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Compliance Verification Paths for Residential and Commercial Energy Codes

September 2011

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for the U.S. Department of Energy Building Technologies Program

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Executive Summary

Conformity assessment is a term used to describe the processes followed to demonstrate that a product, service, management system, or body meets specified requirements, such as standards, codes, laws, regulations, or other criteria. With respect to energy codes, conformity assessment includes all activities and tasks undertaken by any number of entities to ensure that the provisions of an adopted energy code are achieved at a designated point in time. This report identifies and discusses conformity assessment activities and provides guidance for developing new or adjusting existing ways of verifying compliance. In addition, this report looks at different ways to ensure that the energy efficiency goals of an adopted code or standard are achieved.

The following variables, discussed in detail in Section 2, affect the design and implementation of the conformity assessment process:

- Code adoption
- Scope of the code
- Code format
- Responsible party
- How and when compliance is verified
- Use of penalties and incentives

Code adoption is the vehicle that establishes code requirements and their administration. Adoption can be mandatory, voluntary, or a combination of the two. The details associated with energy code adoption influence the scope and format of the code and the time at which compliance can be determined. The means of adoption can include state and local building regulations, professional and contractor licensing guidelines, insurance policies, and utility tariffs, among many others.

The scope of an energy code can include attributes, components, and devices that affect the energy efficiency of a building. In most energy codes for residential buildings, the criteria for the building's thermal envelope; heating, ventilation, and air conditioning (HVAC) system; and service water heating and lighting systems are generally less comprehensive in terms of complexity and quantities than the criteria for commercial buildings. As energy codes continue to increase the level of cost-effective energy savings for the envelope and the mechanical, domestic hot water, and lighting systems, new measures for building energy efficiency are being introduced to further reduce building energy use.

The format of an energy code determines how the provisions of an energy code are presented. From micro to macro, the code can provide specific criteria for each aspect of the building, include provisions for a specific system in the building, or cover the building as a whole. The code format can drive what is included in the code and when and how compliance is verified. Similarly, a code compliance path can drive the code format. Energy code formats include prescriptive, component performance, total building performance, outcome-based, peak energy capacity, and alternative guidelines.

The entity assigned to validate compliance generally makes the determination that the building complies with the adopted code. Code officials, builders, design professionals, lenders, insurance underwriters, realtors, and utilities are all possible candidates for assessing and verifying compliance. In general, those determining compliance are either local or state agencies or first-, second-, or third-party conformity-assessment entities.

The methods for determining energy code compliance depend on the scope and format of the code. The entities most regularly involved in determining compliance with adopted codes are code officials, zoning departments, fire marshals, health department personnel, and other authorities having jurisdiction to enforce model codes and standards that are adopted as state or local law, rule, or regulation. However, other entities can be helpful in this process, including the manufacturers of building products and technologies and the testing and certification agencies selected to validate conformance with the code. The methods for determining compliance may include testing, simulation, surveillance, inspection, auditing, certification, registration, and accreditation.

Verifying that a building complies with an energy code generally occurs at a particular point in construction, initial occupancy, or post-occupancy. Verification consists of many separate and parallel activities that address the conformity assessment of all products, materials, equipment, appliances, components, and devices that comprise the building and its systems. It also involves assessing the assembly of those items to ensure that they conform to specific codes and standards and that the assembled system as a whole complies with the energy code.

Penalties and incentives can be used by states or jurisdictions to encourage compliance with energy codes. Penalties are designed as a consequence for noncompliance and often delay the progress of a construction project, affect building operations, or result in increased fees or costs. Incentives are designed as a positive outcome for a project that has fulfilled or exceeded the requirements of the code and generally save the builder or owner money, increase the value of the property, or offer the builder a benefit that is exclusive to those who comply with the code.

The variables presented above affect compliance and the probability of complete compliance (e.g., compliance rate) over the lifetime of the building. Each of the conformity variables is discussed to explain what the variable is and its role related to compliance. The variables can be selected to assemble various conformity assessment models, or compliance verification paths. The traditional compliance verification path is driven by an energy code that is adopted at the state or local level, has a prescriptive format, and is administered through building construction regulations. Plans and specifications must be submitted that document that the proposed project meets the criteria in all adopted codes, including energy. That plans are reviewed by state and/or local government agencies or an agent acting on their behalf and, if the plans are approved, construction is authorized through the issuance of a permit to build. During construction, the entity that approved the plans will typically inspect construction to verify code compliance and to ensure that the provisions of the approved plans and specifications are followed. When construction is complete and compliance has been verified, a certificate of occupancy (CO) is granted.

Based on an assessment of each conformity variable, this report identifies and discusses a number of other compliance paths, including many widely used paths that were developed based on a specific code format and the criteria presented in the code. Several compliance paths, most notably the traditional

compliance path, are currently being assessed as part of a pilot study of energy code compliance in nine states, sponsored by the U.S. Department of Energy.[1] This report also outlines new or less used compliance paths. In identifying these paths, this report focused first on achieving a high level of compliance and then on selecting the variables needed to achieve it. Using the traditional compliance path for comparison, this report also evaluates whether resource needs would be lesser or greater and whether compliance rates could potentially decrease or increase for each path.

The intent in identifying current, revised, and new compliance paths is to help interested individuals or jurisdictions achieve energy efficient buildings by selecting the best conformity variables for their circumstances. This report can also inform model codes and standards developers to explore new means of adoption, scopes, formats, and/or timelines for compliance verification that may increase compliance rates or reduce the costs associated with compliance verification. The contents of this report are important to public- and private-sector agencies or entities that want to increase levels of compliance with current building energy codes or that are considering adopting energy codes for the first time. The information is even more important to those who purchase or lease buildings and pay for the energy used to operate the buildings, but who are not trained or in a position to ensure compliance with energy codes. As codes require higher levels of efficiency, use different formats to present the criteria, increase their scope regarding energy use in buildings, or extend beyond issuance of the initial CO, new methods to assess conformity will need to be considered to ensure that more advanced energy codes and standards can be effectively implemented and conformance with the code requirements can be verified.

Section 3 of this report provides nine compliance paths that are designed around various code scopes and formats. These nine paths represent only a few viable compliance paths—there are many others that can be derived from the ones presented by simply changing one variable. The sample paths and their associated variables are presented to provide the information and structure needed to develop unique compliance verification approaches. The compliance paths outlined in Section 3 include the following:

- Traditional Adoption and Enforcement
- Traditional Adoption with Peer Review
- Traditional Adoption with Self-Certification
- Adoption and Compliance as a Function of Licensing
- Adoption and Compliance as a Function of Utility Service
- Voluntary Sector Program Equivalency
- Outcome-Based EUI
- Capacity Limits
- Joint Commission

Tables are used to present the development of each compliance path. The conformity variable indicates the item relevant to compliance that is being considered. Details pertaining to each variable are presented along with resources needed and expected compliance rate as compared to the traditional

[1] DOE compliance pilot studies are being conducted in GA, MA, IA, WI, WA, OR, ID, MT and UT.

compliance path. Table ES.1 presents the traditional compliance path for most current codes and standards that are adopted by state or local governments. Additional tables are presented in Section 3.

Table ES.1. Traditional Adoption and Enforcement

Conformity Variable	
Adoption	As part of state or local law, rule, or regulation associated with building design and construction
Scope	Building thermal envelope HVAC systems and equipment Service water heating systems and equipment Lighting systems and equipment
Format	Prescriptive with a performance equivalency alternative based on annual energy use simulations
Responsible party	State or local agency staff
Determination	Initial project development Submittal of plans for construction permit approval During building construction Prior to final issuance of a CO
Penalties	Construction stop work order Fines Increased time to completion, final CO, and revenue generation from the project
Incentives	None
Traditional Path Baseline	
Resources	Plan review and construction inspection staff funded by state and local government through permit fees and/or other federal, state, or local resources likely stemming from the tax base
Compliance rate	Varies by building type and resources available to the agencies verifying compliance

Acronyms

AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BBD	Budget Building Design
BECP	Building Energy Codes Program
CALBO	California Building Officials
CBECS	Commercial Buildings Energy Consumption Survey
CO	certificate of occupancy
COMNET	Commercial Energy Services Network
DOE	U.S. Department of Energy
EA	Energy and Atmosphere
ECB	Energy Cost Budget (Method)
EUI	energy use intensity
FAR	floor area ratio
HERS	Home Energy Rating System
HUD	U.S. Department of Housing and Urban Development
HVAC	heating, ventilation, and air conditioning
ICC	International Code Council
IECC	International Energy Conservation Code
IRC	International Residential Code
LEED	Leadership in Energy and Environmental Design
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
OTC	over-the-counter
PA-ALT	Pennsylvania Alternative Energy Provisions
PG&E	Pacific Gas and Electric Company
PV	photovoltaic
RDP	registered design professional
SHGC	solar heat gain coefficient
SWH	service water heating
TJC	The Joint Commission

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1.0 Introduction

Conformity assessment is a term used to describe the processes followed to demonstrate that a product, service, management system, or body meets specified requirements, such as standards, codes, laws, regulations, or other criteria.[2] Conformity assessment encompasses all activities focused on ensuring that a desired outcome is achieved. Activities associated with compliance verification are an integral part of conformity assessment.

For energy codes, conformity assessment includes all activities and tasks undertaken by any number of entities to ensure that the provisions of an adopted[3] energy code are achieved at some designated point or window in time. These activities begin with the development of a model energy code or standard in the private or public sector, and result in adoption of the code or standard by private or public entities. Adoption typically includes a requirement to verify that compliance with the code has been realized and as such, the intended energy savings of the code can be achieved.

The contents of this report are important to public- and private-sector agencies or entities that want to increase levels of compliance with current and future energy codes or that are considering adopting building energy codes for the first time. The information is even more important to those who purchase or lease buildings and pay for the energy used to operate the buildings, but are not trained or in a position to ensure compliance with energy codes. As codes require higher levels of efficiency, use different formats to present the criteria, increase their scope regarding energy use in buildings, or extend compliance requirements beyond issuance of the initial certificate of occupancy (CO), new methods to assess conformity will need to be considered to ensure that more advanced energy codes and standards can be effectively implemented and conformance with the code requirements can be verified. In addition, these new methods can be used to direct future revisions to the means of adoption, scope, format, and time at which compliance is verified in energy codes.

1.1 Purpose

The purpose of this report is to explore paths for ensuring compliance[4] with building energy codes.[5] The following four principles influence the expected compliance rate of a residential or commercial building with energy efficiency goals or objectives:

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[2] ISO, http://www.iso.org/iso/resources/conformity_assessment/what_is_conformity_assessment.htm

[3] Adoption is an act that makes compliance with the energy code mandatory. While adoption typically occurs through state or local laws or regulations, it can also happen through contracting mechanisms, utility tariffs, contractor licensing requirements, incentive programs, or simply as a corporate policy.

[4] Compliance is simply the delivery of some expectation. In the case of energy codes, compliance means that the code provisions have been satisfied.

[5] The term "building energy codes" includes model codes such as the International Code Council's (ICC's) International Energy Conservation Code (IECC), energy standards such as American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1, and laws, regulations, tariffs, incentive programs, and other vehicles that require or provide incentives for the design and construction of energy efficient buildings. The term "energy codes" is used throughout this report to describe such criteria.

1. Those involved with building design and construction choose to comply based on any number of factors, including economic benefits, a desire to save energy, market advantage, or for altruistic reasons.
2. Those involved with building design and construction can stand out from the competition because of their choice to comply.
3. Those involved receive incentives such as utility rate reductions or tax rebates as rewards for compliance.
4. Those involved are required to comply through a law, rule, regulation, or legally binding condition in a construction contract.

If everyone involved in building design, construction, financing and/or operation complied with energy codes based on the first three principles above, the need for laws, rules, and regulations ensuring compliance could conceivably be eliminated. But because the first three paths do not guarantee compliance, energy codes exist, compliance with energy codes is mandated, and, as a result, conformity assessment activities are needed to ensure that code requirements are satisfied.

However, there are many challenges to ensuring compliance with code requirements. Many of these challenges are the result of increasing demands for energy efficiency and decreasing financial support and resources to sustain traditional state and local government code compliance verification practices. This report is intended to better prepare the individuals involved in the design and construction of buildings and those implementing or verifying compliance with energy codes to acknowledge and apply existing conformity-assessment practices, modify practices to increase compliance, and develop new practices to address compliance challenges.

1.2 How to Use This Report

This report is meant to better prepare public or private entities to update and enhance existing compliance verification processes or develop and implement new processes, either of which can be used to improve the rate of compliance with an energy code. Not all energy codes are the same with respect to adoption, scope of coverage, format, or how and when compliance is to be verified. In addition, the agencies or entities responsible for verifying that a project complies may differ within states or jurisdictions. As such, a single conformity assessment approach may not best serve the current national need to secure energy efficiency and may be even less likely to work in the future. The intent of producing this report is that those interested in securing energy efficiency improvements by adopting energy codes and verifying compliance will gain additional information and insight that can be used to design new, or enhance existing, conformity-assessment practices and programs.

The entities or individuals responsible for overseeing the adoption of and compliance with energy codes will first want to review Section 2, which addresses six variables that affect the selection of an energy code compliance path, including means of code adoption, scope of the code, code format, responsible party for validating compliance, how and when compliance is verified, and use of penalties and incentives. In addition to options and examples, each variable is described and resources that can provide more information are cited. Section 2 can be used as a reference to make a more informed decision regarding how to address a particular variable or can be used to help guide the development and implementation of overall code adoption and compliance strategies found in Section 3.

Section 3 provides nine example compliance paths that are designed around selected variables chosen from Section 2. These nine paths represent only a few of the many viable compliance paths. The example paths and their variables are meant to provide users with the information and structure needed to develop unique compliance verification approaches tailored to their needs. To facilitate this, the compliance verification paths can be reviewed first, using Section 2 for additional information on the variables.

2.0 Conformity Assessment Variables

This report looks at different ways to verify energy code compliance and to ensure that the energy efficiency goals of an adopted code or standard are achieved. Conformity assessment is the body of work that ensures compliance, including activities that can assure residential and commercial buildings satisfy energy codes and standards. This report identifies and discusses conformity assessment activities and provides guidance for conducting assessments.

This section discusses the variables that affect the design and implementation of paths to verify and ensure compliance with energy codes, including:

- Code adoption
- Scope of the code
- Code format
- Responsible party
- How and when compliance is verified
- Use of penalties and incentives

Suggested compliance paths are presented in more detail in Section 3, Results.

2.1 Code Adoption

A jurisdiction's process for adopting an energy code affects the scope and format of the code as well as the time at which compliance can be determined. The means for adopting a code—which can include state and local building regulations, professional and contractor licensing guidelines, insurance policies, and utility tariffs, among others—are typically tied to an infrastructure that supports compliance verification, such as state or local government or first-, second- or third-party assessment entities.

The adoption process determines whether compliance will be mandatory or voluntary. Mandatory requirements are effected through a law, rule, or regulation from an authoritative body or agency. Failure to comply with mandatory requirements can result in a project not receiving approval for construction, the issuance of a stop work order on construction until compliance is achieved, the withholding of a CO, or the implementation of some action to verify continued compliance after occupancy. Compliance may also be mandatory as a condition for other outcomes—such as electrical service hook up, a contract to design and construct a project, qualification to perform reimbursed government services (e.g., U.S. Department of Health and Human Services Centers for Medicare and Medicaid Services conditional criteria for health care entities to participate in HHS programs), an adjustment in property taxes—or to ensure that there is no loss of insurance or value of the building for asset and sales purposes.

Voluntary adoption is simply a decision by a designer, contractor, owner, developer, or some other authority associated with the building to comply with all or certain portions of an energy code, standard, or other criteria. Voluntary compliance is generally driven by economic, environmental, or social benefits that add quantitative or qualitative value to a building in the absence of a mandate to comply. It is possible for mandatory and voluntary codes to co-exist and be adopted and implemented in tandem. An example

would be where there is a mandatory minimum state energy code, but a national chain building has a corporate requirement to exceed the energy efficiency requirement of the existing code.

An adopted energy code or standard can have very specific or simple requirements, or both. For example, a code or standard could specify mandatory requirements for minimum equipment efficiency and not specify any requirement for building envelope efficiency. However, building envelope efficiency and other measures such as plug and process load requirements could be voluntarily adopted or implemented as part of a corporate or other policy. Other measures, such as lighting efficiency, could be voluntarily adopted because of utility incentive programs.

The adoption process and the code or standard adopted determine which buildings will be covered by the energy code. The energy code may include all building types or specific facilities only (e.g., state-owned or state-funded buildings or private sector buildings). The Alabama State Building Code, for example, applies only to "state building and construction, schoolhouses, hotels, and moving picture theaters" (Alabama Building Commission Chapter 170-X-1, Section 170-X-1-.03 (e)).

