducing costs to local government have been scattered throughout this report. In this section, key themes related to this topic derived from several pointed questions to both pools of experts are presented. General experts were asked how the costs of compliance could be reduced as well as about the best ways to increase compliance at any level (regardless of cost), and specifically at the local level. Local experts were asked about what they would do to improve compliance with energy codes, if they had additional funding. Local experts also brought up additional needs, particularly for outside funding, in their final comments. Similar themes ran through all of these responses. This indicates that methods used to increase compliance, taken as a whole, may not necessarily be counter-productive in reducing costs to building departments for ongoing enforcement activities (*i.e*., plan review and inspection).

Based on the surveys, eight key methods to reduce costs and increase compliance were identified, as listed immediately below and further described in the following pages; the listing is not ranked in order of priority.

1. Conduct **education and training.**
2. Enhance responsibility of **design professionals.**
3. Conduct **outreach** with improved **messaging.**
4. Increase **funding** for staff and resources.
5. Use **third parties** (or voluntary programs).
6. Develop processes and tools to **streamline** compliance, review, and inspection**.**
7. Review **compliance paths** and **infrastructure.**
8. Increase **buy-in** of key stakeholders in compliance and enforcement.

Many of these themes are similar to those identified in Phase 1, as well as in the literature. For example, these methods address some of the main barriers to compliance and enforcement identified in Phase 1 including: (1) lack of incentives for compliance, (2) lack of knowledge from builders and designers, (3) lack of resources in local government, (4) low prioritization of energy codes, and (5) lack of knowledge and training for code officials. [Williams et al. 2013] In addition, the recent DOE report on pilot studies of code compliance assessment identified similar key problems of (1) education/training, (2) time/staff, and (3) lack of information on plans. [USDOE 2013] Furthermore, the listed methods are similar to the

"broad based coordinated strategies" discussed by Eric Makela of the BrittMakela Group in a presentation at a DOE code compliance technical meeting in April 2013. [Britt & Makela 2013]

This list is not comprehensive; many more thorough studies on this matter exist, particularly focused on individual jurisdictions. [See Williams et al. 2013 for extensive references.] In addition, the U.S. Department of Energy (DOE)'s Building Energy Codes Program has developed several tools and resources to address many of the listed activities (e.g., see www.energycodes.gov/compliance).

This study does not assess the incremental value of increasing spending or implementing these suggestions. Some jurisdictions, particularly those with high compliance rates, may not achieve cost-effective energy savings through increasing building energy code compliance.

6.1 Education and Training

Experts noted that education and training of code officials and builders are important for reducing costs and increasing compliance. One local expert noted: "The biggest challenge we have for meeting the energy code, without a doubt, is education. That starts with the educators at the community colleges. They don't all understand the importance. The architects, engineers, code officials, contractors, everyone needs an education." Another local expert noted: "Even licensed energy consultants do not do [plan review] correctly."

One local respondent indicated that, when they first started enforcing the energy code, compliance was 0% and remained below 50% for more than a year. The respondent added: "Training and outreach are essential in order to get a reasonable design-plan review-construction-inspection-processing operation up and running."

Training may increase costs in the short run. However, education may also decrease costs in the future by reducing time required for plan review and inspection: "Building contractors need to understand what it is they are trying to build. With more education, it becomes easier, so compliance becomes easier because the contractor is doing it right, and, if the inspector understands the intent of the code, it comes together better." Several general experts indicated that, the more educated a code official was, the less time it would take for plan review and inspection.

About one-third of local experts wanted more training for their staff, and several others noted that they would like to have more education for designers, contractors, manufacturers, and homeowners. Some local code officials took it upon themselves to educate the builders and contractors:

- "Every house that fails is a chance to teach."
- "I try to do it in a way that shows them they can build the [best] houses in the country. [I ask them:] Do you want to build great houses or mediocre houses?"
- "In the last 10 years the builders and the trade contractors that I have taught and been in contact with will never ever go back to the way they used to do things because they found a way to do it better and more cost effectively, and now they are providing a product that is as good as they claim. By showing them the path through energy code stuff they are able to build houses that are comfortable, healthy, and durable. And they have gotten rid of mold. Through

education they have started to appreciate energy code. They aren't seeing the warranty calls that they used to get."

However, educating builders one by one in the field may not be sustainable for all jurisdictions or even appropriate. One local expert noted that education should take place in vocational-technical programs in high school, community colleges, university architecture and engineering programs, and through apprenticeships. General experts recommended tiered training approaches offered statewide, circuit riders[32], and development of self-paced and on-line training modules with a marketing campaign. In addition, one expert noted that the impact of training must be measured in order for it to be fully effective. Both general and local experts also recommended that training and education were appropriate and important roles for utilities to undertake.

6.2 Design Professional Improvements

Experts recommended expanding the use of design professionals as a way to reduce costs (to local building departments) and increase compliance. Recommendations for how to better integrate design professionals included:

- Stimulating the design team to think about well-performing buildings upfront and give information to local government that reflects that thinking;
- Implementing curriculum on building energy codes in university systems, including architectural schools and engineering schools;
- Implementing licensure laws for design professionals, which would include responsibility for building performance or code compliance;
- Encouraging design professionals to put full information related to the energy code on the plans and to call it out accurately;
- Enlisting professional associations in partnership to train their memberships; and
- Encouraging the design community to pay more attention to what goes on at the model code process.

However, one general expert noted that many design professionals are adequately competent but may not be convinced that the energy code provisions will be enforced or that not meeting them may impact their ability to get a permit or pass inspections.

6.3 Outreach and Messaging

While general experts did not rank outreach highly as a way to increase compliance, in the final comments on the local survey, several local experts expressed the need to provide outreach to building owners and homeowners, in particular, but also to contractors. This was not an activity that they felt they could fund themselves, as it would increase their costs. However, if outreach drove demand for compliance, and builders started building more compliant buildings, the time needed for plan review and inspection could decrease.