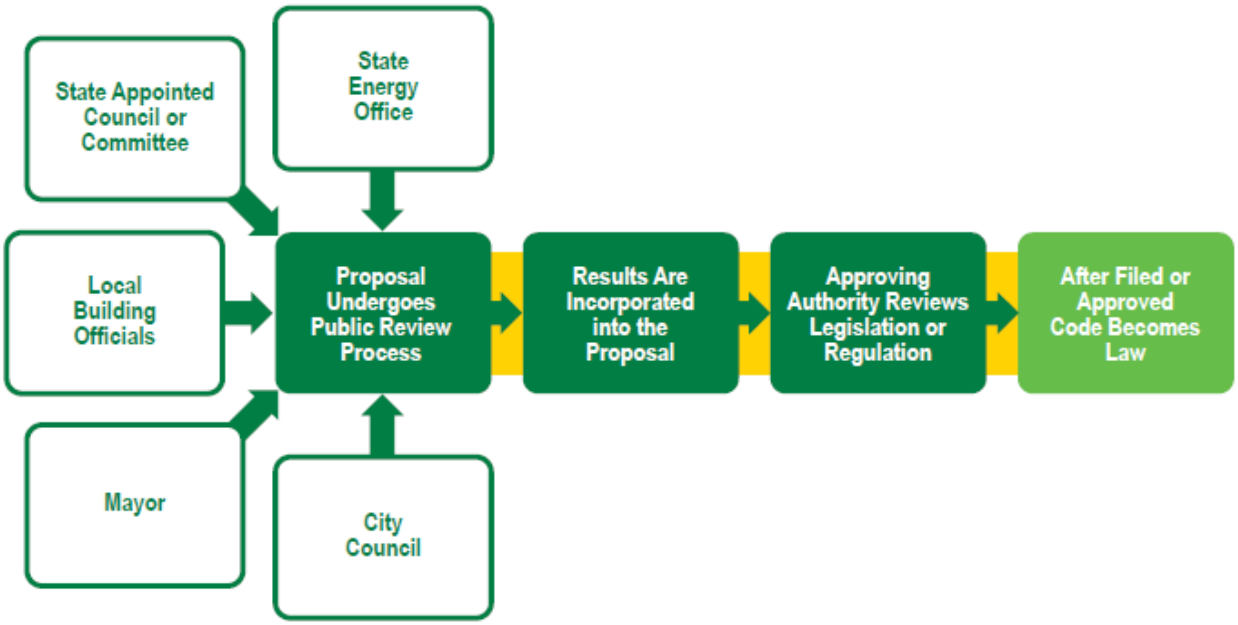
Mandatory adoption of energy codes can occur through legislation that adopts an energy code. Alternatively, legislators can empower or require a state agency to adopt an energy code through regulatory action. Such legislative authorization may also require that an energy code that is adopted by the regulatory agency be returned to the legislative body for additional review and concurrence.

When adoption is accomplished through legislation, a committee may be appointed to provide recommendations and/or draft the legislation. As an option, one or more legislators assisted by stakeholders interested in energy efficiency can draft the bill. When adoption occurs through a regulatory process, state and local government officials or empowered regulatory agencies often appoint an advisory panel composed of representatives of the design, building construction, and enforcement communities. This panel recommends the energy code, or revisions to an existing energy code, that should be considered for adoption. In basing their recommendations on model energy codes or standards, the advisory panel considers modifications to those documents to account for unique local conditionss and construction practices. The panel also may serve as a source of information during the adoption process. Their recommendations then typically enter a public review process.

Details of the adoption process vary depending on whether the energy code is adopted via legislation or regulation by a statewide or local government. However, the process generally includes the following steps:

1. A proposal is initiated by a legislative body or regulatory agency with the authority to promulgate energy codes. Interested or affected parties also may initiate a change. Typically, an advisory body is convened and will recommend a new energy code or revisions to an existing energy code. Typical initiators include state energy offices, state-appointed energy code councils, local building officials associations, mayors, and city councils.
2. The proposal undergoes public review consistent with the legislative or regulatory process under which the code is being considered. Public review options include publishing a notice in key publications, filing notices of intent, and holding public hearings. Interested and affected parties are invited to submit written or oral comments.
3. The results of the review process are incorporated into the proposal, and the final legislation or regulation is prepared for approval.

4. The approving authority reviews the legislation or regulation. Revisions may be submitted to the designated authority for final approval or for filing.
5. After being filed or approved, the code becomes effective, usually on a future date so that those affected by the code can become familiar with new requirements. The period between adoption and effective date typically varies from 30 days to 6 months.



Adoption at the state level can specify a mandatory compliance requirement throughout the state or require compliance in local governments (city, county, township, etc.) that have elected to adopt the code themselves. The adoption process can also stipulate when and if local government is allowed to amend the state-adopted code. For example, the Virginia Uniform Statewide Building Code cannot be amended by local governments. In Idaho, jurisdictions that adopt and enforce building codes must also adopt and enforce the IECC, and may amend the IECC only if doing so makes the code more stringent.

Some states adopt or revise energy codes in concert with the publication of a new edition of model energy codes and standards, such as the ICC, International Association of Plumbing and Mechanical Officials, National Fire Protection Association codes, or ASHRAE standards. This may occur either through a legislative or regulatory process or when the state regulation or legislation cites the most recent edition, in which case the adoption may occur automatically without formal action. The date of a new adoption and the date at which the adopted code becomes effective[6] can also be tied to the publication date of an energy standard. For example, jurisdictions may require that a new code become effective 1 month

[6] There is generally a difference between the date of adoption and the effective date. The date of adoption refers to the point in time that the code is adopted. The effective date is the point in time that the adopted code must be satisfied. During the period between the date of adoption and the effective date, the previously adopted code generally remains in effect. Or in instances where there was no previous code, no code requirements would be imposed until the effective date.

from the publication of the model energy code. Other states may review the new editions case-by-case without a designated time line when considering adoption.

Although model codes are most commonly adopted through legislation, regulation, rules, or other action by state or local government, there are other mandatory means of adopting such documents in whole or in part. One way is through a contract for services such as design, construction, procurement of equipment and products, commissioning, or even building operation. For instance, most federal agency contracts for building design and construction require specific codes and standards to be the basis for building design, construction, commissioning, or operation. To secure the contract and receive payment for the services provided, the contractor must satisfy codes and standards referenced in the contract. If the scope does not cover the entire building, such a mechanism can be applied to portions of the building, such as the renovation or replacement of a lighting system or the ongoing procurement of mechanical equipment. If the scope, format, and application of the energy code cover post-occupancy performance, a performance contract for building operation can be a vehicle for ensuring compliance with post-occupancy requirements.

Another mandatory means of adopting an energy code is a property lease that stipulates that the building owner/operator provide continued compliance as a condition for the lessee who may be responsible for payment of utilities. For instance, Florida Atlantic University Regulation 6.010 on leasing at Section (5) provides specific details associated with fire code compliance in leased space. Other mechanisms include utility service, wherein a contract between the utility and building owner/operator or tenant specifies the satisfaction of certain criteria as a condition for continued service, rate incentives, avoiding penalties, or other utility involvement in adoption. For example, the Texas Utilities Code requires the Utility Commission to adopt standards for rating solar energy devices (Title 4, Chapter 185). Rent control of multifamily properties can also affect adoption wherein uninhabitable conditions that are uncorrected can affect the deductibility of expenses for state income tax purposes and prevent raising rents until code violations are corrected (Los Angeles Municipal Code, Sections 151 to 151.21).

Adoption of any energy code provision is considered voluntary when the individual or entity that is responsible for the adoption decides to comply or require compliance with no mandate to do so. The motivation for such adoption can include saving energy, reducing operating expenses, or simply gaining a position in the market. For speculative properties, voluntary adoption is not likely to be considered unless the building owner/developer feels that the economics or other attributes are such that the building has an increased desirability in the market compared to competing buildings. Where the building owner/developer is also the operator of the building, such as in federal, state, or local government buildings, any increase in first cost associated with adopting an energy code can be weighed against the life-cycle costs of operating the building. National corporate accounts such as hospitality, recreation, food, and mercantile can also adopt energy or green building codes or programs, or both, to reduce operating costs, increase the market value of the building, and improve the way they are viewed by consumers.

Adoption is not as simple or one-dimensional as passing a law, rule, or regulation. While that is the traditional and most common way of adopting a code, there are other adoption vehicles available that vary with respect to the scope of the code provisions being adopted, the point in time or time frame applicable to adoption, and the entity doing the adopting. To secure the expected outcome associated with the adopted code, it is necessary to ensure compliance with the code. The code that is adopted, the time at which it is applied, and the format of the code will affect how compliance is to be ensured.

2.1.1 Education and Training

Though not always thought of as a formal part of the adoption and compliance process, education and training typically play a key role in a traditional code adoption process and are always a necessary component for successful code implementation and compliance. When successfully incorporated into the planning of an energy code or standard adoption process, and developed and applied based on stakeholder and implementer needs, education and training provide the foundation for a common understanding of the intent and technical requirement of the energy code.

The audience for energy code education and training includes code adoption decision makers, enforcement entities, industry stakeholders, compliance assessors, and to some degree, the public. To be most effective, education and training needs to target the full range of audiences, providing timely, critical information on the code in an acceptable format and package based on audience needs and area of focus.

There are three distinct phases for education and training delivery:

- Pre-adoption education and training supports the informational needs associated with securing adoption of an energy code. Education before adoption should focus on the differences between current practice under the existing code and the new code and the subsequent value that will be delivered with adoption. This phase of training works best when implemented with an outreach component that solicits public inquiry and comment.
- Once the code has been adopted and an effective date has been set, those responsible for code implementation must be educated on the scope and technical attributes. Post-adoption training should focus on preparing responsible parties for the successful implementation of the energy code. At this point, education and training must deliver clear information on code-specific measures and facilitate discussions that lead to an understanding of energy code scope and application.
- The third phase of education and training comes after the date the code goes into effect. It is very similar to post-adoption training but typically includes more knowledgeable industry discussion related to specific needs. For example, an architect may want to discuss compliance choices in greater detail to better understand the best approach for a building type or occupancy. Education and training in this phase can also support compliance by delivering targeted information on assessment protocol, documentation, and code effectiveness. A formal feedback loop should be established between compliance and education to provide direction for future training based on actual field observation and documentation of compliance issues.

Education and training should be an integral part of energy code development, adoption, and delivery. Strategic education and training supports a clearer understanding of the other conformity variables and can help to ensure a higher level of energy code compliance.

2.1.2 Outreach

Similar to training, outreach can help ensure that any energy code related activity or event is purposefully vetted and supported. Outreach can be considered the underlying structure or basis for all dialogue, discussion, training, and collateral that is initiated or generated in support of the code.

Developing an outreach plan is one of the first steps to take when looking to adopt an energy code. An outreach plan is intended to deploy the message of the code and identifies those who need or will benefit

most from the energy code message, the timeline and venues for delivering the message, and the format in which the message is presented.

Outreach should include an approach for soliciting feedback from the stakeholders and entities affected by the energy code as well as an approach for assessing the value that the energy code provides to those affected parties such as building owners, the construction industry, state agencies, local jurisdictions and utilities. When adopting an energy code, a jurisdiction generally does not know the full extent of the outcome or effect. Outreach sets a path to continuously learn from the energy code endeavors and improve the communications regarding the code.

Outreach should be addressed with a phased approach:

- During adoption, outreach messages and collateral should be broadly focused. For example, outreach should engage early recognition of a new energy code and providing consistent information on the adoption process and on the value the code will provide to adopting entities and stakeholders.
- Post-adoption and implementation outreach should continue to provide a consistent message, solicit feedback for continuous improvement, and develop supporting documentation such as case studies. The purpose of outreach at this phase is to generate support and to engage a process for feedback that improves provisions of future codes and encourages construction that both meets and exceeds the minimum code.

Outreach is the communication strategy that is developed, delivered, and adapted to foster a consistent understanding of the intent of the energy code. Outreach is a dynamic approach to communication and education that supports the energy code through an ongoing and cyclical process.

2.2 Scope of the Code

An energy code can include attributes, components, and devices that affect the energy efficiency of a building. In most energy codes for residential buildings, the evaluation criteria for the building's thermal envelope; heating, ventilation, and air conditioning (HVAC) system; and service water heating and lighting systems are generally less comprehensive in terms of complexity than the criteria for commercial buildings. As energy codes continue to increase the level of cost-effective energy savings for the envelope, mechanical, domestic hot water, and lighting systems, new measures for building energy efficiency, such as plug and process loads, vertical and horizontal transportation, and daylighting, are being considered.

The scope of the energy code can vary widely. For example, the scope could consider just one or two building elements, virtually every component in the building, or just the energy-using components and systems on the building site. In residential buildings, energy uses can be readily classified into those used for heating and cooling, service water heating, lighting systems, and plug loads associated with non-permanent equipment, such as appliances. Some homes or dwelling units could have additional loads such as elevators, pools and spas, garage door openers, and other miscellaneous non-portable uses. Starting from the narrowest scope, the items most likely to be covered in the scope of an energy code are products, materials, equipment, appliances, and building components that are manufactured at the national or global level and sold interstate or internationally. Examples include HVAC equipment, SWH equipment, and luminaires wherein federal law may address the energy efficiency of all such items at the point of manufacture.

Insulation and fenestration are additional examples of items included in the scope of a code, although the establishment of specific thermal performance criteria is determined in the energy codes rather than at the national level. The code can include not only required levels of insulation and fenestration thermal performance, but also restrictions on the air leakage associated with both the components of the building and of the building as a whole. In addition, building design can also be regulated through provisions that limit glazing area, require overhangs or shading, or direct building orientation. Appliances and miscellaneous systems, such as transportation or pools, should also be considered. Plug loads covering consumer appliances and controls for those plug loads can be included within the scope of the code as well.

In commercial buildings and large multifamily residential structures, the number of energy-using systems, equipment, appliances, and components is increased. In addition to the fundamental HVAC, SWH, and lighting systems, there can then be other appliances, such as vending machines, ice making machines, laundry services, commercial cooking, process exhausts, and vertical or horizontal transportation to include in the scope of the code. However, because fewer appliances are included in residential construction than in commercial construction, there is less potential to capture additional energy savings. Additional savings are being sought in the fundamental residential systems such as lighting controls, hot water piping, and ductless heating and cooling systems. Non-traditional savings are being reviewed for major kitchen appliances and televisions.

Any decision on the scope of the code must consider the format of the code; the timeframe at which compliance is examined; the methods of compliance, including documentation and verification; and any incentives for compliance or penalties for noncompliance. An example is plug loads. While the code can require the installation of certain controls, if code compliance is only verified prior to occupancy, only the existence of the controls can be verified. The actual operation and energy use associated with the building electrical system from plug-supplied appliances or equipment cannot be controlled or regulated. Conversely, if the code format is based on the energy performance of the building and compliance is determined after occupancy, all plug-related loads, including the purpose, efficiency, and control, are simply addressed by determining whether building energy use complies with a specified energy use intensity (EUI) and penalties or rewards are imposed.

Traditionally, the stringency of energy codes has been set at a minimal level and the time at which compliance verification is to be determined has occurred prior to occupancy. As such, the scope of codes has included only certain building systems and components that easily meet prescribed requirements and that can be evaluated for compliance before occupancy. As the figures below demonstrate, expanding the stringency, timeframe for compliance verification, and scope of a code could allow for greater energy efficiency and sustainable buildings than traditional codes.

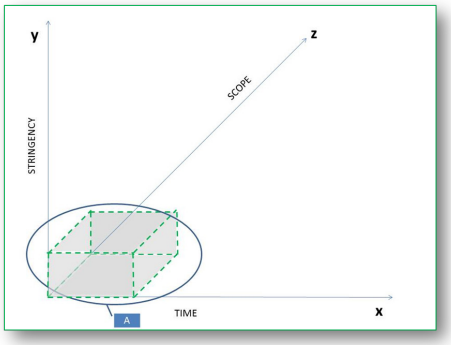


Figure 2.1. Traditional Approach

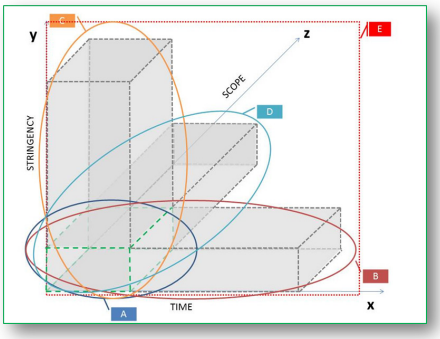


Figure 2.2. Traditional Approach with Expansion of Variables

Figure 2.1 represents the stringency, time, and scope of most current energy codes. The requirements to meet an energy code are generally set as singular prescriptive criteria with minimum efficiency requirements and compliance is usually determined prior to the issuance of a CO through plan review and inspection. Due to these limitations, the scope of current energy codes can only include the elements of construction that can be assessed prior to occupancy. However, this approach does not account for the energy savings of other building systems, measure the energy use of the building over time, or award performance that goes beyond the minimum requirements.