[32] Circuit riders are a team of building officials who travel from jurisdiction to jurisdiction in order to review projects in person, respond to outstanding questions, and provide hands-on training.

One expert stated:

> "Everyone involved starting with the builder, going through from designer/architect to buyer, needs to understand the importance of efficiency in terms of the environment, the future, and their own pocketbooks – *i.e.*, lower energy costs, more comfort, and longer lasting… The whole [building] industry needs to care about efficiency for it to be the norm rather than dependent upon enforcement."

At least three local experts mentioned that outreach needs to include information on energy and cost savings accruing to the owner of a building that meets energy code requirements. One expert noted that outreach is needed, because people "don't realize we are saving them money." Another noted that the outreach that does take place is effective, because people want to save money. One local expert noted that for the customer, energy efficiency is not visible, but labels (like ENERGY STAR) are, making labels easier to sell. The expert also mentioned that, if there was more demand for ENERGY STAR-compliant buildings, builders would not complain when [ENERGY STAR requirements] get ratcheted up.

BCAP has recently begun engaging consumers in five states to create demand for energy code compliance, using trained spokespeople, articles, and ads, informed by a 2011 survey of 5,000 consumers. [Guttman 2013] The BCAP survey found that 82% of consumers felt they had a right to a home that meets minimum energy efficiency standards. [Guttman 2013]

6.4 Funding Increases

General experts felt that increasing compliance could come from increasing funding to add staff, pay better inspectors, allow more time to do work, or pay for training: "Some administrations won't let officials take time off or pay for training. They expect the individual to do their job in a changing technological environment without continuing education."

About half of local experts cited a need for additional staff for plan review or inspection, and, of these, five local experts wanted energy-specific personnel. They noted that increasing funding would not reduce costs for compliance in the short term, but in the long term better trained staff could lead to cost efficiencies.

6.5 Third Parties and Voluntary Programs

Use of third-party programs was mentioned by general experts both as a way to reduce costs to local governments and as a way to increase compliance. General experts felt third parties should be used for plan review and inspection, with oversight and QA of third parties conducted by the administering jurisdiction or state. It is important to note that this would reduce the costs to the jurisdiction (assuming administration and QA required less time than in-house plan review and inspection would) but could potentially increase the costs to builders or owners, as they would generally be responsible for contracting with the third parties. Two general experts suggested that the use of design professionals who are required to use building energy use models and are de facto involved with the entire project would increase compliance. As suggested by one interviewee, this could be done by mandating use of HERS or LEED, for example. Several experts noted that there may also be a role for DOE in facilitating

development of certification programs for professionals or in signing off on alternative code compliance programs.

Despite the general expert interest, very few local experts reported that their jurisdiction used third parties, and only one mentioned third parties on their list of ways to improve compliance. That local expert was particularly interested in a third-party inspector who could oversee the whole process from development through completion.

6.6 Streamlining and Tools

Experts suggested streamlining of the code compliance and enforcement process as a way to reduce costs and increase compliance. Streamlining could increase up-front costs while reducing future costs. Streamlining may include electronic plan review and tracking, improved communication such as through websites, and standardization of templates and structures. For example, one expert noted that code officials should be presented information that is "complete, accurate, and consistent among applicants." Another simpler approach suggested is to staple all energy code compliance requirements to plans and make sure the inspector has a copy of the plan and code requirements.

Experts noted that tools should help to prioritize code official efforts. One expert recommended "a handful of iPad devices that allow check box type code compliance surveys on site." Another general expert expanded on the need for checklist-type tools:

> "There are a lot of good tools, but they don't make their way into the hands of the code enforcement community with any degree of regularity. [Examples include] plan review record checklists by ICC and ENERGY STAR; these are very useful and aren't used to the extent they should be. People don't know what they are, how they work, or see value in them working for them. "

In addition, the same expert noted that integrated checklists must be developed for site visits that include "structural, egress, light and ventilation, and energy mandatory requirements," specific to the jobs that need to be done at the time each site visit takes place. He added, "If those were developed and implemented, we would see much larger and actual concentration on a lot of things that get passed by – particularly energy."

Local experts also expressed interest in information technology, such as software to run Manual J calculations (required by code), and handheld devices.

6.7 Compliance Paths and Infrastructure

Experts mentioned code types (often referred to as compliance paths) as a way to reduce costs but not as much as a way to increase compliance. While one general expert felt that a prescriptive code would reduce costs, another felt that performance-based codes would reduce costs. The recent DOE pilot studies report indicates that software tools associated with trade-off or performance-based compliance were correlated with higher compliance rates. [USDOE 2013]

Other general experts mentioned that thought should be given to code implementation during code development. One local expert noted that, with additional funding, they would like to send staff to participate in the general code development meetings. They suggested that this could help staff understand the code better and the reasons for certain provisions, and having code officials at meetings might help improve the enforceability of the code.

One expert mentioned that statewide implementation and management of codes would reduce costs. Another noted that phasing in code requirements, as is an option when states or local jurisdictions adopt the code, would increase compliance. A third suggested that to get compliance, there needs to be a more gradual approach, adopting measures after industry has completed R&D and items become affordable and easily available in a market.

However, one expert noted: "There may not be any [way to reduce costs]. Building codes are getting more complex. It requires more education and review time and field time in order to inspect them to make sure they are complying. There may not be anything to reduce them unless we go back to 45 pages of code like we had before." Similarly, another expert noted that the three-year code cycle is too short, requiring frequent evaluation and revision of forms and processes and extensive staff, builder, and design community training, often one job at a time.

6.8 Buy-In of Key Stakeholders in Compliance and Enforcement

Experts suggested that buy-in of political entities (mayor, city council, etc.), building departments, and the building industry would reduce costs and increase compliance. Policymakers and lawmakers who understand that the energy code can help achieve their conservation or climate goals may encourage or require their building departments to focus on energy efficiency and allow fee increases to cover the costs. One general expert noted that the most fundamental way to improve energy code compliance is to get buy-in from political entities above the building department, such as an economic development agency.

Among code officials, experts suggested that cultural barriers must be addressed, and the mission of the enforcement community – to prioritize energy efficiency along with life and safety – must be clarified. According to one expert, "A key element is for the head building official to see the value and drive staff to be concerned about efficiency." Another expert noted that energy code compliance is a cultural perspective; you will not be very successful with compliance if you try to force it on code officials rather than getting the officials to believe it is their job and do it as routine business. .

7 SUMMARY OF KEY FINDINGS/CONCLUSIONS

The Phase 2 report builds on the findings from the Phase 1 report by way of surveys with 17 general experts and 23 local experts, and this section summarizes some of the key findings and conclusions.[33]

[33] For references, please refer to the appropriate section of the report or Table 4.

Summary of Phase 2 Costs

This study found that the incremental cost of enforcing energy codes (compared to the cost of already-existing enforcement of other building codes) using a traditional review and inspection process (exclusive of overhead and travel) is typically $50 or less per home, but may range up to nearly $200, for residential energy codes; and $60 to $145 per building, but may range up to around $1,000, for commercial energy codes.

The typical values are fairly consistent with those presented in Phase 1, although toward the lower end. Annual incremental costs for a jurisdiction processing 5,000 residential permits per year would range from approximately $127,000 to $257,000.[34] This range is significantly lower than that in Phase 1 (up to $531,000), because Phase 1 included more time for re-inspections, more homes re-inspected, and higher recommended time per home than the values estimated in Phase 2 surveys.

Third-party energy code enforcement had been suggested by general experts as a way to increase compliance and reduce financial burden on local jurisdictions. However, few local governments in our surveys used third parties for this purpose or would like to.

Local jurisdictions surveyed sometimes use third parties for plan review or inspection for all codes when jurisdiction staff are over-loaded, passing through all or part of the permit fees, but nothing additional. This may indicate that the costs for using third parties would be equal to or less than the costs of using their own staff – assuming that staff are primarily funded through permit fees. Therefore, Phase 1 estimates of $200 for a residential energy inspection and $750-$940 for a commercial energy plan review or inspection may be over-estimated.

Local jurisdictions or states still must incur costs for administration of third-parties.

Annual third-party administration costs estimated by national experts in Phase 2 for local jurisdictions or states ranged from $25,000 to $500,000, which is a higher, but not markedly so, range than that presented in Phase 1 ($23,000 to $300,000).

Additional potential methods of improving energy code compliance discussed in the literature include performance testing or programs such as HERS ratings, which are mandatory in some jurisdictions. These services require expenditures by a local jurisdiction or state for administration, QA, and oversight, but fees are typically paid by builders or owners directly to third parties that provide the services.

Phase 2 estimated performance testing costs of $90 to $500 per home and HERS rating costs of $275 to $575 per home.

These values are consistent with the estimate in Phase 1 for performance testing ($300 to $400), but lower than the range for HERS ratings ($450 to $1,700).

[34] The low end is based on a median value of $25 per home without re-inspections and the high end is based on an average value of $51 per home that includes re-inspections.

Compliance and enforcement processes should include expenditures for training and outreach.

Phase 2 estimated training budgets of $0 to $5,000 per full-time equivalent (FTE) per year, with a median value of $350. Estimated outreach budgets were up to $6,000 per year per jurisdiction (excluding two high outliers).

The training budgets are consistent with attending one or more energy-related trainings a year or becoming ICC [International Code Council] certified, based on the costs presented in Phase 1, but only one jurisdiction's training budget meets or exceeds the $1,250 per FTE per year recommended by BCAP. The Phase 2 estimates of outreach budgets per jurisdiction are significantly less than the budgets estimated by BCAP ($39,000 per year).

These budgets should not be taken as an indication of what should be spent in these areas. In some cases, the budgets are either not adequate 100% compliance or, in the case of training, are avoided through training staff internally by energy experts or through subsidized state training. Experts repeatedly noted that education, training, and outreach are crucial for increasing compliance.

Conclusions

The costs reported in this study are presented to inform a national dialogue about the investment needed to improve compliance with building energy codes. They are not intended to be representative of the nation as a whole, and the cost numbers in this report do not address the many jurisdictions without any code enforcement infrastructure at all.

As determined through experts interviewed for this study, successful local jurisdictions appear to have the ability to conduct energy code plan review and inspection in a reasonable amount of time, with shorter times when well-trained contractors and code officials are involved. Experts noted that actions such as educating code officials, training industry to design and build to code, providing outreach to consumers to increase demand, giving code officials the proper tools to streamline and prioritize enforcement, and requiring design professionals to provide adequate information on plans all have the ability to increase compliance while reducing plan review and inspection time. These activities could be key contributions from utilities, states, and the federal government.

Finally, experts suggested that In order to get the energy and carbon savings that codes are expected to save, key stakeholders must make long-term commitments to code compliance and enforcement and that there must be a cultural change that prioritizes energy efficiency, along with life and safety.

8 ACKNOWLEDGEMENTS

The authors wish to thank each of the general and local experts for their participation in the survey, and especially those who also took the time to review the initial draft. The authors also wish to thank Mary James, of LBNL, for editing assistance. Any errors or omissions are the authors' own. This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building

Technology, State and Community Programs, of the U.S. Department of Energy under Contract No. DEAC03-76SF00098.

REFERENCES

Air Conditioning Contractors of America (ACCA). Manual D - Residential Duct Systems. *Air Conditioning Contractors of America.* [Online] 2011(a). [Cited: February 7, 2013.] http://www.acca.org/store/product.php?pid=355.

Air Conditioning Contractors of America (ACCA)**.** Manual J Residential Load Calculation (8th Edition - Full). *Air Conditioning Contractors of America.* [Online] 2011(b). [Cited: February 7, 2013.] https://www.acca.org/store/product.php?pid=172.

Air Conditioning Contractors of America (ACCA). Manual S - Residential Equipment Selection. *Air Conditioning Contractors of America.* [Online] 2011(c). [Cited: February 26, 2013.] http://www.acca.org/store/product.php?pid=154.