Increasing the stringency of energy codes, extending the time to validate compliance past CO, and increasing the scope, as shown in Figure 2.2, can foster more energy efficient and sustainable buildings. The extended time to determine compliance will allow for such activities as commissioning and measuring energy use, both of which will ensure that building systems are functioning properly over the lifetime of the building. An increased scope will allow codes to include all items that impact building energy use. By including these elements, greater efficiency will be achieved and more sustainable buildings will be constructed.

2.3 Code Format

Format describes how energy code provisions are presented. From micro to macro, the code can provide specific criteria for each aspect of the building, include provisions for a specific system in the building, or cover the building as a whole. The format of an energy code can drive what is included in the

code and when and how compliance is verified. Similarly, a code compliance path can drive the code's format. Possible energy code formats include:

- Prescriptive
- Component or system performance
- Total building performance
- Outcome-based performance and
- Peak energy capacity and
- Alternative Guidelines

Prescriptive provisions are simple, singular metrics that individual components of the building must satisfy. Examples include minimum insulation R-value, maximum window U-factor, lighting source minimum lumens per watt, and requirements for specified controls, such as a thermostat.

Component performance relates to the performance of a particular component, system, or sub-system of a building, such as the entire wall, building envelope, or HVAC system. The lighting provisions in codes provide an example of system performance; a maximum allowable lighting power density is provided without specifying how the designer is to satisfy the requirement. Additionally, the performance of the entire building as an assembly of components and systems can also be considered.

Total building performance relates to how the building is expected to perform as designed compared to how the building would perform if it complied with all prescriptive or performance provisions of the code. For example, a building design that does not comply with the lighting provisions of the code can show that the expected increase in energy use associated with the lighting system is offset by increased energy efficiency in another area, such as building thermal envelope. If the actual design does not use more energy than the code-based design, code compliance has been verified.

The outcome-based performance format extends the timeframe of evaluation from design simulation to metered energy use of the building once it is operating. Outcome-based performance is similar to total building performance, but rather than evaluating compliance in the design phase based on equivalency with an annual energy use limitation, the energy code establishes a performance goal in the form of a singular EUI for all buildings of a particular type. Compliance with the performance goal is determined after occupancy based on actual metered energy use. In all cases, whether by simulation or actual energy consumption, building performance in terms of energy use, energy cost, and/or carbon emissions is compared to the performance objective.

Peak energy capacity limits the ability of the building, building systems, or components to use energy. Peak capacity can be applied to the connected load of individual systems such as lighting, HVAC, or SWH, or to the aggregate of all building energy uses. One example of peak energy capacity is a limit on peak heat loss for a home as a function of floor area (X Btuh/ft^2). This sets a benchmark for building design that allows the designer to comply in several ways. This approach also considers elements of the building design, such as geometry or aspect ratio, which are not currently considered in most energy codes. For example, the Kansas Residential Energy Code, implemented in the late 1970s, set a limit of 35 Btuh/ft^2 peak heat loss. Peak capacity can be applied to a whole building by limiting the connected load, such as X watts/ft^2 or X Btuh/ft^2. This approach goes beyond the envelope and covers all energy uses in the building. Unlike an outcome-based approach, this approach does not consider time of use.

In addition to prescriptive, component performance, total building performance, outcome-based and peak energy capacity formats, alternative guidelines may be used as an accepted method for achieving code compliance.

The energy code format influences the degree to which individual components of a building, a building system, or the entire building must be evaluated for compliance. An energy code that has a specified performance level may only require one action to assess and verify compliance. For example, the requirements of a maximum allowable building envelope air leakage rate at a specified pressure differential would necessitate a performance test to determine building compliance. If the tested air leakage rate does not exceed the maximum limit in the code or if statistical analysis has determined that only a certain statistically valid sample must be tested if an approved quality assurance program is in place, compliance is achieved. This performance testing approach is often preferred over visually inspecting the air sealing of window installations, utility penetrations, or other envelope components, all of which can be subjective.

2.3.1 Prescriptive Format

A prescriptive format is the easiest way to present energy code criteria. Prescriptive formats are widely used by states and jurisdictions because text is written in mandatory and enforceable code language. An energy code with a prescriptive format will specify the materials and methods required during construction, generally in an easy-to-read table of maximum or minimum values. Prescriptive provisions of an energy code define the individual metrics that various building components must satisfy. Prescriptive requirements for each component must be met without exception unless there is an alternative path to compliance, such as component performance or equivalent performance. An example of prescriptive criteria is shown in Table N1102.1 of the 2009 International Residential Code (IRC), which provides climate-dependent R-values, U-factors, and solar heat gain coefficient (SHGC) values for components of the building thermal envelope. Prescriptive measures are also available in Table 402.1.1 of the 2009 IECC, which lists minimum R-values, maximum U-factors, and maximum SHGC values for residential buildings. For a comprehensive list of prescriptive requirements by climate zone in the 2009 IECC, visit Pacific Northwest National Laboratory's Building Energy Code website at http://energycode.pnl.gov/EnergyCodeReqs/index.jsp.

Compliance with a code that is presented in a prescriptive format is verified by whether each of the specific components of the building, such as ceiling insulation, satisfies the minimum/maximum metric and is installed correctly. The prescriptive path is the simplest compliance method available to guide code-compliant designs or to facilitate compliance verification. However, the prescriptive format may limit design options, creating a need for alternative compliance paths such as equivalent performance. To add flexibility, prescriptive minimums can be combined with performance- or outcome-based approaches to ensure a minimum level of efficiency while allowing the designer to meet additional efficiency requirements through alternative approaches.

Prescriptive Format: 2009 IECC

A prescriptive approach for residential occupancies is included in Chapter 4 of the 2009 IECC. The approach includes a look-up table to determine the minimum insulation R-value requirements for the walls, roof/ceiling, and floor assemblies, in addition to determining the maximum limitations for window U-factor and SHGC. The table is based on assembly type, construction approach (e.g., ceiling, floor, wood framed wall) and climate zone. For example, a residence built in climate zone 3 would need to install ceiling insulation with a minimum R-value of 30 to comply with the code. For the same home, fenestration would be required to have a maximum U-factor of 0.50 and SHGC would be limited to a maximum of 0.30 to comply with the prescriptive requirements of the code.

Table 4.2.1.1. Insulation and Fenestration Requirements by Component

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Glazed Fenestration SHGC	Ceiling R-Factor	Wood Frame Wall R-Value	Mall Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value & Depth	Crawl Space Wall R-Value
1	1.20	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4 / 6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5 / 8	19	5 / 13[f]	0	5 / 13
4 except Marine	0.35	0.60	NR	38	13	5 / 10	19	10 / 13	10, 2ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5	13 / 17	30[g]	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	20 or 13+5	15 / 19	30[g]	15 / 19	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19 / 21	38[g]	15 / 19	10, 4 ft	10 / 13

Prescriptive approaches, similar to the requirements in the 2009 IECC, also have minimum requirements for air sealing of the envelope, heating and cooling systems including sealing ductwork, water heating systems focused on minimum water heater efficiency and insulating hot water piping, and high efficacy lighting. To meet the prescriptive requirements in the code, the builder or designer must demonstrate compliance with both the R-value minimums and U-factor maximums in Table 402.1.1 or the U-factor equivalents in Table 402.1.3 and the other requirements of the code. The authority validating compliance would review the plans and construction for conformance to the requirements in the code.

2.3.2 Component Performance Format

The component performance format relates to the performance of a particular component, system, or sub-system of a building. For example, the building envelope can comply with a total UA approach, which is the total U-value of all of the components multiplied by their respective areas and divided by the total area of all the individual components.[7] This approach is flexible in that the component of the building envelope, or the total envelope of the proposed building, must simply have a UA less than or equal to a building with an identical geometry that complies with the energy code. The approach allows portions of the building envelope that do not comply with the code to be offset by parts of the envelope that over comply, so that, on average, the building envelope complies with the code.

[7] A code will generally provide a maximum Uo for various opaque components of the building envelope. Using standard heat loss calculations, the R-value through each series of materials between inside and outside (e.g., studs, insulated cavity) is determined, the U-value for each series is determined as 1/R, and the relative areas of each is considered to yield an area weighted average U-value, or Uo. For a total UA approach, this calculation is performed two times; once for the building as designed and once as if the building met the prescriptive provisions in the code. Compliance is achieved if the former does not exceed the latter.

Component Performance Format: Housing and Urban Development

Subpart F of 24 CFR Part 3280 of the U.S. Department of Housing and Urban Development (HUD) Code provides minimum standards for the design and construction of manufactured homes. The thermal provisions of the HUD Code are provided in terms of a maximum allowable Uo associated with the entire thermal envelope of the home (e.g., summation of each heat transfer path UA [U-factor × the component area] in the envelope divided by the entire A of the envelope).

2.3.3 Total Building Performance Format

Total building performance goes beyond individual system performance to address the whole building. This format focuses on the performance of the regulated loads of the building as estimated through simulation in the design phase. The performance, or estimated annual energy use, of the proposed design is compared to the annual energy use of the proposed building assuming it satisfied the minimum requirements of the code. Using equivalent performance, a designer can use an annual energy simulation of the designed building to document that it will use no more energy than if the building were designed to meet the minimum provisions of the code. By establishing guidelines to ensure the comparability of the two simulations, this approach essentially provides a way for changes above or below the limitations in the code to be assessed by their effect on annual energy use. When the net change in energy is negative, the design is considered code compliant because it uses less energy than the design of the reference building that satisfies the code.

Another approach is to establish a uniform EUI for all buildings of a certain type and in a particular location, rather than developing a specific EUI for each building. For instance, office buildings in climate zone 4 could have an EUI of 50 kBtuh/ft^2/yr (50,000 Btu per square foot of floor area per year). Following certain energy simulation rules, the designer would determine their design's EUI and compare it to the stated EUI. This approach is the same as the equivalent performance approach described above, except instead of the EUI or other metric being established from a set of prescriptive provisions applied to the particular building, there is one pre-determined limit that applies to all buildings of a certain type. This approach essentially changes the foundation for the energy code criteria from a prescriptive basis to a performance basis.

Total Building Performance: Energy Cost Budget Method of ASHRAE 90.1-2007

The Energy Cost Budget (ECB) Method of ASHRAE Standard 90.1-2007 (90.1-2007), found in section 11, allows the designer to trade off levels of increased and decreased efficiency between the building envelope, mechanical system, service water heating system, and lighting system. This type of approach gives the design team the most flexibility in meeting the requirements of 90.1-2007 for commercial buildings, but it also requires the design team to have more expertise to complete the required energy simulations and document compliance. It also requires plan review and inspection staff to have more knowledge of the energy code for verifying compliance with the project. Compliance with the ECB approach requires the designer to determine the cost of energy to operate a proposed building (proposed design) annually. The cost to operate the building is compared to the cost to operate a building using the same building geometry and other operational characteristics, and levels of efficiency that just meet the minimum prescriptive requirements specified in Sections 5 through 10 of 90.1-07, Budget Building Design (BBD). If the cost to operate the proposed building is less than or equal to the cost to operate the BBD, the building complies with 90.1-2007. This approach essentially allows the establishment of an energy performance path. However, instead of one benchmark EUI or cost index for all buildings of a particular type, each building has its own unique benchmark based on the application of the prescriptive provisions of the code to the building design.

The ECB approach requires that the designer develop a BBD (standard reference building) based on the proposed building geometry and other operational characteristics. The ECB approach also requires that the designer

understand both 90.1-2007 and the modeling software. Table 11.3.1 of 90.1-2007 provides specific requirements for defining the BBD and addresses the following:

- Design Model
- Space Use Classification
- Schedules
- Building Envelope
- Lighting
- Thermal Blocks (HVAC Zones designed or not designed)
- HVAC Systems
- Service Hot Water Systems
- Modeling Limitations Simulation Program

Once the BBD is developed, the building is modeled through computer simulation to determine an energy cost budget that will be used to compare the results of the proposed building model with the BBD.

2.3.4 Outcome-Based Performance Format

Similar to total building performance, an outcome-based performance format requires that a building must satisfy a pre-determined EUI target that is specified in the code. Rather than simply measuring expected energy use, however, outcome-based codes measure actual energy use once a building is occupied, commissioned, and operating. If the pre-determined EUI is not exceeded, the building is deemed to satisfy the stated conditions, regardless of how compliance was achieved. If the building exceeds the EUI, the building fails and further actions would have to be taken, as determined by the energy code, to bring the building into compliance. Those actions can include the following:

- Recommissioning of the building and continued monitoring to ensure compliance
- Loss of a required performance bond to support renovation and retrofit of the building
- Loss of an occupancy permit or conditional occupancy permit
- Loss of any incentives for compliance such as utility rate reductions or property tax reductions

Outcome-Based Performance Format: Seattle, Washington

The City of Seattle, in partnership with New Buildings Institute and the Preservation Green Lab, is developing and piloting a new outcome-based regulatory framework for improving existing building energy performance. The goal is to develop regulations for improving older and historic buildings that will make this building stock more energy efficient. An outcome-based format was selected to give building owners the flexibility to increase energy efficiency through techniques and technology that may not be included in building energy codes. Current energy codes focus more on upgrading the building envelope through a retrofit process, which could degrade the character of the building. For example, an energy code would require upgraded windows and modifying the wall system to add insulation. In Seattle, this could mean replacing single glazed wood mullioned windows that add character to the building with double glazed units with aluminum frames. Instead of a code-prescribed method, the owners could use commissioning of existing systems or the installation of renewable energy to meet their energy goals for the building.

The draft policy framework for the outcome-based code addresses several logistical issues that are creating barriers for developing and deploying outcome-based codes in multiple jurisdictions. Setting energy use targets is often the most difficult. The program only allows buildings with certain occupancies to participate, as they use the ENERGY STAR Target Finder design tool and Portfolio Manager to establish the target for the building. These tools are based on the national Commercial Buildings Energy Consumption Survey (CBECS) database and are consistent with the 2030 Challenge. The energy targets are proposed to be expressed in kBtu/ft^2 or EUI. The target also is to be adjusted for each change in occupancy or use.

Project Submittal

The proposed applicant plan submittal will include the following:

- Performance target set by ENERGY STAR Target Finder or an appropriate modeling tool
- Detailed plan for sub-metering/monitoring of landlord and tenant loads
- Detailed plan for automated controls that may be installed as part of the retrofit
- Submittal of proof of compliance with certain City of Seattle Energy Code provisions
- Plan for adoption of "green lease" provisions that allow the owner to have access to tenant energy use data

Proposed Enforcement

The proposed regulation will be enforced using performance bonds that can be used to fund another retrofit in the building in the case of noncompliance. The bond will be based on the total annual energy cost as calculated using ENERGY STAR Target Finder. If projects do not meet the set performance targets, and the bond has been used to fix the building, the project will be subject to fines that could include:

- Assessment of \$.10 per kBtu/ft^2/yr for every kBtu above the performance metric
- Escalating utility rates
- Tax lien/covenant that remains with the property.

After the Certificate of Occupancy

Occupants will demonstrate that the performance targets have been met for a continuous and fully occupied 12-month period based on a 36-month evaluation period. Based on building performance, the performance bond:

- Will be returned in full if the building meets the performance targets for the 12-month period
- Will be forfeited at a rate of 25% per 6-month period until the performance targets are met or the bond is used.

Failure for the building to perform after the bond is consumed will result in escalating utility rates or a tax lien until the building meets the performance target. The City of Seattle will monitor and validate owner-reported performance data using strategies that include disclosure at point of sale, random audits, checking against automation, and sensor data.

2.3.5 Peak Energy Capacity Format

The peak capacity format limits the capacity of energy systems installed to support a building. To some degree, this format is already contained in the lighting requirements of most energy codes as lighting is addressed in terms of lighting power density for various building types and space uses. The limitation on HVAC equipment sizing in certain buildings can also be a form of peak capacity. In both instances, there is a limit on system capacity that cannot be exceeded. However, the intent behind peak capacity is to limit the ability to use energy for all purposes, which the HVAC and lighting capacity examples do not fully address. Instead, more relevant examples include the 1970s North Carolina State Building Code, which had a peak connected load limit for commercial buildings in watts per square foot of conditioned floor area for all purposes. This approach, while not addressing the total energy use of the building over time, was considered a simple way to address energy efficiency by limiting the capacity to use energy. In some respects, demand metering and demand charges from power companies address this same issue through economic incentives and disincentives, rather than an energy code. As with outcome-based codes, which do not consider the efficiency of the building components and are based solely on annual energy use, peak capacity criteria also indirectly accounts for passive solar, orientation, building design, and other factors that are virtually impossible to prescribe without limiting design freedom.