Britt, Michelle and Makela, Eric. *Expanding the Conversation to Conquer Compliance*. Washington, DC: Britt/Makela Group, Inc., 2013. Presented at U.S. Department of Energy (DOE) Code Compliance Technical Meeting, April 2013.

Building Codes Assistance Project (BCAP). *Residential Building Energy Codes - Enforcement & Compliance Study.* Alexandria, VA: North American Insulation Manufacturers Association, 2008.

Building Codes Assistance Project (BCAP) and Arkansas Energy Office. *Arkansas Gap Analysis.* Washington, DC: Building Codes Assistance Project, 2010.

Building Codes Assistance Project (BCAP), Southeast Energy Efficiency Alliance, and Southface. *Building Department Pilot Study: Guidance on Effective Enforcement of Georgia's Energy Code.* Atlanta, GA: Georgia Environmental Finance Authority, 2012.

California Energy Commission (CEC). 2008 Building Energy Efficiency Standards for Residential and Nonresidential Buildings. CEC-400-2008-001-CMF. Sacramento, CA: California Energy Commission, 2008.

Cohan, David. *Special Plans Examiner/Inspector System in Washington State.* Portland, OR: Northwest Energy Efficiency Alliance, 2011.

Compliance Planning Assistance Program (CPAP). *Illinois Strategic Compliance Plan: Improving Energy Code Compliance in Illinois's Buildings.* Washington, DC: Building Codes Assistance Project, 2011.

Cooper, Adam and Wood, Lisa**.** *Integrating Codes and Standards into Electric Utility Energy Efficiency Portfolios.* Washington, DC: Institute for Electric Efficiency, 2011.

DNV KEMA; Energy & Resource Solutions; and APPRISE**.** *Final Report Project 11 Code Compliance Baseline Study: Massachusetts Energy Efficiency Programs' Large Commercial & Industrial Evaluation.* Burlington, MA: National Grid, 2012.

Groshans, Dan and Lee, Allen. *Extra Credit: How Utilities Can Receive Credit for Savings From Building Energy Codes*. Chicago, IL: International Energy Program Evaluation Conference, 2013. International Energy Program Evaluation Conference.

Guttman, Maureen. *Energy Codes Compliance Programs*. Washington, DC: Building Codes Assistance Project, 2013. Presented at U.S. Department of Energy (DOE) Code Compliance Technical Meeting, April 2013.

Institute for Market Transformation (IMT) and Global Buildings Performance Network. *Residential Performance Testing in Georgia.* Washington, DC: Institute for Market Transformation, 2012.

Institute for Market Transformation (IMT) and Global Buildings Performance Network**.** *Third-Party Performance Testing: A case study of residential energy code enforcement in Austin, Texas.* Washington, DC: Institute for Market Transformation, 2011(a).

Institute for Market Transformation (IMT) and Global Buildings Performance Network. *Third-Party Plan Review.* Washington, DC: Institute for Market Transformation, 2011(b).

Kunkle, Rick. *The Washington State Energy Code: Certification for Inspectors and Plan Reviewers for the Non-Residential Energy Code.* Olympia, WA: Washington State Energy Office, 1997.

Maine Public Utilities Commission (MPUC)**.** *Investigation of Building Code Compliance and Enforcement Methods.* Augusta, ME: Utilities and Energy Committee, 2004.

Majersik, Clif and Stellberg, Sarah. *$810 Million Funding Needed to Achieve 90% Compliance with Building Energy Codes.* Washington, DC: Institute for Market Transformation, 2010.

Meres, Ryan; Sigmon, Jeremy; DeWein, Mike; Garrett, Ken; and Brown, Jim H. *Successful Strategies for Improving Compliance with Building Energy Codes.* Pacific Grove, CA: American Council for an Energy-Efficient Economy, 2012. ACEEE Summer Study on Energy Efficiency in Buildings. pp. 4-275 - 4-288.

Misuriello, Harry; Kwatra, Sameer; Kushler, Martin; and Nowak, Seth. *Building Energy Code Advancement through Utility Support and Engagement. Report Number A126.* Washington, DC: American Council for an Energy Efficient-Economy, 2012.

National Conference of States and Building Codes and Standards (NCSBCS) and Alliance for Building Regulatory Reform in the Digital Age. *Final Report NCSBCS/Alliance Survey on Savings from the Application of Information Technology to Building Codes Administration and Enforcement Process February - April 2005.* Ashburn, VA: Institute for Building Technology and Safety, 2005.

Online Code Environment and Advocacy Network. *Compliance and Enforcement.* Washington, DC: Building Codes Assistance Project, 2010(a).

Online Code Environment and Advocacy Network. *Engaging HERS for Code Compliance: The Long Island Experience.* Washington, DC: Building Codes Assistance Project, 2010(b).

Online Code Environment and Advocacy Network. *Roundtables 3 and 4 Summary and Moving Forward Evaluation 2009.* Washington, DC: Building Codes Assistance Project, 2009.

Pacific Consulting Services, Davis Energy Group, and Eley Associates. *MA&E Study in Support of Codes & Standards Final Report Volume 1: Project Description and Results. PG&E Study ID number: 411.* San Francisco, CA: Pacific Gas and Electric Company, 2000.

Pacquette, Zachary; Miller, John; and DeWein, Mike. *Incremental Construction Cost Analysis for New Homes: Building to the 2009 IECC*. Washington, DC: Building Codes Assistance Project, 2011.

Smith, Loretta and Nadel, Steven. *Energy Code Compliance.* Washington, DC: American Council for an Energy-Efficient Economy, 1995.

Stellberg, Sarah; Cooper, Adam; Sarno, Carolyn; and Lis, David. *Role for Utilities in Enhancing Building Energy Code Compliance.* Pacific Grove, CA: American Council for an Energy-Efficient Economy, 2012. ACEEE Summer Study on Energy Efficiency in Buildings. pp. 5-387 - 5-398.