Compliance with peak capacity codes can be easily verified by, for example, determining the maximum allowable electric service capacity for a building based on a specific building metric, such as

floor area. Peak capacity codes also limit the ability to use energy, which can more easily address plug and process loads that are difficult to regulate prescriptively. Peak capacity codes, however, do not address the time rate of energy use. As such, they may be a good candidate for buildings that are expected to operate 24/7 with relatively constant loads, such as a hotel or hospital, and are not as preferable for buildings with limited peak load operation, such as buildings used for religious services. A code with peak capacity considerations can also be more effectively coupled with utility rate structures and electric utility planning. As alternative power sources, such as PV (photovoltaic) or energy storage systems, become more widely used, the peak capacity format will better coordinate with the capabilities of such sources.

2.3.6 Alternative Guidelines

Although codes have a specific format for presenting requirements, additional supporting documents, such as guidelines and manuals, are often available for design professionals and builders to use to verify compliance with the code in different ways. These documents, known as alternative guidelines, represent accepted methods that have been proven to result in code compliance. Examples include REScheck, RESNET, the Pennsylvania Alternative Energy Provisions, and COMcheck.

Within the prescriptive path, unique opportunities exist to incorporate performance-oriented elements into the requirements for a part of the building that otherwise reside in a prescriptive code. An example is the UA alternative/limited scope alternative path. This path consists of software, known as REScheck, that is used to determine the compliance of residential structures with section 402.1.4 of the IECC using the UA alternative. The REScheck approach provides builders with several combinations of insulation levels, glazing U-factors, glazing areas, and other envelope requirements that meet the prescriptive requirements for each climate zone on a thermal equivalency basis. REScheck was created by DOE and can be downloaded for free from the Building Energy Codes Program (BECP) website. REScheck is available as two different tools, REScheck desktop software and REScheck-web. Most of the United States, including many counties and jurisdictions, accepts REScheck reports as compliance verification; several states include REScheck requirements in the state energy code. For a complete list of states using REScheck and for a free download, visit the BECP website at energycodes.gov.

Similarly, RESNET standards are recognized by many states and the federal government as alternatives to minimum code compliance. RESNET is a national membership corporation that specializes in the energy efficiency rating systems of buildings. RESNET ratings result in a number on the HERS (Home Energy Rating System) Index that corresponds to the amount of energy used by a building compared to the 2006 IECC. The lower the HERS Index rating, the more energy efficient the home is. Many state energy codes and above code programs require that homes attain a minimum HERS rating for compliance verification or green program recognition.

State Specific Alternative Guidelines: Pennsylvania

Some states have individual alternative guidelines for verifying compliance, such as the Pennsylvania Alternative Energy Provisions, or PA-ALT. PA-ALT is one of three compliance path options in Pennsylvania and was designed as an easy alternative to the mandated energy code. PA-ALT is intended to supplement chapter 11 of the IRC and has the same scope, intent, and general layout as both the IRC and IECC. However, PA-ALT focuses primarily on Pennsylvania's climate and is more flexible, easier to enforce, and simpler to build to than the IRC and IECC. In terms of energy efficiency, the most current version of PA-ALT is equivalent to the 2009 IECC.

For commercial projects, several alternative guidelines to code provisions are available, including DOE's COMcheck software. COMcheck, like REScheck, was created by DOE to simplify energy code compliance. COMcheck gives builders and code officials a computer-based alternative to physical computation and provides forms and checklists to help document compliance. The majority of states accept COMcheck as a method for verifying compliance; visit the BECP website for a complete list of states and jurisdictions currently using COMcheck.

2.4 Responsible Party

The entity assigned to validate compliance generally documents and determines that the building complies with the adopted code. Code officials, builders, designers, lenders, insurance underwriters, realtors, and utilities are all possible candidates for assessing and verifying compliance with the code. In general, those determining compliance are either local or state agencies or first-, second-, or third-party conformity-assessment entities. First-party conformity assessment involves self-certification by the entity that is responsible for compliance. Second-party conformity assessment involves the entity receiving the completed building, such as the building owner or developer, that has a vested interest in the outcome of the project. Third-party conformity assessment involves an individual or company that is not affiliated with the building in any way, including its design, construction, ownership, commissioning, operations, or maintenance, and does not have a vested interest in the outcome of compliance verification.

One or more conformity assessment approaches can be used to determine compliance depending on the means of adoption, scope of the code, code format, and timeframe in which compliance is determined.

2.4.1 Local Government Agency

Where the code is adopted by state or local law, rule, or regulation, compliance with the code is generally assessed by employees of a local government or their agents. Typically, these employees are responsible for reviewing building plans and/or inspecting construction to validate compliance with the energy code. While this process is traditionally completed based on the issuance of an initial CO, in some cases, as with fire, life safety, and health codes, local agencies can be involved in post-occupancy code compliance verification as well.

In addition, some local government agencies allow approved third parties hired by the building owner or developer to validate and report on compliance to the local government. In such cases, the local government will generally implement an accreditation program to continually evaluate the competency of the entities to act on behalf of the government. An example of this is the HUD manufactured housing program, wherein HUD approves certain plan review and inspection agencies hired by the manufacturer of the home to validate that home plans meet the HUD Code and that the home is constructed in accordance with the approved plans.

The involvement of local government agencies in code enforcement depends somewhat on the role of the state.[8] States that have the authority to adopt a code may conduct some or all of the compliance verification activities or may delegate certain activities to local governments. Where the state does not have authority to adopt a code, the choice to adopt a code and the manner in which code compliance is

[8] The involvement of state agencies in the code can also have dependencies on local government level of enforcement.

verified is left to local government. Local and state enforcement agencies face many of the same issues when adopting a code: determining responsible agencies, defining the scope of that responsibility, coordinating the efforts of multiple agencies, and addressing the need for sufficient resources, including funding.

2.4.2 State Government Agency

State agencies can also be responsible for any number of activities associated with verification of code compliance, including activities in support of local government, in addition to local government or in lieu of action by local government. This can range from oversight of state programs that evaluate and accredit third parties to product certification activities to complete review and approval of all building plans and construction. Typically, state agencies are responsible for state-owned or state-funded projects, including universities and government agency buildings, and will conduct all plan reviews and inspections on such or authorize private sector third parties to do so. For private sector buildings, a mixture of state and local enforcement may occur. The state may have complete responsibility for certain building types, such as theaters, hotels, casinos, or schools, or might only have responsibility for enforcement where there is no local government agency enforcing the code. The state may conduct plan review and approval to construct and then defer construction inspection to an appropriate local agency or private sector third party. Depending on the state, the scope and format of the code, when during the process compliance is to be determined, and political issues such as home rule and other factors, the involvement of state agencies in lieu of or in support of local agencies can range from no involvement to complete oversight of all compliance verification activities.

In any situation where the state has a role in compliance verification, the following must be considered:

- Which state agency or agencies are responsible for enforcing the code?
- Do those agencies act alone or do they supplement local agency enforcement?
- How are efforts coordinated when multiple state and/or local agencies are involved?
- Is there a mechanism to recover the costs associated with enforcement and/or are some or all of those costs incorporated into the tax base? If fees more than cover enforcement, where are the surplus funds directed?
- Are there sufficient resources to ensure code compliance through the state activities?

2.4.3 First-Party Verification

First-party entities are those who are directly responsible for the design, construction, commissioning, or compliance with all or part of an energy code. First-party entities essentially state that the project complies with the code or a particular provision in the code and compliance is assumed based on that statement. For instance, the designer can state that the building design complies with the code, a contractor can assert that the building construction complies with the code, and any entity responsible for manufacturing components of the building can declare that the components meet relevant standards contained in the code. Inaccurate claims of compliance by first parties can result in penalties—designers can lose their professional licenses, contractors can lose their business licenses, and components can be recalled or precluded from use in a building. Including oversight in first-party verification provides

ongoing quality assurance and assessment of professional capability that would allow one to trust a statement of compliance by the first party.

2.4.4 Homebuilder

The first-party, or self-certification, compliance verification model requires that code-educated builders provide proof of compliance either to a government agency or to the home or business owner. The proof is often in the form of a checklist or certificate that is completed by the builder at the conclusion of the project. This enforcement model is most popular in jurisdictions that have minimal resources such as funds and personnel, because self-certification costs very little and requires nothing more than a knowledgeable builder. The rate of noncompliance when self-certifying is can be relatively high, however, due to the absence of onsite inspections and plan reviews by others. Jurisdictions must rely solely on the proficiency and principles of a builder, which can often lead to an inaccurate account of building compliance.

Vermont is one of the few states with a building code, either statewide or in specific jurisdictions, that relies on the credibility of builder self-certification. The Vermont Residential Building Energy Standard is a mandatory statewide energy code for new residential construction that requires a compliance certificate, completed by the builder, for each residential project. It is the responsibility of the builder to understand, design, and build to the minimum requirements of the energy code and to determine compliance using one of four compliance methods: fast track method, trade-off method, VTcheck software method, or home energy rating method. Builders must then complete a compliance certificate that enumerates the required energy components of the building, indicates the home is compliant with the code, and guarantees the accuracy of the information provided. The certificate is a one-page adhesive label that is to be affixed to the electric-service panel or heating component of a completed project. If a residential building does not meet the minimum requirements of the energy code, a disclosure form must be completed instead and provided to the owner.

Vermont Residential Energy Standards Compliance Options

Fast-track Method: Compliance can be determined by incorporating the prescribed technical requirements of the code. This is the easiest way to demonstrate compliance.

Trade-off Method: Compliance with the technical requirements of the code can be demonstrated through the use of trade-off tables.

VT*check* Software Method: Compliance with the technical requirements of the code can be demonstrated though the use of VT*check* software. The software identifies deficiencies in the structure.

Home Energy Rating Method: Homes must score a minimum of 82 to comply with the code. This method recognizes air tightness, hot water heating, and solar orientation.

Source: Vermont Residential Building Energy Code Handbook.

Some states allow the builder to choose self-certification from a variety of certification methods. Texas, for example, allows self-certification as one of three compliance options in areas outside of a municipal jurisdiction. To verify compliance with the Texas Building Energy Efficiency Standards, residential structures must attain certification from an energy efficiency program, a completed inspection by a code-certified professional, or a checklist completed by the builder. Many states also incorporate more stringent requirements into prevailing energy codes. These above code or green programs often rely on self-certification to help distinguish builders and architects who integrate voluntary green building practices into their building designs. Built Green programs in cities and counties such as Santa Barbara, California, and Tacoma, Washington, encourage environmentally friendly and resource-efficient building.

The program assists builders and architects by providing training materials, building information, and a self-certification checklist to ensure green building compliance in addition to compliance with state energy codes and standards. Both commercial and residential structures can rate at a one-, two-, or three-star level. Sample self-certification certificates for Vermont, Santa Barbara, and Texas can be found in Appendix A.

Self-certification by the builder, whether to a state agency/municipality, other authority, or the building owner, is the least expensive and most resource-efficient compliance verification method available. It requires little to no administration and holds knowledgeable builders responsible for compliance. The risk for noncompliance is highest, however, due to the lack of reinforcement and the large amount of trust placed on the integrity of the builder. The availability of programs to occasionally oversee builder activities and impose penalties for incorrect statements concerning compliance can increase the reliance on and enhance the credibility of self-certification programs.

2.4.5 Second-Party Verification

As with first-party compliance, second-party compliance involves an individual with a vested interest in the outcome of compliance. However, they are not directly responsible for compliance themselves. Second-party verification could include the building owner, developer, or an individual hired by the owner, developer, designer, or contractor who also has a vested interest in the project.

2.4.6 Developer/Owner

A developer that understands and appreciates the value of energy efficiency can be a catalyst to ensuring compliance with codes, either by supporting mandatory adopted codes or making code compliance a requirement for voluntary codes. Developers are most influential when an external factor, such as an incentive or possible penalty, causes the developer to take an active role in demanding a quality building. Based on the stringency of energy codes and the ability of buildings to far exceed those codes, many developers are building above code and acting as second-party verification agencies and will continue to do so because of such external factors. Conversely, developers who are currently building at minimum code are unlikely to undertake any compliance verification activities unless compliance is required by another entity, such as state or local government.

A developer who is also the building owner and operator, as is the case with buildings owned by federal, state, or local government; projects funded with government support; and national accounts such as those associated with the hospitality, healthcare, or retail industry, is more likely to see the value in energy code compliance because of their involvement in operating the building. Developers with a vested interest in the building are more likely to meet or exceed the minimum code to receive an economic benefit and play a significant role in energy code compliance.

The degree to which a developer or owner can review design and construction work on their own behalf and play a role in compliance verification as a second-party agency depends on their motivation to possibly exceed minimum code, interest in quality assurance and construction practices, and reputation for trustworthiness. A developer is most likely to participate in compliance verification in instances where they continue to have an interest in the project after its completion and less likely in instances where the motivation is to complete and sell the project. Developers and owners can be considered key components in compliance verification for all projects if there is a random assessment of completed work by a third party and a means to remove their authority to verify compliance should projects not comply with energy codes.

2.4.7 Third-Party/ Third-Party Privatization Verification

The most common form of energy code compliance verification, whether for components associated with the building or the entire building design or construction, is through an assessment of compliance by a third party. Third-party compliance verification occurs when an individual or company without a vested interest in the project is responsible for verification of compliance, such as state and local building regulatory agencies. Privatization as applied to third-party compliance verification describes a situation where the third party is a private sector entity that verifies compliance on behalf of a government regulatory agency. One example of this is the approval of products, materials, equipment, appliances, or devices used in buildings upon which a test standard or code criterion depends. Compliance or approval is generally validated by the code official based on the official's direct investigation or as the result of work performed by a nationally recognized organization. Nationally recognized organizations, such as Underwriters Laboratories and Factory Mutual, fill the role of the privatized third party, and building officials accept validation of compliance by these organizations. This approach is more readily implemented for components associated with a building, although the same concept can be applied to compliance verification of entire buildings.

HUD has used third-party privatization for 35 years to verify compliance with the HUD Code for manufactured housing (24 CFR Part 3280). This mandatory code covers the design and construction of manufactured homes. The compliance verification provisions provide for the ongoing review and approval of plans by private sector entities, such as design approval primary inspection agencies (DAPIA) and in plant inspection agencies (IPIA) that have been approved by HUD. The manufacturer can hire these agencies to carry out plan review or construction inspection to validate HUD Code compliance; complying homes are labeled to indicate code compliance. HUD oversees these agencies to ensure that they continue to operate pursuant to HUD requirements and conducts training for the agencies on a regular basis.

Third parties that are contracted by a regulatory agency are generally not considered privatization, however, and instead act as an employee of the agency to which they are consulting. In general, contracted third parties must meet and maintain a level of competency with respect to the work performed during various phases of a project, including plan reviews and inspections. The success of third-party verification is dependent on the competency of the entity verifying compliance, the capacity of the third party to be objective, and the ability to place confidence in and trust findings. Once those provisions are satisfied, third parties can perform code compliance verification of buildings within the scope granted to them by the code official. For instance, the code official may retain the authority to conduct special inspections for commercial buildings, such as application of fire protection or inspection of concrete reinforcement.

Another way to verify code compliance is to recognize the use of other design and construction programs, such as HERS Index ratings programs, ENERGY STAR certification, and Leadership in Energy and Environmental Design (LEED) certification as an equivalent to complying with the provisions of an energy code. The degree to which the programs meet or exceed the adopted code determines whether compliance with the code is achieved if the program is followed. If equivalency is recognized, a state or local agency may choose to conduct inspections to ensure that the project is built according to the criteria of the program. However, the programs often require qualified verifiers, such as a HERS Rater, an ENERGY STAR Provider, or LEED Accredited Professional and the inspections performed by such verifiers will validate that the building is compliant with the code.

2.4.7.1 HERS Index

A more comprehensive approach for residential development requires a specific HERS Index score. The index scale is 100 to 0 and the 2006 IECC is used as a baseline for comparison. A home built to the 2006 IECC scores a HERS Index of 100, while a net zero energy home scores a HERS Index of 0. Thus, a home with a HERS Index of 85 is 15% more energy efficient than the HERS Reference Home; a home with a HERS Index of 80 is 20% more energy efficient. The HERS Index rating takes into account heating, cooling, water heating, lighting, appliances, and potential onsite power generation. The ratings are established using trained, certified inspectors, who provide third-party verification of installations and specifications, such as whole house air leakage. The level of energy efficiency, when measured using the HERS index scale, is typically 60–80, which translates to 20–40% above the 2006 IECC baseline.

2.4.7.2 ENERGY STAR

The ENERGY STAR program for residential construction has specific, prescriptive requirements, in addition to the HERS Index. ENERGY STAR homes are required to have a HERS Index of 85 in climate zones 1–5, and a HERS Index of 80 in climate zones 6–8.

2.4.7.3 LEED

LEED is a third-party certification program and nationally accepted benchmark for the design, construction, and operation of high-performance green buildings. When measured using a LEED rating system, the level of building energy efficiency is compared to the level of energy efficiency achieved by following the requirements of the IECC. The energy efficiency of a building is then presented as a percentage above the IECC. The percentage above the IECC is one way to earn Energy and Atmosphere (EA) credits on a LEED project. Several green building or above code programs specify the number of EA points that the project must acquire to obtain a LEED certification.

2.4.8 Contractor Licensing Board

Where the compliance verification method is not through the traditional state or local building regulatory agency that engages in plan review and inspection, other capable third parties, such as a contractor licensing board, are able to ensure compliance. A contractor licensing board provides licenses for contractors and has the authority to rescind those licenses when license retention is tied to code compliance. A contractor licensing board may also ensure that bonds required as a condition for compliance be surrendered should a building be non-compliant. In Rhode Island, for instance, the Contractors Registration and Licensing Board has issued minimum standards that prescribe the quality level for materials and performance for the construction or alteration of residential structures. These standards include using certain HVAC components and the performance standards of systems; noncompliance can result in a fine and/or loss of license. Another example is the Municipal Code of Casper, Wyoming. Chapter 15.12 ties revoking a contractor license to failure to construct a building in accordance with the building plans approved by the building department based on compliance with the adopted codes. A similar example is found in the Texas HVAC contractor licensing regulations. Section 75.110 (Applicable Codes effective April 1, 2011, 36 TexReg 1975) indicates that the Texas Department of Licensing and Regulations adopted the 2009 edition of the Uniform Mechanical Code and 2009 editions of the International Mechanical Code, the IRC, and other applicable codes. Texas requires the use of the codes effective September 1, 2011, as part of the state contractor licensing requirements. To ensure

compliance, contractor boards generally conduct project inspections, either based on reports of non-compliance by building owners or as part of a random inspection process. The possibility of an inspection that may result in action by the board can be enough motivation for contactors to comply with the code.

2.4.9 Utility

Utilities can also serve as a third-party compliance verification entity. To some degree, utilities already do this now with respect to the safety and capacity associated with providing permanent or temporary electrical or natural gas service. Propane distributors play a role in compliance because of their involvement in the installation and maintenance of tanks and associated piping. Steam and chilled water supplied by utilities may also be involved in a similar manner. While the scope of utility involvement is generally limited to the initial point of delivery, onsite piping, and metering, it does provide a precedent for utility involvement in the design and construction of buildings. Utilities remain involved during the life of the building to address issues that may affect interests associated with a building, such as transformers, piping, meters, and other system components. A new area of utility involvement is in automatic load controls on selected equipment and the smart grid. The ability to foster more informed control of selected energy loads following occupancy shows that utilities can be involved at any point during the design, construction, commissioning, or operation of a building. States like New Hampshire are recognizing that utilities may also play a role in fostering energy code compliance; the responsible agency for the New Hampshire energy code is the state Public Utilities Commission.

Another example of utility involvement is Austin Energy in Austin, Texas. Austin Energy offers a green commercial rating program to drive sustainable building practices, including energy efficiency. After receipt of a nominal fee, owners and developers receive assistance to ensure that a building will meet certain program requirements throughout the design and construction phases of the project. In this manner, while the energy provisions are what could be considered above minimum code, the utility is directly involved in evaluating compliance with the program provisions.

Utility: Pacific Gas and Electric Company

Pacific Gas and Electric Company (PG&E), a California-based utility, has developed an Energy Efficiency Portfolio Program Implementation Plan (Plan) that focuses on increased implementation of codes and other programs to increase energy efficiency. The overriding strategy focuses on improving code compliance and enforcement for California's Title 24 Energy Code. Five different activities are identified to meet the Plan, four of which focus on how the utility can support code enforcement. The Plan is based on the mission set by the Codes and Standards program and focuses on saving energy for the utility ratepayers. The program's mission is to influence standard and code-setting bodies to strengthen energy efficiency regulations by improving compliance with existing codes and standards.

Activity 1
PG&E proposes first to assess the current enforcement and compliance process to determine where improvements can be proposed to increase compliance with the energy code. This will include identifying best practices for energy code implementation by interviewing experts who have been providing training, software, and regulatory support to industry practitioners. The utility will also conduct a process pilot project with local jurisdictions to determine opportunities to streamline enforcement practices and improve consistency among jurisdictions.

Activity 2
Activity 2 will design energy code education, targeted at plan review and inspection staff that focuses the training only on the topics that staff members need to know to enforce the code. For example, "role-based" training programs will be developed for plan review, field inspection, and counter staff, targeting only those sections in the code related to each particular position. As part of this, PG&E will develop and test process improvement tools to increase code enforcement.

Activity 3
PG&E will target those responsible for preparing documentation submittals to increase the quality and accuracy of the submittals, reducing the time required for plan review and field inspection. One method that they have chosen to increase the level of knowledge is to work with the California Association of Building Energy Consultants, the California Energy Commission, and the California Building Officials (CALBO) to increase the stringency of the voluntary professional Certified Energy Analyst Test and to initiate a certification program for consultants that perform energy code documentation. In addition, PG&E will work with CALBO to integrate energy code related education for building officials as part of the existing continuing education program.

Activity 4
PG&E is also proposing to develop context-sensitive code guidelines that target specific compliance items and common measures that must be addressed at each stage in the permitting and inspection processes. In addition to working on code guidelines, PG&E will research specific areas of the code that can be simplified by reducing the number of potential trade-offs and compliance options. Simplifying the code will increase enforcement as plan review and inspection staff members are having difficulty keeping up with the changes and level of complexity associated with the energy code.

2.4.10 Lender

The institution, or lender, that has proffered the funds to design and construct a building is technically the building owner. While the property title may be in the name of an individual or corporation, the property belongs to the lender as long as there is a loan on the property. Although the lender is generally not involved in design or construction decisions, they do have an interest in the outcome of those decisions. Buildings that do not comply with a code may have an increased risk of liability for repairs and higher operating and maintenance costs, all of which can affect the short and long term value of the investment. Ensuring that the building is designed and constructed to minimum codes can protect the investment in that building.

Lenders are involved both in compliance verification practices and in setting the standards for government-backed loan programs, such as those offered through Veteran's Affairs, HUD, and the Federal Housing Administration. To accomplish such, lenders must have a vested interest, adopt particular standards, and use certified appraisers to evaluate whether a home qualifies for a loan. However, the current number of noncompliant home foreclosures suggests that lenders may not have enough code awareness to have sole responsibility for conducting compliance verification. In addition, lenders face a number of code compliance challenges when foreclosing, including the fines, liens, and costs to abate code violations, all of which can exceed the value of the property. Lenders must understand these challenges and have solutions to resolve them.

The degree to which certain incentives may be offered influences the viability of lenders as verifiers of code compliance. Where an energy efficient mortgage is offered, or a reduced rate that considers the energy efficiency of the property, the lender has a vested interest in ensuring that the energy standards adopted as part of the program are satisfied. Commercial lenders are already protecting their loans prior to funding by including zoning compliance as a major factor on the closing checklists of buildings. Lenders require that the property be in compliance with applicable zoning ordinances with respect to usage, parking, setbacks, height, density, coverage requirements and more.[9] Zoning compliance is especially important for lenders and building owners seeking confirmation that a property can be reconstructed to the same building configuration in the event of massive casualty.

Just as zoning compliance has become a major factor on the closing checklist, energy efficiency is increasingly becoming a required factor. Many jurisdictions are requiring an energy efficiency rating on property transactions. For example, in North Bay, California, a formal report regarding the energy use of a building is required as part of the sale, lease or financing of nonresidential buildings under a new state benchmarking law. Assembly Bill 1103 requires owners to provide 12 months worth of comparable energy-use information to prospective buyers or full-building tenants as well as financiers. As energy efficiency becomes a required factor of property transactions in more jurisdictions, lenders will have a greater interest in ensuring compliance with adopted codes and standards and can undertake compliance verification to provide accurate and subjective assessments of code compliance.

2.4.11 Appraisers

Appraisers are in a position to evaluate the condition of a property and the degree to which it complies with codes and other regulations. Appraisers generally act on behalf of a lender in assessing a property and, in many cases, are already determining the level of compliance a building has with fire codes. Energy efficiency affects both the short and long term equity of a property, and, similar to code compliance related to fire codes, can result in expensive repairs and impact the appraised value. Appraisers could address energy codes in the appraisal process if energy efficiency were important to a lender. The results of any such appraisal would likely be considered valid as the lender and appraiser are interested in reporting the real condition of the property.

[9] http://www.pzr.com/articles/commercial-lenders-demanding-zoning-conformance-reports

2.4.12 Insurance

Insurance underwriters have a particular interest in codes and code compliance because codes affect the level of risk to which the insurance carrier is exposed. Traditionally, insurance underwriters have focused interest on health, life safety, and other issues that affect the ability of the property to withstand a fire, seismic event, flood, or other disaster. The degree to which insurance interests affect code compliance on these key issues can have a tangential affect on energy.

Mississippi provides one example of insurance industry involvement in code compliance. The Mississippi Residential Property Insurance Underwriting Association has rules and rates that address aspects of code compliance that members must follow. The construction practices of certain portions of the building, such as the roof, affect the insurance rates that are applied to the property.

Insurance: Liability Coverage for Solar Energy Systems

The insurance industry may also become more involved in code compliance by providing liability coverage for solar energy systems. For example, the RJ Ahmann Company, an insurance group based out of Minnesota, recommends an extended coverage of property insurance on solar energy systems and the benefits associated with such. Although the concept of covering solar energy systems is not specifically related to energy code compliance, this provides an example of the insurance industry's interest in covering energy-producing systems in buildings. The degree to which solar energy systems comply with codes or standards are adversely affected by the loads associated with the building on which they are located could increase insurance company involvement in energy efficiency. This is especially true as buildings use more renewable energy and onsite power production.

"We are seeing a growing interest by large insurance carriers that are now underwriting property insurance on small solar installations. Typically, they are providing coverage for a broad range of perils, but are most concerned about wind storms, hail damage, lightning caused power surges and ice build up. The limit of liability purchased for the solar energy property insurance should be adequate to replace the installation. We typically recommend that the property insurance coverage in a solar energy insurance program be extended to include potential business interruptions and the extra expense associated with them. This is particularly important if the entity using the electricity owns the panels themselves, as they will need to purchase electricity on the open market until the panels are brought back on line."

-RJ Ahmann Company

Additionally, the Insurance Services Office, a program within the insurance industry, evaluates the competency of building departments. Based on the Insurance Services Office rating, insurance rates are adjusted on properties in the area covered by the building department. Although the insurance industry is not directly involved in code compliance, this program can be a catalyst for additional support to local building departments by increasing the pressure on local officials from those affected by higher insurance rates compared to other jurisdictions.

2.5 How and When Compliance is Verified

When developing a process for verifying code compliance, a jurisdiction must consider both the methods that will be used and the time at which verification is determined. The methods for verifying compliance consist of many separate and parallel activities that address the conformity assessment of all the items (products, materials, equipment, appliances, components, devices, etc.) that comprise the building and its systems. Compliance verification also involves assessing the assembly of those items to ensure that they conform to codes and standards and that the assembled system as a whole complies with

the energy code. Verification that a building complies with an energy code is generally addressed at a particular point in construction, initial occupancy, or post-occupancy.

2.5.1 Methods for Verifying Compliance

The entities most regularly involved in officially verifying compliance with adopted codes are code officials, zoning departments, fire marshals, health department personnel, or other authorities having jurisdiction to ensure compliance with codes and standards that are adopted as state or local law, rule, or regulation. However, other entities can be useful as well, including the manufacturers of various building products and technologies and the testing and certification agencies selected to validate conformance with the specific criteria in the adopted code.

Depending on the individual and collective provisions of an energy code and the format used to present the provisions, compliance verification methods may include the following:

- *Testing.* Test and measurement standards define the methods to be used to assess the performance or other characteristics of a product or process. Air Movement and Control Association (AMCA) Standard 500D is an example of a standard adopted in energy codes that is used to determine the leakage rate of dampers used in building air intakes and exhausts.
- *Simulation*. Use of computer and other calculation approaches to assess the performance or other characteristics of a product or process without testing. National Fenestration Rating Council (NFRC) 100 is an example of a standard adopted in energy codes that allows the use of software to simulate fenestration thermal performance based on characteristics of the fenestration product.
- *Surveillance*. Surveillance involves ongoing monitoring and verification of the status of conditions, methods, procedures, and products, and analysis of associated records to ensure compliance with established requirements. An example would be the continued review and monitoring of the construction of dampers to ensure that continued production of dampers is consistent and is found to have a certain air leakage rate.
- *Inspection*. Physical review of the building and its components during construction to ensure that what is being constructed complies with adopted codes, approved plans and specifications, manufacturer installation instructions, and other documents that support visual verification of compliance.
- *Auditing*. Periodic, independent, and documented examination and verification of activities, records, processes, and other elements of a quality system to determine conformity with the requirements of a quality standard, such as ISO 9000. With respect to energy codes, auditing would be performed as one of the processes associated with the production of the items (products, materials, equipment, etc.) that are used in constructing a building and its systems. It would also cover the processes associated with verifying and documenting that building construction meets certain criteria.
- *Certification*. Certification is the process of ensuring that an item (product, material, device, etc.) has passed performance and quality assurance tests, qualification requirements, or stipulated test standards. With respect to energy codes, this would be a certification that an insulation product has a specific thermal resistance or a window product has a specific U-factor.
- *Registration*. Registration is a process by which an entity involved in testing, certification, or another conformity-assessment activity is determined to be a qualified verification entity and is listed as an acceptable entity for performing the services covered by the registration.
- *Accreditation*. Accreditation is the act of granting credit or recognition to any entity that performs services associated with an aspect of conformity assessment.

Depending on the specific criterion that must be satisfied, various types of compliance documentation can be used. This documentation can include testing to verify performance or certification that an item meets certain requirements. If the code provisions are simple and prescriptive, compliance can be directly verified (e.g., structural members shall be 2 by 4 in. at 16 in. on center). Where product standards are also relevant, such as the specifications of the structural member, certification that the item in question was manufactured to specific quality-assurance metrics and the referenced standard for such members is also relevant to code compliance. Examples include required R-value of insulation, required U-factor or SHGC of fenestration, connected lighting power, equipment efficiency, sealing of air leakage sources in a building, or a simple requirement for a damper in an outdoor air inlet. Compliance with these provisions can generally be verified during reviews of plans and specifications, although compliance is more reliably determined by examining what is actually installed in a building.

2.5.1.1 Traditional Path Compliance Evaluation

The responsibility for traditional code compliance verification varies by state and within jurisdictions. In some states, a state agency enforces the code[10] for specific buildings, such as state-owned buildings or universities, or for specific areas such as plumbing or electrical systems. The state may conduct all plan reviews and approvals before construction and rely on local governments to validate that construction is carried out in accordance with the approved plans and the code. In states that adopt a statewide mandatory code but do not require or empower local governments to enforce the code, a state agency may assume responsibility for all or some enforcement activities. In other states, local governments may enforce the statewide code with support from the state.

Traditional code compliance verification consists of the following:

- Reviewing construction documents, building plans, specifications, test data, evaluation reports, certification listings, and other information that documents compliance of the building components separately and compliance of the building as a whole with the adopted codes.
- Issuing permits to initiate or to continue subsequent stages of construction based on a review and inspection of the construction against the approved plans.
- Inspecting buildings during various stages of construction and conducting *in situ* testing to validate performance of particular components or portions of the building.
- Issuing a CO after it has been determined that the code has been satisfied.
- Verifying that existing buildings continue to be maintained safely and all additions, alterations, repairs, renovations, or change of use applied to existing buildings also satisfy adopted codes.

In traditional code compliance verification, several activities occur as part of the determination process: plan review, permit issuance, construction inspection, and CO issuance. During plan review, the construction documents, which consist of drawings and specifications, are reviewed to determine whether the building will comply with code requirements. Upon plan approval, a construction permit is issued. The construction permitting process typically applies to all types of construction and is specified in the scope of the enabling legislation or in the administrative section of the code as adopted through legislation

[10] Enforcement is considered all activities undertaken by an authority having jurisdiction to verify that a building complies with the adopted code. Those activities will vary depending on the format and scope of the code, the nature of the provisions in the code, and the time frame over which the code applies.

or regulation. The permit grants the legal authority to undertake the construction approved in the plans and specifications.