U.S. Department of Energy (DOE): Building Technologies Office. *90% Compliance Pilot Studies: Final Report.* Washington, DC: U.S. Department of Energy, 2013.

U.S. Department of Energy (DOE): Building Technologies Office. *Measuring State Energy Code Compliance: Report released March 2010 subject to further development*. Washington, DC: U.S. Department of Energy, 2010.

U.S. Department of Energy (DOE): *Building Energy Codes Program.* [Online] August 16, 2012(a). [Cited: August 14, 2013.] https://www.energycodes.gov/comcheck.

U.S. Department of Energy (DOE): *Building Energy Codes Program.* [Online] August 16, 2012(b). [Cited: August 14, 2013.] https://www.energycodes.gov/rescheck.

Washington State Department of Commerce (WSDC). *Home Energy Audit and Retrofit Including Home Energy Scoring.* Olympia, WA: Washington State Department of Commerce, 2011.

Williams, Alison; Vine, Ed; Price, Sarah; Sturges, Andrew; and Rosenquist, Greg. *The Cost of Enforcing Building Energy Codes: Phase 1.* Berkeley, CA: Lawrence Berkeley National Laboratory, 2013.

APPENDIX A: ADDITIONAL SURVEY RESULTS

General experts were asked to rate several different possible ways to increase compliance. The results are summarized in Table A-1.

Table A-1. Ratings of Compliance Methods

Method to Increase Compliance	Percent Rating 1-2*	Percent Rating 3-5	Percent Rating 6-7
Conducting **re-inspections** where necessary	0%	24%	76%
Providing additional **energy training opportunities for code officials**	0%	29%	71%
Providing additional **energy training opportunities for builders/tradespeople/construction workers**	0%	29%	71%
Withholding occupancy certificates until the building is compliant	0%	29%	71%
Implementing or participating in **third-party programs** for energy code- specific plan review/inspection	0%	38%	63%
Improving the compliance process such as pre-application meetings, case managers, application checklists, etc.	0%	41%	59%
Increasing time spent on in-house energy code plan review/inspection	0%	47%	53%
Using **performance testing** to verify compliance	6%	41%	53%
Using **in-house staff specializing in energy code**-specific plan review/inspections (as opposed to staff who do all code reviews/inspections)	12%	41%	47%
Designating building code staff as **energy code champions**	18%	35%	47%
Requiring **energy certification** for code officials	6%	53%	41%
Educating home/building owners about the value of energy efficiency and code compliance	18%	41%	41%
Using **building commissioning** to verify compliance	12%	59%	29%
Using existing **voluntary above-code programs** such as HERS or LEED	18%	53%	29%
Investing in **information technology** for code compliance– submittal, review, inspection, etc.	6%	71%	24%

* Question: I am going to read several potential ways for local jurisdictions to increase compliance. Some of these actions will lead to increased costs, but we are interested in how you rate the importance of each activity (in terms of increasing compliance) regardless of cost. Please rate each statement from 1 to 7 where 1 means "not at all important" and 7 means "extremely important." How would you rate…

APPENDIX B: SURVEY INSTRUMENTS

CODE COMPLIANCE SURVEY FOR NATIONAL EXPERTS

Interviewer:

Date:

Subject Name:

Organization:

Hello, my name is _____ from Lawrence Berkeley National Laboratory (LBNL) and I am calling on behalf of the U.S. Department of Energy (DOE). We are conducting research to better understand the cost of compliance and enforcement with local building codes. As part of this research, we are interviewing key experts at the national level to gather cost information, and information about increasing energy code compliance.

There is no payment for participating in this study. Knowing that this is voluntary, we appreciate that you are willing to be interviewed. You can decline to be interviewed or stop at any time. Your input is extremely valuable, as your input will help to improve building code compliance and enforcement. We anticipate this interview will last about 30-40 minutes.

LBNL is leading this study, and the primary contact person at LBNL is Dr. Edward Vine; he can be reached at 510-486-6047. LBNL will keep the information private as noted below. LBNL will analyze the interview data and provide a summary analysis that will be presented to DOE. We will list the people that are interviewed in an Appendix in the final report to DOE. However, all publications will use only summary-level data and will not identify individual respondents or firms associated with specific statements, so we can assure you that your comments will remain confidential.

If ok: Then let us jump right in.

OVERVIEW

In 2010, a national study estimated the total cost to reach 90% compliance nationally at $810 million annually, including $660 million for best practice plan review and inspection, $125 million for implementation and training, and $25 million for national level support. These costs are calculated by using 8-year average construction data. Further details are not available.

1. Are you familiar with how this estimate was developed? If so, what do you know about the estimate?

2. Let's focus on the $660 million estimate for plan review and inspection. Based on what you know, do you think this number is realistic or too high or too low? Why?

3. What actions, if any, do you think could be taken to reduce the cost required to reach 90% compliance? (i.e., strategies that could be implemented at the local, state, or federal level?)

4. What do you think is the single most effective action that could be taken (at the local, state, or federal scale) to increase building energy code compliance (regardless of cost)?

RESIDENTIAL ENERGY CODE PLAN REVIEW AND INSPECTION

One study estimated that the average time for home energy code plan review and inspection was 1.25 hours.

5. Do you think this is an appropriate amount of time to ensure compliance?

[IF NO, CONTINUE; IF YES, SKIP TO Q7]

6. Should it be higher? Lower?

7. What are the variables on which this estimate most highly depends?

COMMERCIAL ENERGY CODE PLAN REVIEW AND INSPECTION

One study estimated that commercial energy code *plan review* time ranged from 10 minutes to 2 hours and for *field inspections*, 15 minutes to 4 hours.

8. What do you think the appropriate amount of time for commercial energy code plan review and inspection should be?

9. What are the variables on which this estimate most highly depends?

10. At what size (or other parameter) of building does commercial plan review/inspection take place with a *professional engineer* as opposed to a general inspector (thus increasing the labor rate)?