The inspection of construction for which a permit has been issued is intended to verify that the work completed conforms to the construction documents and the code requirements. The responsibility for ensuring conformance is shared by the permit holder and those involved with the proposed construction, such as the building contractor, the designer (if retained during construction), and the manufacturer or developer of the technologies that comprise the building. State or local agencies, or their designated agents, will conduct inspections during construction and at the end of construction. If it is determined that the building was constructed in accordance with the approved plans and specifications, and thus meets the requirements of the energy code, a CO is granted and the building essentially becomes an existing building.

There are various means and methods beyond testing, certification, and product evaluation that may need to be used for code compliance determination. Plan reviews, field inspections, and field testing can be used to evaluate the compliance of the assembly of components comprising a building system. Compliance can also be determined by applying the concept of component validation with product standards to an entire building. In this approach, once a building plan is evaluated and shown to comply with the code, additional buildings that follow the same plan and are in the same climate zone could be said to comply. Of course, other variables such as building orientation may need to be considered. It is also possible to grant compliance based on the compliance record of the building contractor. Once it has been determined through prior inspections and projects that a contractor consistently complies with the code, the regulatory authority could assume compliance of future projects. Random inspections or sampling could be used to determine continued compliance.

2.5.1.2 Product and Component Compliance Evaluation

Determination of compliance with the adopted code also includes verifying that building components and products comply with other standards referenced in the code, such as NFRC Standard 100 for the rating of fenestration thermal properties or American National Standards Institute (ANSI) Z 21 standards for the safety of equipment and appliances that use natural gas or propane. In most instances, verification that building components and products comply with referenced standards is performed by an accredited third party that tests and/or certifies that the product, equipment, or appliance meets the criteria in the standard. If the product complies, it is certified, labeled, and listed, eliminating the need for each enforcement agency to develop and conduct similar but duplicative activities. The component or product will have continued compliance with the referenced standard if an independent quality assurance or inspection agency randomly evaluates ongoing production and audits the records of the manufacturers. Examples of components or products that are determined compliant through third-party verification or laboratory testing include the insulation R-value, fenestration U-factor, SHGC, air damper leakage rate, and the rated wattage of lighting fixtures.

However, not all components or products are included in specific prescriptive provisions, attached to a referenced standard, or evaluated by a testing laboratory. Instead, the requirements for a product, material, or device may be written in more performance-oriented language and may need to be evaluated using other methods to document that the provisions of the adopted code have been satisfied. Rather than having each manufacturer, designer, or enforcement authority develop a unique assessment process, the development and issuance of a product evaluation report can satisfy the need for information to validate code compliance. Typically issued by an evaluation service such as ICC Evaluation Services (ICC ES) or

IAMPO R&T, an evaluation report reviews the documentation provided by a manufacturer as evidence of product compliance with specific code provisions. The findings of the evaluation service can be used by federal, state, and local officials to approve and inspect the product for code compliance. For example, a product evaluation report can be issued for a material that is required in an energy code that may not have its thermal properties effectively evaluated by current test standards.

2.5.2 When Compliance is Verified

There are several possible touch points during the life of a building that are relevant to compliance with an adopted code. The earliest point is when components that will be used in a building are designed, constructed, tested, certified, labeled, and shipped for sale.[11] The last point occurs long after the building is occupied, including the periodic inspections for compliance with fire codes or health department regulations. Between these two points, compliance could be assessed at initial design, during preparation of the final design and specifications, during construction, at the completion of construction concurrent with pre-occupancy commissioning, and at any time after initial occupancy. Once a CO has been issued and a project becomes an existing building, any alterations, additions, repairs, renovations, remodeling, or changes in occupancy or use of the building can necessitate additional energy code compliance activities. During the life of a commercial building, these changes may occur many times. As such, an assessment of compliance with the energy code for all or portions of the building may occur many times as well.

The time at which compliance is or can be assessed is directly related to the scope and format of the energy code. For example, if the scope is limited to equipment efficiency, the means of compliance are most likely testing and product certification prior to offering the equipment for sale or use in a building.

2.5.2.1 Initial Design (Programming, Pre-Design, Schematics, and Design Development)

During the initial design of a project, it is important for designers to understand what codes and standards apply to the building. Examples of provisions in energy codes that should be considered at this point are limitations on window-wall ratio, requirements for orientation, and requirements for solar access. As addressed in the integrated design approach of the American Institute of Architects, the architect, specialty engineers, contractors, and code officials should all participate during initial design of project delivery and continue to collaborate until construction documents are approved. During initial design, compliance with relevant codes and standards is generally based on the direct assessment of the design against the provisions of the code.

2.5.2.2 Final Design and Specifications (Plan Review)

Leading up to the finalization of the project plans and specifications, activities associated with the initial design process should have occurred. At plan review, the final design and specifications of the building can then be evaluated for compliance with the provisions of the code, including the thermal properties associated with the building envelope, the location of HVAC duct systems, and the lighting system layout. The format and scope of the code will affect how compliance is determined at this point in the life of the building. For instance, if the code is outcome based, it is possible that there is no review of the plans with respect to energy efficiency as compliance is based on energy use rather than specific

aspects of design. Regardless of the format or scope of a code, if an authority (e.g., a state or local government, third party, or utility) is responsible for verification of code compliance, the final plans and specifications will be reviewed and, if the plans are approved, construction will be initiated.

The approval of plans and specifications can also occur in stages. For example, it is possible to approve footings and foundation to proceed with construction, but defer approval of the HVAC or lighting plan development to a later date. In this case, only those portions of the plans and specifications that have been approved can be constructed. This process is often dynamic and ongoing, with design and construction approval occurring onsite as the building is erected. Reviewing in stages frequently occurs in multi-tenant commercial buildings where the building shell is completed and the mechanical, electrical, and plumbing systems are addressed separately as each tenancy is built.

2.5.2.3 During Construction

Once the construction documents have been approved by a relevant authority, construction is initiated. During construction, there will be ongoing inspection and review to verify that construction is being performed in accordance with the approved plans and specifications. This occurs throughout construction until construction is completed and the building is ready for occupancy. For some buildings, such as modular construction, inspection will occur in a factory and take a matter of days from the initiation and completion of the construction. In others, such as homes or small commercial buildings, it may be a matter of weeks or months, with more complex projects taking a year or more. In addition, in multi-tenant buildings where occupancy is staged, inspections can occur as each tenancy is built out. The primary focus of these inspection activities is to ensure that the approved plans and specifications are being followed and that the items that require compliance verification during construction comply with the code, including air barrier installation, insulation installation, duct construction, and the operation of required controls. In some cases, such inspections would include testing to verify compliance with provisions in the code, such as duct or building envelope air leakage or proper operation of require controls.

2.5.2.4 Commissioning

Building commissioning is a process in which an individual verifies that building energy systems are compatible, performing as designed, and interacting correctly. Verification of operation ensures that the building is delivering the desired energy efficiency. Commissioning usually begins as early as the planning and pre-design phases of the building and continues through construction documentation, construction, and the remainder of the building's lifecycle. The commissioning process generally includes the HVAC system, lighting system and controls, fire protection system, and domestic hot water system. Whole building commissioning will also include the exterior walls and roofing of a building, as well as the plumbing, electrical, and acoustical systems. Careful commissioning of building systems will not only produce more resource- and energy-efficient buildings, but can also reduce excess moisture and noise, resulting in optimal indoor air quality and more positive occupant feedback. Commissioning can extend the lifespan of building systems and lower operating and maintenance costs. Commissioning existing buildings, or retro-commissioning, can improve performance and energy efficiency by identifying deficiencies in existing systems. In addition to looking at major building systems, retro-commissioning often looks at past building performance, including energy consumption and occupant reviews of building conditions.

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[11] Terms such as certified, listed, and labeled refer to an ongoing conformity-assessment process that ensures that the items (products, materials, devices, components, equipment, appliances, etc.) selected for use in buildings comply with specific standards and other related criteria, and can be offered for sale as being compliant.

Commissioning: Washington New Building Commissioning

The state of Washington requires new building commissioning as part of the state building code, as does the 2012 IECC for commercial buildings. Per the Washington code, commissioning compliance checklists must be completed and signed by the building owner and submitted to the building official upon project completion. Commissioning checklists are intended not only to ensure all systems are performing as designed, but to hold builders and contractors responsible for completing all mandatory code provisions. A copy of the Washington State Commissioning Compliance Checklist can be found in Appendix A.

2.5.2.5 Certificate of Occupancy

A CO is intended to represent that the building or tenant space of a building meets the adopted code. A CO is usually obtained after a building has undergone plan review and onsite inspections to validate code compliance and is generally issued immediately prior to occupancy. A CO may also be issued conditionally for limited occupancy and use until additional work is completed. Additionally, multi-tenant buildings such as shopping malls will likely have multiple COs issued as the common areas of the mall and individual shops are built out and completed.

A building can lose its CO due to problems with property maintenance, fire and life safety, or health. Programs, such as health department inspections of restaurants, can be implemented that verify continued compliance with code provisions after initial occupancy has occured. While a building is unlikely to lose its CO for lack of energy code compliance after occupancy, it is certainly possible should an authority having jurisdiction wish to pursue energy code compliance in this manner. This could occur in the renovation or rehabilitation of an existing building or an occupancy change. Compliance with the applicable provisions of the energy code would be verified and a new CO issued for the existing building as renovated or otherwise changed. It is possible that a CO could be rescinded for non-energy compliance depending on the entity responsible for compliance verification. While unlikely to be a state or local agency decision, it is possible that the loss of utility service or insurance could create situations where the building could no longer be operated and have the same effect as loss of a CO.

2.5.2.6 Post Occupancy

A post-occupancy timeframe includes any specific time in which a building or tenancy within a building is operating. During that time, any number of energy-related provisions could be imposed, including allowances for ventilation, air temperature and humidity set points, lighting levels, water temperatures, and limits on large plug loads such as copiers. Historically, energy code provisions have been such that compliance is assessed during building design and construction, and once the scheduled work is completed, a final inspection is conducted and occupancy is granted. Post-occupancy energy provisions are more likely to be tied to actual building energy use and measured either monthly or annually for total energy use or hourly or daily for peak energy use. The consideration of post-occupancy energy use also includes the operation and maintenance of a building over its operational lifetime.

There are currently no criteria in energy codes in which compliance is verified after a new building is occupied or an existing building is reoccupied after permitted work. While the assessment of energy code compliance at plan review and during construction ensures that there is some expectation that the building will be able to perform, there is rarely verification that the building is performing as intended once it is occupied. Some code provisions are written in a way that can only be evaluated once the building is

occupied, however. For example, a provision requiring that lighting systems that are not intended to be operated 24/7 be turned off when not in use.

The entity conducting the compliance verification influences what is inspected and when compliance is determined. For instance, while a state or local building regulatory authority is unlikely to evaluate compliance with the lighting system after CO, compliance verification could be continued during occupancy through voluntary inspections initiated by a corporate policy. Post-occupancy assessments may also be conducted prior to a real estate transfer. This would typically be implemented by a lender, but could also involve a homeowners association or corporate office complex having certain standards for projects that are part of the complex.

As cities and jurisdictions become increasingly aware of the effect that buildings and the resultant green house gas emissions have on the environment, energy-related activities in the post-occupancy phase of construction become a greater priority. One of these activities, benchmarking is becoming increasingly popular in cities across the nation. Energy benchmarking is the process of capturing an accurate expression of building energy consumption. Benchmarking can be used to compare buildings of similar size and occupancy type, or as a means to measure the reduction of energy usage over time. In the post-occupancy phase, benchmarking will not only help building owners assess the energy efficiency of their buildings, but may help lower building operating costs. Benchmarking also creates a more competitive real estate market. As energy performance ratings are disclosed, more building owners should see the need to retrofit existing systems to compete with comparable, more efficient buildings that could sell for more, have higher rents, and higher occupancy rates.

Energy Benchmarking: Seattle, Washington

Seattle, Washington is at the forefront of energy benchmarking. With the passing of Ordinance 123226, all commercial and multifamily buildings in Seattle must benchmark their energy performance using ENERGY STAR Portfolio Manager, the U.S Environmental Protection Agency's web-based benchmarking tool. Buildings 50,000 ft^2 and larger have until October 3, 2011, to submit an initial benchmarking report, with an annual report due each April thereafter. Buildings 10,000 ft^2 and larger are required to report annually starting April 1, 2011. Multifamily buildings will have until April 2012. Energy ratings will be available to the city and to all prospective lenders, buyers, and tenants upon request at the time of purchase. Similarly, New York has an annual ENERGY STAR benchmarking requirement for commercial and multifamily. The benchmarking system was phased in, with the benchmarking of city buildings completed in May 2010, followed by commercial and multifamily buildings 50,000 ft^2 or greater in May 2011. Energy performance will be disclosed annually to a public website. In addition to energy, New York buildings with water meters are also required to benchmark water use annually. Washington State and other cities across the U.S., including San Francisco, Austin, and Washington, D.C., have passed benchmarking ordinances as well.

Similar to benchmarking, energy auditing and disclosure has become increasingly popular as consumers become more interested in the energy performance and efficiency of commercial buildings or homes. Energy disclosures give buyers and lenders access to the energy efficiency information of a building. Commercial buildings and homes are rated according to the building's energy efficiency. Austin, Texas helped pioneer the effort to mandate energy ratings, disclosure, and audits in both commercial and residential projects. It became mandatory, under the 2009 Energy Conservation Audit and Disclosure Ordinance, for nonresidential buildings, including multifamily residential complexes, older than 10 years to produce an energy rating by June 2011. All other buildings are required to produce an energy rating within 10 years of construction completion. Ratings are generated by the ENERGY STAR software or a web-based tool from Austin Energy and will be available to potential buyers. For

multifamily residential buildings, energy ratings will be displayed in the buildings and provided to all potential tenants. Apartment buildings that use more than 150% of the average energy use of multifamily residential buildings will be required to make energy efficient retrofits within 18 months. Residential dwellings are required to receive an energy audit before a home can be sold; the results are to be provided to prospective buyers.

Energy Rating and Disclosure Policies: Washington, D.C.

In 2008, Washington, D.C. mandated the rating of all public buildings and commercial buildings greater than 50,000 ft^2. Energy ratings are generated using ENERGY STAR software and include utility data collected for one year. Building ratings are disclosed to a publicly available database online. Washington State requires the rating of nonresidential buildings using ENERGY STAR software as well and prohibits state agencies to rent or lease facilities with an energy rating of less than 75. A rating of 50 indicates an average energy performance based on CBECS data. Alaska, Kansas, Maine, Nevada, New York, and South Dakota are among the other states with residential disclosure policies, as well as Santa Fe, New Mexico, and Montgomery County, Maryland, with legislation in many other states and cities pending.

2.6 Use of Penalties and Incentives

Penalties and incentives can be used by states or jurisdictions to encourage compliance with energy codes. Penalties are designed as a consequence for noncompliance and often delay the progress of a construction project, affect building operations, or result in increased fees or costs. Incentives are designed as a positive outcome for a project that has fulfilled or exceeded the requirements of the code and generally save the builder or owner money, increase the value of the property, or offer the builder a benefit that is exclusive to those who comply with the code.

2.6.1 Penalties

Penalties for noncompliance come in many forms and differ greatly based on who levies the penalty and who is penalized. Penalties can be direct or indirect and are used to encourage compliance with the code. Direct penalties cause a project to shut down or keep a building from operating. Direct penalties include activities such as: failure to secure a permit to construct, inability to obtain a CO, cancellation of construction contract, stop work order, or building closure. Such penalties are levied by code officials and affect the owner, developer and lender. In addition, direct penalties can include the loss of utilities as cutting off utility service would render the building inoperable. Utility penalties are levied by a utility and impact the building owner or operator.

Penalties that do not affect the construction or operation of a building but instead subject the project to additional burdens and fees are considered indirect penalties. These penalties include items such as: loss of insurance, loss of lease, criminal or civil penalties, fines, forfeiture of posted bonds, or energy-offset costs. Indirect penalties are levied by a building owner, insurance underwriter, or authoritative agency and affect the building owner or operator. Additional indirect penalties associated with outcome-based codes increase the operating costs of the building. Levied by a utility, insurance underwriter or other relevant party, these penalties also impact the building owner or operator.

The most common direct and indirect penalties for addressing energy code compliance are: cancellation of construction contract, stop work order, building closure, criminal penalties, civil penalties, forfeiture of posted bonds and energy off-set costs. These penalties are discussed in greater detail below.

2.6.1.1 Cancellation of Construction Contract

Where compliance with an energy code is through a contract for goods and services, such as the purchase of equipment or construction of a building, the code can be made part of the contract. In the case of equipment procurement, stipulations can be made that the purchased equipment must perform in a certain manner or be designed and constructed to meet certain standards. For an entire building, this can be through a reference to a particular energy code. Enforcement is then addressed by the entity issuing the contract and who has the vested interest in ensuring the terms of the contract are satisfied. If the building was found to be noncompliant, changes would have to be made to ensure compliance or the contract would be null and void, and resolution could be the subject of mediation or legal action. This penalty is most likely to work where the owner/developer has a particular reason for adopting particular energy provisions and ensuring that what is adopted is delivered. Federal agencies, for example, generally reference specific codes and standards and require compliance with such in contracts for the design and construction of federal buildings.

2.6.1.2 Stop Work Order

One manner in which a construction contract can be stopped is through the issuance of a stop work order. A stop work order is the formal notice to a contractor or other entity responsible for building construction that work on a project must immediately cease until further notice, usually until the cause of the stop work order is remedied. Several states and jurisdictions have included the possible issuance of a stop work order in the energy code for instances when building construction no longer complies with the code.

Stop Work Order: San Mateo, California

San Mateo, California amended the San Mateo Municipal Code with Ordinance No. 2009-14 to include the use of a stop work order. If, during any inspection throughout building construction, a code official determines that proceeding with construction activities will prohibit the project from complying with the required code, a stop work order will be issued. The order will remain in effect until a compliance official determines that the approved plan changes will bring the project back into compliance. Stop work orders are critical in ensuring builders and contractors are not deviating from approved building plans or modifying construction practices partway through a project.

2.6.1.3 Building Closure

An existing building, or portion of a building, can be temporarily or permanently closed as a result of non-compliance with the adopted code or standard. For example, a building may be temporarily closed due to a violation of health department regulations (e.g. food service, pool, and health care) or fire and life safety provisions (e.g. failure of smoke or fire alarms when tested). A permanent closure is more likely to occur when a building repeatedly violates code criteria or as a result of property maintenance issues where the building is condemned, determined to be a risk to health and life safety, or adversely affecting community standards. While building closure is more commonly used for fire or safety code violations, a number of states and jurisdictions are beginning to apply this penalty to buildings that do not meet the requirements of the energy code.

2.6.1.4 Criminal Penalties

In a few instances across jurisdictions, violating the code can result in criminal penalties. Criminal penalties are the result of willfully and knowingly participating in illegal activities, including providing misleading information or purposefully violating the law.

Criminal Penalties: Telluride, Colorado

With the 2010 Ordinance 1331, the City of Telluride, Colorado adopted a green building program that applies to all new construction, additions, and remodels of commercial, residential, and multifamily homes. The green building program requires compliance with both energy and green building codes. Violating any portion of the ordinance will result in a misdemeanor, and upon conviction may result in a fine up to $1000, imprisonment up to 90 days, or both.

2.6.1.5 Civil Penalties

Unlike criminal penalties, which are imposed by the government on those not complying with a law or regulation, civil penalties are brought against one believed to be in violation of the code by a party that believes they have been adversely affected. For example, a building owner may bring action against a designer or contractor because of a belief that the building does not comply with the code. Tenants could also bring action against the building owner if they felt that their energy use and resultant energy costs were too high. Even the public can bring civil action against building owners where they feel they have been adversely affected by the building.

2.6.1.6 Forfeiture of Posted Bonds

Another way to penalize noncompliance is through the forfeiture of posted bonds. In several counties and jurisdictions, builders or developers are required to post a bond, generally determined by the square footage of the project, that will be returned once the building achieves compliance with the energy code requirements. Cobb County, Georgia, for example, requires contractors to post a code compliance bond. The bond, which totals $10,000, is used to ensure that a project complies with the provisions and requirements of the building and other codes adopted by the county. A copy of the Code Compliance Bond of Cobb County can be found in Appendix A.

Forfeiture of Posted Bonds: Arlington County, Virginia

As part of the Arlington County Virginia Green Building program, the county established a Green Building Fund to encourage builders to attain a LEED certification. While the green program is not mandatory, builders that do not commit to achieving a LEED rating contribute to the fund at a rate of $0.045 per square foot of floor area. The calculation is based on the fees assessed by the U.S. Green Building Council for registration and evaluation of a formal LEED application. Furthermore, since a LEED certification relies on the performance after a building is occupied, developers must post a bond or letter of credit to ensure the building is compliant before a CO is issued. If a project receives LEED certification, the fund contribution is refunded in full. If three LEED points are missed, 50% of the bond is forfeited to the county. If four or more points are missed, the entire bond is forfeited to the county. The Green Building Fund is used by Arlington County to provide education and outreach to developers and the community on green building issues.

2.6.1.7 Energy-Offset Costs

In some cities, excessive energy use is accompanied by high usage fees or alternative energy requirements. For example, the City of Telluride, Colorado has created a TEMP program, or an Energy

Mitigation Program, that requires the owners of all excessive exterior energy use, larger homes, and heated garages to mitigate or offset the effects of the additional energy requirements by either using an onsite renewable energy source or making a payment in-lieu. The TEMP program includes outdoor pools, heated garages, and all spas and hot tubs. Funds from the TEMP program are used on town projects.

2.6.2 Incentives

Incentives are often offered to developers, building owners, or building operators to increase participation and compliance with energy codes. The effectiveness of an incentive depends on what is most valuable to builders and owners in each locality. Effective incentives save builders time, such as expedited plan review, or money, including decreased operating costs, tax reductions, utility rate reductions or reduced loan or insurance rates. Effective incentives may also build capacity through training or design education or add value to a business through subsidized marketing, increased building valuation, or positive public relations. Many entities may offer incentives, including state and local government agencies, utilities, and insurance underwriters.

The most common of these incentives include expedited plan review and permitting, increased building valuation, property and income tax reductions, permit variances, marketing, utility rate reduction, and education. These incentives are discussed in greater detail below.

2.6.2.1 Expedited Plan Review and Permitting

In jurisdictions that have lengthy plan review and permitting times, expedited permitting can be an attractive incentive for building owners, developers, and lenders. Expedited plan review and permitting not only saves time, but speeds up project completion as well, which can accelerate the influx of revenue associated with the project and increase the payback in investment in the project. States and local governments across the country offer expedited processing for both voluntary and mandatory energy codes and beyond code programs.

Expedited Plan Review: Las Vegas, Nevada

The City of Las Vegas, Nevada has developed an expedited plan review process that has proven to save both plan review time and money. The city initiated the program in 1995 and it has grown in popularity. Two processes are available based on the type and size of the project:

Expedited Plan Review
The owner/builder team (architects, engineers, contractor, etc.) meets with plan examiners representing structural, architectural, plumbing/mechanical, electrical, planning, land development, and fire review (Express Team) with the goal of issuing building permits by the end of the meeting. Prior to the meeting, the development team must submit:

- An approved civil and land use approval from the planning commission, city council, etc.
- Building plans at least two weeks in advance of meeting with the building permit team so that the plans can be pre-reviewed.

During the review the Express Team will identify any code violations, which are then fixed by the owner/builder team at the time of the meeting. To be effective, members of the design team must be present with the ability to make on-the-spot decisions, changes, etc., as required. The Express Team will work with the owner/builder team until a permit is issued or until unresolved issues require revisions beyond what can be done during the express appointment.

The fee structure for using the expedited plan review process is a nonrefundable $500 administrative fee in addition to $600 per hour for the time of the meeting. This is over and above the regular permit fees for the project.

Over the Counter (OTC) Express Plan Review
OTC Express Plans Review is offered for small projects or plan revisions that typically require 1 hour for plans review. This same-day service is available for $200 per hour with a one-hour minimum. These fees are in addition to other permit or plan review fees.

2.6.2.2 Increased Building Valuation

Insurance underwriters, real estate agencies, and potential buyers are all interested in the value assigned to a building. Insurance underwriters are interested in the replacement value of the building; the greater the value placed on energy efficiency, the greater the value placed on the building. Those paying costs for insurance would not favor an increased valuation as it increases expenses. However, if a building owner needed to replace the building due to a natural or man-made disaster, funding would be available to rebuild the building to be at least as efficient as it was before the disaster. In addition, homes or buildings that meet at least the minimum energy code requirements are considered by real estate agencies and potential buyers to have a higher value than homes or buildings that do not meet minimum code.

2.6.2.3 Property and Income Tax Reductions

There are many examples of actions or programs to incentivize building energy efficiency, including public relations, competitive ratings, and/or financial incentives. Certainly federal and state tax credits or reductions are well known incentives and are generally one-time payments to entice an individual to make an energy efficiency decision that would otherwise not be made. Examples include recent federal and state incentives for the purchase of more efficient HVAC equipment. Other tax incentives can be ongoing and tied to the continued performance of the building. Such programs are possible where the code is tailored to go beyond a CO and is of a format that provides a benchmark for continued compliance validation.

Property and Income Tax Reduction: Virginia Beach, Virginia and New Mexico

Virginia Beach is one of a few cities in Virginia that offer tax relief or credits as an incentive for complying with the energy code requirements, a program empowered by legislation passed in Virginia. As allowed by state law, the Virginia Beach property tax incentive applies to both residential and commercial projects and requires that the property owner prove that a home or building is at least 30% more efficient than the current state energy code. If a home or building is certified as 30% more efficient by an architect or engineer, the owner gets a 15-cent reduction in property taxes per $100 of assessed value each year the incentive is offered. Likewise, The Green Building Tax Credit in Carroll, Maryland provides a 25% tax credit for new buildings that achieve LEED Silver certification, a 50% tax credit for new buildings that achieve LEED Gold, and a 75% tax credit for new buildings that achieve LEED Platinum for five consecutive years.

Additionally, New Mexico provides an income tax credit based on square footage and the level of LEED certification achieved by commercial or residential projects. The credit requires third-party verification and applies to all buildings that incorporate elements of LEED or Build Green New Mexico.

2.6.2.4 Permit Variances

Energy code compliance or compliance with green building programs can increase a building's allowable floor area ratio (FAR) or unit density. Greater FAR values allow builders to increase the size of a project in relation to its location. For example, an additional market-rate dwelling unit is offered as a density bonus in Bar Harbor, Maine for construction projects in which all dwelling units meet LEED standards. This bonus applies to projects within a planned unit development, and compliance is determined by either application or by affidavit for adherence during construction.

Permit Variances: Seattle, Washington

The City of Seattle, Washington offers a density bonus to provide greater heights and/or greater floor area for commercial and residential projects that meet or exceed LEED Silver certification. Similarly, many other cities across the nation offer FAR incentives, including Nashville, Tennessee; Arlington, Virginia; Bloomington, Minnesota; and Charlotte County, Florida.

2.6.2.5 Marketing

A variety of jurisdictions use marketing techniques as an incentive for building to or exceeding the energy code. Publicity increases consumer awareness, creates a market for energy efficient buildings, and ultimately transforms development patterns and methods. Marketing incentives can include prominent signage, press releases, website coverage, newspaper advertisements, or inclusion on municipal and green program websites.

Marketing: Charlotte County, Florida

Charlotte County, Florida has developed an enticing marketing program as part of their Green Building Program. Incentives apply to all projects that receive LEED certification and include an outdoor sign to promote the project during the construction phase, inclusion of the builder on the program website, press releases, a permanent affixed sign post-construction, a green building award, and special recognition in the building community.

2.6.2.6 Utility Rate Reduction

Reduced utility rates based on energy consumption are an incentive for many small business owners in Alabama. Beginning June 2011, businesses that use less than 20,000 kWh per month qualify for the lowest business rate available and businesses that utilize unused storefronts are eligible for a 15% monthly discount with a one-year service agreement. In addition, businesses that increase the number of employees and increase power usage will receive a 24-month rate reduction, 10% the first year and 5% the second with a one-year service agreement.

2.6.2.7 Training Resources

Many states and jurisdictions provide education and training resources to builders and contractors throughout the construction process, including everything from detailed design assistance to workshops on energy efficiency. New Hampshire, for example, has provided comprehensive energy code workshops on the 2009 IECC, funded by state utilities, to building and design professionals and code officials. Starting in 2010, New Hampshire planned to conduct 24 trainings statewide over a two-and-a-half year period, specifically focusing on communities and jurisdictions that might need additional assistance with the state code update. These training sessions are free and provide continuing education credits to the participants. Other states have mandatory training requirements, such as New York's 15-hour builder training requirement for New York State Energy Research and Development Authority's Green Residential Building Program. Builders may fulfill the requirement by receiving green building credits from an accredited educational institution or by participating in green building training from a professional builders association, such as the National Association of Home Builders, the National Association of the Remodeling Industry, and the Building Performance Institute.

Several large cities, including Seattle, have provided online resources intended to help ensure compliance with the energy codes of the city. Seattle Online Coaching, for example, is an interactive tool available for builders and designers constructing single-family homes in the Seattle area. Seattle Online Coaching provides information on submittal requirements for compliance with the Seattle Residential Code in an easy to follow format that generally takes no more than 30 minutes. Other cities and states simply incorporate energy efficiency requirements into commercial and residential review checklists that can be very beneficial, both in ensuring that builders and code officials understand the code and that new construction is built in compliance with the code.

Training Resources: Michigan State University

Many states are partnering with local universities to provide education and training resources to building code officials. The construction management program at Michigan State University, for example, provides training to building officials to ensure that new projects comply with Michigan's updated energy code. The program uses grant money to develop materials, such as classroom training sessions and web guides that will help Michigan achieve a goal of 90% compliance with the energy code.

3.0 Results

The following sections present nine paths to compliance based on selected variables chosen from Chapter 2. These example compliance paths represent only a few viable paths—many other combinations of variables exist. The example paths are meant to provide users with the information and structure needed to develop unique compliance verification approaches that are tailored to specific needs.

In addition to presenting the variables of each example path, the resources needed and expected compliance rates associated with each path are summarized as well. Using the traditional compliance path for comparison, each path has been evaluated as to whether resources would be lesser or greater and whether compliance rates could potentially decrease or increase.

The example paths are provided in two sections. Current paths that are worth consideration for continued use and future enhancement are presented in Section 3.1 along with additional paths derived from current paths. Section 3.2 presents potential new paths that are not currently in use or have very limited use.

3.1 Paths Currently Used to Verify Compliance

Energy codes and standards have traditionally been adopted by state and local governments as a component of building construction regulations. As such, a traditional approach to code enforcement has driven the scope and format of energy codes, as well as the time at which compliance is determined. To some degree, a traditional approach has also influenced code stringency as building construction regulations are generally considered the minimum acceptable criteria. The following represent viable compliance paths for current energy codes and standards. The examples start with the traditional path and then variations from that path are provided.

3.1.1 Traditional Adoption and Enforcement (Baseline)

The most frequently used compliance path, considered the traditional path, assesses the rate of compliance with adopted codes and standards through a traditional building regulatory process. In this compliance path, the builder or designer develops construction plans and specifications, which are submitted to state or local government authorities having responsibility for issuing building permits. The plans and specifications are approved when compliance with the code is confirmed. A permit to build is issued upon plan approval and state or local agencies conduct construction inspections to ensure that the provisions of the approved plans and specifications are followed. At project completion, a final inspection is made and an occupancy permit is issued. While this compliance path is identical for residential and commercial buildings, as the building becomes larger and more complex, the level of effort to review plans and inspect during construction increases.

Table 3.1 provides a summary of the “traditional adoption and enforcement” compliance path. The scope is generally limited to the items that can be validated for compliance at plan review and/or during construction inspection, such as insulation R-value or the existence of certain required controls. Criteria are written in language that is enforceable within the time frame in which compliance verification efforts are conducted. For example, criteria for control of HVAC system operation would be stated as “controls shall be provided that have the capability to provide X ventilation ….” as opposed to “the building shall be

provided with X ventilation." The former can be assessed during plan review and construction inspection; the latter would have to be verified throughout building occupancy. As efforts to increase the scope of energy codes are pursued, it is important to recognize the limitations this compliance path will have in addressing items not within the scope of energy codes. Portable appliances, for instance, are generally not regulated by state or local building construction regulations and their efficiency would be difficult to address by any other means than through criteria addressed at point of manufacture or point of sale. The actual operation of portable appliances could be addressed after occupancy.