INCREASING CODE COMPLIANCE FOR LOCAL JURISDICTIONS

11. For a typical local jurisdiction, what is the most effective way to increase compliance?

12. I am going to read several potential ways for local jurisdictions to increase compliance. Some of these actions will lead to increased costs, but we are interested in how you rate the importance of each activity (in terms of increasing compliance) regardless of cost. Please rate each statement from 1 to 7 where 1 means "not at all important" and 7 means "extremely important." How would you rate…

Rating [1-7]	**Ways to Increase Compliance**
	a. Using in-house staff specializing in energy code-specific plan review/inspections (as opposed to staff who do all code reviews/inspections)
	b. Increasing time spent on in-house energy code plan review/inspection
	c. Conducting re-inspections where necessary
	d. Implementing or participating in third-party programs for energy code-specific plan review/inspection
	e. Withholding occupancy certificates until the building is compliant
	f. Improving the compliance process such as pre-application meetings, case managers, application checklists, etc.

Rating [1-7]	Ways to Increase Compliance
	g. Using building commissioning to verify compliance
	h. Using performance testing to verify compliance
	i. Using existing voluntary above-code programs such as HERS or LEED
	j. Providing additional energy training opportunities for code officials
	k. Requiring energy certification for code officials
	l. Providing additional energy training opportunities for builders/tradespeople/construction workers
	m. Educating home/building owners about the value of energy efficiency and code compliance
	n. Investing in information technology for code compliance– submittal, review, inspection, etc.
	o. Designating building code staff as energy code champions
	p. Other (specify):

13. Others have suggested additional approaches for increasing code compliance in local jurisdictions. These approaches could be taken at the state or national level by governments or non-profits. Please rate each statement from 1 to 7 where 1 means "not at all likely to increase compliance" and 7 means "extremely likely to increase compliance." How would you rate…

Rating [1-7]	Ways to Increase Compliance
	a. Running a state stakeholder collaborative on energy code adoption and compliance
	b. Funding a state or national demonstration program to implement best practices on code compliance
	c. Conducting random surveys of local governments for code compliance [i.e., auditing local government inspections/certificates of compliance]
	d. Developing a liability structure under which code officials could hold relevant parties (developers, designers, builders, building owners, etc.) accountable for non-compliance through use of penalties.

14. What are the restrictions on local governments as to charging higher permit fees for their services (for example, covering the cost of review and inspection as well as training)? [**PROBE: Are restrictions written into statute, just a general pro-business policy, etc.?**]

15. If a local jurisdiction could choose between: 1) hiring more staff and increase training, or 2) implementing a third-party program:
    a. Which option would be most appropriate?

    b. Which option would be cheaper for builders (i.e., have lower fees)?

    c. What are the pros and cons of each option?

16. Would local jurisdictions use third-party programs if they were administered at the:

Administered at the:	**Yes**	**No**
a. Local level		
b. State level		
c. National level		
d. Utility level		
e. Other (specify):		

17. Would third-party programs be **cost-effective** AND useful/adaptable if they were offered at:

Scale	**Yes**	**No**
a. Local level		
b. State level		
c. National level		
d. Utility level		
e. Other (specify):		

18. One analysis of third-party code compliance programs estimated administration costs ranging from $131,000 to $250,000 (exclusive of training). What do you think the approximate costs of this type of program would be at the local level and at the state level?

ROLE OF UTILITIES AND CODE COMPLIANCE

19. What is the most appropriate role for a utility in the area of building code compliance and enforcement? [**ASSUME THAT A REGULATORY MECHANISM IS IN PLACE FOR UTILITIES TO RECEIVE CREDIT/ATTRIBUTION**]

20. I am going to read several potential roles for utilities in the area of building code compliance and enforcement. Please rate each potential role from 1 to 7 where 1 means "not at all appropriate" and 7 means "extremely appropriate." How would you rate …

Rating [1 to 7]	**Utility Role**
	a. Provide energy code plan review/inspection
	b. Provide as-needed code assistance for complex systems, verification of load calculations, inspection of mechanical systems, etc.
	c. Fund local jurisdiction staff for energy code plan review/inspection
	d. Fund/administer third party programs for energy-code specific plan review/inspection
	e. Fund/administer performance testing program
	f. Fund/administer voluntary above-code programs such as HERS or LEED
	g. Provide training for code officials
	h. Provide training for builders/tradespeople/construction workers
	i. Provide outreach to home/building owners to promote energy efficiency and building code compliance
	j. Provide tools such as guidebooks, checklists, etc.
	k. Provide rebates for performance testing
	l. Provide rebates for HERS ratings
	m. Fund the purchase of diagnostic equipment
	n. Engage in stakeholder processes such as building code advisory councils
	o. Conduct code compliance studies
	p. Other (specify):

21. Do you have any additional comments or suggestions regarding any of the potential utility roles mentioned?

22. What is needed for *encouraging utilities* to be more actively engaged in code compliance enhancement programs? **[PROBE: UTILITIES GET CREDIT FROM ENFORCEMENT FOR MEETING ENERGY SAVINGS GOALS; ACTIVITIES THAT DON"T MAKE THEM SEEM LIKE "CODE POLICE", etc.]**

23. Are there program implementers that have worked with utilities on code compliance enhancement activities? If YES: Which ones?

ADDITIONAL CONTACTS

We would like to get additional information from people working in the field.

24. What states would you recommend that we examine?

25. Do you know of particular local governments that we should interview?

26. Are there other national experts that we should interview?

27. Do you have any contact information for these local governments and national experts?

28. Finally, do you have any other comments on anything that we have discussed today?

THANK YOU VERY MUCH!

CODE COMPLIANCE SURVEY FOR LOCAL EXPERTS

Interviewer:

Date:

Subject Name:

Organization:

Hello, my name is _____ from Lawrence Berkeley National Laboratory (LBNL) and I am calling on behalf of the U.S. Department of Energy (DOE). We are conducting research to better understand the cost of compliance and enforcement with local building codes. As part of this research, we are interviewing key experts at the local level to gather cost and other related information about increasing code compliance. We recently completed a survey of national experts, and your jurisdiction and/or name was recommended for our survey at the local level.

There is no payment for participating in this study. Knowing that this is voluntary, we appreciate that you are willing to be interviewed. You can decline to be interviewed or stop at any time. Your input is extremely valuable, as your input will help to improve building code compliance and enforcement. We anticipate this interview will last about 30-40 minutes.

LBNL is leading this study, and the primary contact person at LBNL is Dr. Edward Vine; he can be reached at 510-486-6047. LBNL will keep the information private to the extent permitted by law. LBNL will analyze the interview data and provide a summary analysis that will be presented to DOE. All publications will use only summary-level data and will not identify individual respondents or firms, so we can assure you that your comments will remain confidential.

If ok: Then let us jump right in.

Because the residential and commercial building markets are so different, we want to first ask you questions about the residential market.

A. RESIDENTIAL BUILDING CODES

1. In general, how many **residential building starts** do you have in your area per year?
2. Do you offer **pre-application meetings** on a required or voluntary basis?

[IF YES, CONTINUE; IF NO, SKIP TO Q5]

3. What percent of applicants make use of this?
4. What is the average time commitment per meeting for your staff?

5. Does your jurisdiction conduct **plan reviews**?

[IF YES, CONTINUE; IF NO, SKIP TO Q11]

6. What energy-code related information do you require to be submitted with the plans? (**PROBE: Manual J, Manual D, ResCheck, etc.**)
7. How much **time** is typically spent **reviewing** plans with respect to energy codes?
8. What is the total time for plan review (including all codes)?
9. Is energy code review integrated into other reviews or done by a specialist?
10. What is the average **wage** of a **reviewer**?

11. Does your jurisdiction conduct **on-site inspections**?

[IF YES, CONTINUE; IF NO, SKIP TO Q20]

12. For all housing starts or only a sample?
13. How much **time** is spent in on-site **inspections** related to energy code? (Not including re-inspections)
14. What is the total time for site inspection (including all codes)?
15. Is energy code inspection integrated into other inspections or conducted separately?
16. How many site visits do you conduct that include energy code inspection? (**PROBE: are there different site visits for framing, trade rough-ins, insulation, trade finals, building final inspections, and which ones include energy code inspection?**)
17. What percent of homes are re-inspected for energy code compliance?
18. How much time is spent on re-inspections related to energy code?
19. What is the average **wage** of an **inspector**?

20. How much are residential **permit fees**?

21. Are there additional re-inspection fees?

[IF YES, CONTINUE; IF NO, SKIP TO Q23]

22. What are those fees?

23. What are the **penalties** for non-compliance? [PROBE: is a certificate of occupancy withheld?]

THIRD-PARTY CODE COMPLIANCE

24. Do you ever outsource energy code plan review and/or inspection to **third parties**?

[IF YES, CONTINUE; IF NO, SKIP TO Q33]

25. Approximately how much does this cost? (per home?)

26. Who pays for this? (i.e., does the builder pay the 3rd party directly?)

27. Are third parties the standard route or an option for the builder? **[PROBE: IS THIS OPTION EXPEDITED?]**

28. Does the local jurisdiction administer the program?

[IF YES, CONTINUE; IF NO, SKIP TO Q31]

29. What are the administration costs for this program?

30. Do the administration costs include a training and certification component?

[SKIP to Q32]

31. Do you use a program run by another entity (e.g., state or utility)? **[PROBE: Which one?]**

32. What kind of **quality assurance** do you have? (e.g., random inspections, penalties for not meeting quality assurance standards)

PERFORMANCE TESTING

33. Do you use **performance testing** (e.g., duct blower and blower door testing) for determining compliance, in addition to plan review and/or inspection?

[IF YES, CONTINUE; IF NO, SKIP TO Q42]

34. Approximately how much does this cost per home?

35. Who pays for this? **[PROBE: DOES THE BUILDER PAY THE THIRD PARTY DIRECTLY?]**

36. Is performance testing mandatory or optional?

37. Does the local jurisdiction administer the program?

[IF YES, CONTINUE; IF NO, SKIP TO Q40]

38. What are the administration costs for this program?

39. Do the administration costs include a training and certification component or do you rely on existing certification (e.g. HERS, HPwES, BPI, etc.)?

[SKIP to Q41]

40. Do you use a program run by another entity (e.g., state or utility)? **[PROBE: Which one?]**

41. Do you conduct scheduled or random inspections for performance testing (or do you have other types of quality assurance)?

VOLUNTARY PROGRAMS (HERS)

42. Do you use **HERS or other programs** (e.g., LEED) for determining compliance?

[IF YES, CONTINUE; IF NO, SKIP TO Q48]

43. Approximately how much does a HERS rating of a home cost?

44. Who pays for the HERS rating for an individual home? [PROBE: local government, the builder, etc.]

45. What entity runs the HERS program/bears the cost of the HERS infrastructure?

46. What are the costs of the HERS infrastructure?

47. Do these programs replace or supplement in-house plan review and inspection work?

OTHER

48. Does your jurisdiction have alternative compliance paths not discussed yet?

[IF YES, CONTINUE; IF NO, SKIP TO NEXT SECTION]

49. What are they?

Our next set of questions is about the commercial market.

B. COMMERCIAL BUILDING CODES

1. In general, how many **building starts** do you have in your area per year?
2. Do you offer pre-application meetings on a required or voluntary basis?

[IF YES, CONTINUE; IF NO, SKIP TO Q5]

3. What percent of applicants make use of this?
4. What is the average time commitment per meeting?

5. Does your jurisdiction conduct plan reviews?

[IF YES, CONTINUE; IF NO, SKIP TO Q10]

6. What information do you require to be submitted with the plans? (e.g., ComCheck, etc.)

7. How much **time** is typically spent **reviewing** plans with respect to energy codes?
8. What is the total time for plan review (including all codes)?
9. Is energy code review integrated into other reviews or done by a specialist?

   What is the average **wage** of a **reviewer**?

10. Does your jurisdiction conduct on-site inspections?

[IF YES, CONTINUE; IF NO, SKIP TO Q19]

11. For all building starts or only a sample? (**PROBE: What sample?**)
12. How much **time** is spent in on-site **inspections** related to energy code (not including re-inspections)?
13. What is the total time for site inspection (including all codes)?
14. Is energy code inspection integrated into other inspections or conducted separately?
15. How many site visits include energy code inspection are conducted? (**PROBE: are there different site visits for framing, trade rough-ins, insulation, trade finals, building final inspections, and which ones include energy code inspection?**)
16. What percent of buildings are re-inspected for energy code compliance?
17. How much time is spent on re-inspections related to energy code?
18. What is the average **wage** of an **inspector**?

19. How much are commercial building permit fees?

20. Are there additional re-inspection fees?

[IF YES, CONTINUE; IF NO, SKIP TO Q22]

21. What are those fees?

22. What are the penalties for non-compliance? [PROBE: is a certificate of occupancy withheld?]

THIRD-PARTY CODE COMPLIANCE

23. Do you ever outsource energy code plan review and/or inspection to **third parties**?

[IF YES, CONTINUE; IF NO, SKIP TO Q33]

24. Approximately how much does this cost? (per building?)
25. Who pays for this? (i.e. does the builder pay the 3rd party directly?)
26. Are third parties used for all buildings or a certain segment of buildings?
27. Are third parties the standard route or an option for the builder? **[PROBE: IS THIS OPTION EXPEDITED?]**
28. Does the local jurisdiction administer the program?

[IF YES, CONTINUE; IF NO, SKIP TO Q31]

29. What are the administration costs for this program?
30. Do the administration costs include a training and certification component?

[SKIP to Q32]

31. Do you use a program run by another entity (e.g., state or utility)? **[PROBE: Which one?]**

32. What kind of **quality assurance** do you have? (e.g., random inspections, penalties for not meeting quality assurance standards)

PERFORMANCE TESTING

33. Do you use **performance testing** (e.g., duct blower and blower door testing is often used in residential buildings, but what about commercial buildings) for determining compliance, in addition to plan review and/or inspection?

[IF YES, CONTINUE; IF NO, SKIP TO Q42]

34. Approximately how much does this cost? **[PROBE: PER BUILDING?]**
35. Who pays for this? **[PROBE: DOES THE BUILDER PAY THE THIRD PARTY DIRECTLY?]**
36. Is performance testing mandatory or optional?
37. Does the local jurisdiction administer the program?

[IF YES, CONTINUE; IF NO, SKIP TO Q40]

38. What are the administration costs for this program?

39. Do the administration costs include a training and certification component or do you rely on existing certification (e.g. HERS, HPwES, BPI, etc.)?

[SKIP to Q41]

40. Do you use a program run by another entity (e.g., state or utility)? **[PROBE: Which one?]**

41. Do you conduct scheduled or random inspections for performance testing or other types of quality assurance?

OTHER

42. Does your jurisdiction have alternative compliance paths not discussed yet?

[IF YES, CONTINUE; IF NO, SKIP TO NEXT SECTION]

43. What are they?

Our next set of questions is more general about both residential and commercial building codes.

C. GENERAL QUESTIONS

1. Do permit fees cover all enforcement costs, and all costs of the department?

[IF NO, CONTINUE; IF YES, SKIP TO Q4]

   2. What percent of costs do permit fees cover?
   3. What restrictions, if any, are you under in terms of how to set permit fees?
   4. Besides permit fees, how else is code enforcement funded by the government?

5. Do any other parties provide funding, staff, or other resources for energy code compliance and enforcement activities?

[IF YES, CONTINUE; IF NO, SKIP TO Q7]

   6. Which parties and what do they provide (i.e., funding, staff, and/or resources)? **[PROBE: utility, state, building institute, etc.]**
   7. How much funding by party? [utility, state, building institute, etc.]

8. If your department received additional funding for energy code compliance and enforcement, where would it most effectively be spent – that is, what is on your wish list if you had more funding? **[PROBE: additional hires to focus on energy codes, additional training for code officials or builders, IT investments, developing materials, 3rd party program administration, etc.]**

9. Would you be interested in running a 3rd party program (i.e. plan review, inspection, or performance testing) at your local jurisdiction?

   [IF YES, CONTINUE; IF NO SKIP TO Q11]

   10. What would you use the 3rd party for? **[PROBE: plan review, inspection, both, performance testing, residential, commercial, only complex buildings, etc.]**

11. Would you be interested in participating in a 3rd party program run by someone else?

   [IF YES, CONTINUE: IF NO SKIP TO Q13]

   12. Who would you want to run the program and why? [PROBE: state, utility, DOE, REEO]

   [SKIP TO Q14]

   13. Why not?

14. What utility programs or activities related to energy would be most useful to your jurisdiction? **[PROBE: providing staff, funding 3rd parties, administering 3rd party programs, providing performance testing, focusing on training]**

15. How much does your jurisdiction spend annually per FTE on energy code-related training, education, and certification?

16. What are your annual outreach costs (including newsletters, presentations, website, etc.)?

17. Do you use any **software** for the code enforcement process (such as electronic plan submission, tracking, and review; inspection scheduling; conducting inspections)?

[IF YES, CONTINUE; IF NO, SKIP TO Q19]

18. What is the name(s) of the software that is used and what functions does it include?

19. Are there IECC-certified energy code inspectors and plan reviewers on staff?

20. Do you have an energy code champion – a person inside or outside your jurisdiction to whom people can turn for energy code-related questions, such as code interpretation, load sizing calculations, etc.?

21. Do you think your local government would be interested in participating in a state or national demonstration program to implement best practices? Why or why not?

22. Do you have any quantitative or qualitative information on compliance rates that you can provide us?

23. Can you think of any experts on local government code compliance who could help answer some of the questions we've been asking you? [GET NAMES, AFFILIATIONS, AND CONTACT INFORMATION]

24. Finally, do you have any other comments on anything that we have discussed today?

THANK YOU VERY MUCH!