The format of current codes and standards is generally prescriptive-based with an alternative path to compliance that allows the approval of designs in which the predicted energy use is no more than the minimum provisions set forth in the code. The conformance of a particular design to the code can be verified using energy simulations. During construction, the focus is to ensure that the building is constructed in accordance with the approved plans and specifications, noting that the plans may not necessarily meet each of the prescriptive criteria in the code when the alternative performance path is employed. Within these prescriptive provisions, performance-based criteria may require that compliance is verified based on testing or simulation, or both. For example, the performance of materials, products, and equipment, such as insulation R-value, luminaire wattage, fenestration U-factor, and equipment efficiency, are determined through testing. The test results provide the information relevant to determining code compliance. Current prescriptive codes for systems also have embedded performance criteria with which in-situ testing is used to determine compliance. Duct air leakage testing and thermal envelope air leakage testing are examples of such performance criteria. Code provisions that include an energy use target validate compliance through annual energy use simulation. To ensure that energy use simulations are within code, a separate and unique set of prescriptive provisions that must be met at plan review and inspection are assigned to a building. Energy use targets as a code format can also be considered as a basis for other possible compliance paths and is discussed under section 3.2.

Code adoption for this compliance path is generally through federal, state, and/or local law, rule, or regulation. As such, code provisions must be satisfied before a building can be constructed or an occupancy permit is granted. There are other means of adoption that will be presented and discussed under variations to the traditional compliance path, such as contractor licensing laws. Once an energy code as been adopted, compliance must be verified. Traditionally, verification is completed by staff of the state and/or local government agency named in the law, rule, or regulation that adopted the code. In most cases, the energy code is adopted in conjunction with other building construction regulations such that the state or local entities involved in plan review and inspection are involved in all aspects of the building, not just energy. Compliance may also be verified by third parties authorized to act as agents on behalf of state or local government. In this situation, local agencies can contract with other local agencies to conduct enforcement activities, hire consultants who would act as agency employees, or develop programs to recognize and allow others to validate compliance. This latter approach is discussed in Section 3.1.3.

Penalties for noncompliance are usually implemented before the issuance of a CO. Under the traditional approach, an indirect penalty for noncompliance could be a delay in construction and occupancy of the building, adversely affecting project economics from the owner/developer's view. More direct penalties include fines and stop work orders. There are no incentives presented in the traditional compliance path discussion, but variations of the traditional path discussed below will present incentives.

The resources associated with compliance verification under the traditional compliance path are those needed by state and/or local government agency staff to perform plan reviews and construction inspection tasks (e.g., enforcement activities to ensure compliance). The costs of these efforts are generally covered

through building permitting fees and the state or local tax base. A study[12] conducted by the Building Energy Codes Assistance Project on the residential costs needed to address the energy code estimates the amount of time needed for plan review and inspection to be 1.25 person hours per home. This estimation shows that the cost and level of effort to implement the traditional compliance path would be considered on the low end; the cost and level of effort will increase as building size and complexity increase. The estimation does not include the costs associated with the training, education, and support infrastructure that must be in place to support compliance verification. The level of effort associated with this traditional compliance path will be considered a baseline by which the relative level of effort and the cost increase or decreases of other compliance paths will be considered. For instance, a compliance path that relies on a first-party compliance approach, such as builder self-certification, would need significantly fewer resources compared to this traditional compliance path.

In addition to the cost associated with verifying compliance is the expected degree to which compliance is secured and energy savings are truly captured. Compliance rates vary with the traditional compliance verification path. While this report does not analyze the expected rate of compliance for the various paths, the compliance rate associated with the traditional compliance path serves as a baseline for the compliance rates of other paths. For example, a compliance path that relies on a first-party compliance approach would be considered to have a significantly reduced rate of compliance compared to the traditional compliance path.

Table 3.1. Traditional Adoption and Enforcement

Conformity Variable	
Adoption	As part of state or local law, rule, or regulation associated with building design and construction
Scope	Building thermal envelope HVAC systems and equipment SWH systems and equipment Lighting systems and equipment
Format	Prescriptive with a simulated performance equivalency alternative based on energy use simulation
Responsible Party	State or local agency staff
Verification	Initial project development Submittal of plans for construction permit approval During building construction Prior to final issuance of a CO
Penalties	Construction stop work order Fines Increased time to completion, final CO, and revenue generation from the project
Incentives	None
Traditional Path Baseline	
Resources	Plan review and construction inspection staff funded by state and local government through permit fees and/or other federal, state, or local resources likely stemming from the tax base
Compliance Rate	Varies by building type and resources available to the agencies verifying compliance

[12]Building Energy Codes Assistance Project. 2008. Residential Building Energy Codes- Enforcement and Compliance Study. http://bcap-energy.org/files/Residential_Survey_Report_Oct08.pdf.

3.1.2 Traditional Adoption with Peer Review

Self-certification essentially provides that the entity being regulated is responsible for compliance with the adopted code and verifies compliance with the provisions of the code. As discussed in Section 3.1.1, the traditional compliance path through state or local enforcement provides for oversight of design and construction to ensure code compliance. The level of compliance achieved depends on numerous factors, such as code stringency, resources available to support enforcement, and the degree to which the entity enforcing the code will impose penalties. A traditional adoption and compliance path with peer review utilizes a third-party and first-party compliance verification process. The third party ensures compliance in situations where the first-party compliance is in question, often in cases of known noncompliance or because of previous noncompliance by the first-party entity. This compliance path triggers a compliance evaluation by the state or local agencies as described in Section 3.1.1.

Table 3.2 summarizes the traditional adoption with peer review approach. The scope, format, means of adoption, and penalties of the code do not change; the only variable that is different between the traditional compliance path covered in Section 3.1.1 and the traditional compliance path with peer review is the level of resources required and the likely compliance rate.

Table 3.2. Traditional Adoption with Self-Certification

Conformity Variable	
Adoption	As part of state or local law, rule, or regulation associated with building design and construction
Scope	Building thermal envelope HVAC systems and equipment SWH systems and equipment Lighting systems and equipment
Format	Prescriptive a with performance equivalency alternative based on annual energy use simulation
Responsible Party	State or local agency staff
Verification	Any time during construction as triggered by a request for compliance verification by an interested party
Penalties	Construction stop work order Fines Increased time to completion, final CO, and revenue generation from the project
Incentives	None
Comparison to Traditional Path Baseline	
Resources	Likely to be less than traditional enforcement because enforcement action is only taken based on a request for compliance verification
Compliance Rate	Possible increase due to peer pressure and the fear of being turned in

3.1.3 Traditional Adoption with Self-Certification

Self-certification essentially provides that the entity being regulated is responsible for compliance with the adopted code and verifies compliance with the provisions of the code.

Table 3.3 summarizes the traditional adoption with self-certification approach. The scope, format, and means of adoption do not change. A penalty for noncompliance would likely be civil action by the owner or operator of the building. An incentive for compliance could be the threat of civil action. The resources associated with compliance verification do not exist as a self-certification model does not involve additional effort on the part of second or third parties. The compliance rate would likely be reduced

because this compliance path has no official verification of compliance. However, the decrease in compliance would be influenced by code stringency. If the stringency is minimal compared to regular construction practice, compliance would likely be high and the need for third-party enforcement under the traditional compliance path minimized. Conversely, as the stringency increases, the compliance rate would be expected to decrease compared to the traditional compliance path, with resources needed to support that traditional path increasing as a function of stringency.

Table 3.3. Traditional Adoption with Self-Certification

Conformity Variable	
Adoption	As part of state or local law, rule, or regulation associated with building design and construction
Scope	Building thermal envelope HVAC systems and equipment SWH systems and equipment Lighting systems and equipment
Format	Prescriptive with a performance equivalency alternative based on annual energy use simulation
Responsible Party	Self-check by builder, designer, and contractor
Verification	Initial project development Submittal of plans for construction permit approval During building construction Prior to final issuance of a CO
Penalties	Civil action for noncompliance
Incentives	None
Comparison to Traditional Path Baseline	
Resources	No resources are needed
Compliance Rate	Possible decrease due to absence of official verification. Stringency also influences the compliance rate; compliance will decrease as stringency increases.

3.1.4 Adoption and Compliance as a Function of Licensing

Using licensing as a vehicle for code compliance entails self-certification with a penalty for noncompliance being the loss of a license to perform services. Licensing laws tie code compliance to licensure and programs to maintain licenses are in place and implemented.

Table 3.4 summarizes the adoption of and compliance with codes as a function of licensing. Code scope and format do not change. Adoption is not through building construction regulations, but rather through state or local licensing laws that mandate code compliance as a condition for licensure. A penalty for noncompliance would be loss of the subject license and subsequent effect on the penalized party's ability to continue work. An incentive for compliance would be the threat of loss of the subject license. The resources associated with compliance verification are those connected with a program to administer licenses and conduct random inspections to verify that work being done satisfies the adopted code. The rate of compliance compared to traditional enforcement by state or local building regulatory programs could vary considerably depending on the diligence with which inspections are done and licenses are revoked. One significant consideration with this compliance path is that licensure is generally by trade. As such, the code provisions would have to be addressed separately through mechanical, plumbing, electrical, and building contractor licensure.

This concept may be applied to the idea of the registered design professional (RDP), although doing so results in a separate compliance path. In the RDP compliance path, the code is adopted by state or local

government as part of the building construction regulations with a provision that the RDP on record verifies that the building meets the adopted code. Retaining the RDP beyond the design process allows the RDP to oversee construction and ensure that the building follows the approved plans and specifications. If the RDP identifies an area of noncompliance, the building regulatory agency that reviewed and approved the plans and specifications is contacted. That agency mediates the disagreement between the RDP and the contractor.

Table 3.4. Adoption and Compliance as a Function of Licensing

Conformity Variable	
Adoption	As part of state or local contractor licensing rules and regulations
Scope	Building thermal envelope HVAC systems and equipment SWH systems and equipment Lighting systems and equipment
Format	Prescriptive with a performance equivalency alternative based on annual energy simulation
Responsible Party	State or local agency staff or their designated agents
Verification	During construction or post construction
Penalties	Fines Loss of license
Incentives	None
Comparison to Traditional Path Baseline	
Resources	Inspection staff funded by state and local government through licensing fees and/or other federal, state, or local resources likely stemming from the tax base
Compliance Rate	Varies by the resources available, the agencies verifying compliance, and their ability to revoke licenses

3.1.5 Adoption and Compliance as a Function of Utility Service

Adoption and compliance as a function of utility of service can be similar to any of the paths described above. The means of adoption are the same, but the reward for compliance is utility service. Building plan review and inspection with respect to other adopted codes would continue to be addressed as provided for by the adopting law or regulation. Compliance with the energy code, however, would be the verified by the utility provider, by emulating verification practices of state and local code agencies, accepting a self-certification, or conducting an assessment of the building.

Table 3.5 summarizes the adoption and compliance as a function of utility approach. The scope, formation, and means of adoption do not change. A penalty for noncompliance could be the lack of utility service. An incentive for compliance would be the availability of energy services that are necessary to receive an occupancy permit and occupy the building. The resources associated with compliance verification would vary depending upon the actions of the utility and what would be required to verify compliance. The rate of compliance would likely increase in situations where the withholding of service is enforced.

Table 3.5. Adoption and Compliance as a Function of Utility Service

Conformity Variable	
Adoption	As part of state or local law, rule, or regulation
Scope	Building thermal envelope HVAC systems and equipment SWH systems and equipment Lighting systems and equipment
Format	Prescriptive with a performance equivalency alternative based on annual energy simulations
Responsible Party	Utility or their authorized agent
Verification	Initial project development Submittal of plans for construction permit approval During building construction Prior to connection of utility service
Penalties	No utility service
Incentives	None
Comparison to Traditional Path Baseline	
Resources	Third-parties or utility staff funded through a service fee imposed by the utility
Compliance Rate	Possible increase as a function of how serious the utility was in withholding service or if penalties are imposed pursuant to a post-occupancy audit

3.1.6 Equivalency through Voluntary Sector Programs

There are several voluntary sector programs, such as HERS, Green Globes, and LEED, at the national level and within particular states or utility service areas that are accepted as compliance with the code. Each program has select prescriptive or performance-related criteria, or both, which, if followed, result in program compliance and the related benefits. Each voluntary sector program has a compliance verification system in which certified evaluators conduct inspections and other conformity assessment tasks. The programs are as rigorous as many adopted energy codes and can be used as a default compliance path with the adopted code. Section 102.1.1 of the IECC provides the code official with the opportunity to deem buildings following voluntary sector programs in compliance with the IECC. The challenge with this path is that each code official is tasked with determining equivalency between a program and the code.

The scope of a voluntary sector program would have to include at least the same scope as the energy code it represents, have at least the same stringency, and cover at least the timeframe in which code compliance is to be verified; beyond that, the program can well exceed the minimum code. Costs to operate these programs would be borne by the program participants and the compliance rate is likely to be better than traditional programs as the programs are focused solely on energy efficiency.

In considering this compliance path, the degree to which current programs are available and being used is important. To be considered viable compliance paths, voluntary programs would have to be used to assess a majority of new buildings. In doing so, only a minority of buildings would be assessed under the traditional state and local compliance verification model, resulting in the possibility of state or local government ceasing energy code compliance functions and deferring instead to voluntary programs.

Table 3.6. Voluntary Sector Program Equivalency

Conformity Variable	
Adoption	By voluntary participate in the program
Scope	At least the same as the minimum code
Format	The same as the minimum code or an alternative format that yields the same end point as the minimum code
Responsible Party	The voluntary sector program checks for compliance and an accrediting entity on behalf of state or local code officials would have to verify the continuing competency and operational acceptability of the accrediting entity
Verification	During design, construction, and/or occupancy as determined by the program, but at least an assessment of compliance at occupancy
Penalties	Lack of recognition under the program and as such, a designation as not complying with code
Incentives	The ability to participate in a program eliminates the need to be subjected to state or local code compliance activities
Comparison to Traditional Path Baseline	
Resources	Significantly less than current state and local agency programs, although the resources to operate the voluntary program would have to be provided by those participating in the program No labor on behalf of state or local government other than verifying the acceptability of the program and its administration or relying on national accreditation programs for guidance
Compliance Rate	Likely to increase over current codes if the program is seen as providing an advantage in the market and is considered reliable

3.2 New Compliance Paths

Section 3.1 presented a traditional compliance path and variations on that path based primarily on the format and scope of current codes. Codes are generally driven by the compliance path chosen; that is, any new compliance paths associated with current codes would tend to be derivatives of the traditional compliance path.

Section 3.2 presents potential new compliance paths that apply different scope, format, and timeline considerations than those found in current codes.

3.2.1 Outcome-Based Energy Use Intensity

An outcome-based code establishes a target EUI, which serves to guide building design and construction. This target can be established for certain systems in a building (e.g., lighting, HVAC) or it can be established and applicable to all energy use in the building. The EUI is not based on simulation, although energy simulations would logically be used in the building design, but instead relies instead on the actual energy use of the building as occupied and operated. This approach sets an EUI goal that gives the design team the freedom to decide how to best achieve results. Unlike current codes, an outcome-based code extends beyond a CO and covers the actual operation of the building. Compliance is determined by reviewing the audited energy use of the building and can include penalties for noncompliance and incentives for compliance.

The outcome-based energy path eliminates the plan review and inspection associated with traditional compliance paths. It is expected, however, that compliance verification for building, mechanical, plumbing, electrical, and other codes would affect the overall construction of the building. The outcome-

based energy path necessitates that those involved in the design and construction of the building remain connected to the building until compliance is verified. Compared to current codes, this approach is different in that the resultant energy use of the building is verified at the time of operation and corrective actions can be taken if the building is not performing as expected.

The format of an outcome-based energy code is simply an EUI target for actual energy use that the building or selected systems, such as lighting, must satisfy. The EUI target would vary by building type and could be presented in a number of forms, including energy in Btu per unit floor area, Btu per unit volume, Btu per occupant per year, or in terms of CO_2 emissions or some other desired metric. Compliance is verified through a measurement and expression of energy use (or other metric chosen) of the building over a specific period, most logically annually on a fiscal or calendar year basis.

While adoption could be through state or local laws or regulations, it is not generally considered viable under current code adoption and enforcement approaches, as the time frame associated with outcome-based compliance verification occurs after a CO. Adoption would therefore have to be through a vehicle that has a time frame that extends beyond CO and through the ongoing operation of the building. This suggests adoption as part of utility rules or regulations, adoption by state or local agencies for state-owned or state-funded buildings, or through voluntary means such as programs conducting and promoting building labeling or corporate directives to comply.

There are several possible vehicles for verifying that the EUI target is satisfied. Each verification method requires measuring and expressing the actual EUI of a building and submitting the necessary forms and documentation associated with the building EUI. Some authoritative source would then compare the EUI submitted against the target EUI and issue a statement of compliance and possibly another distinguishing document such as an official EUI label or certification. The degree to which compliance is achieved depends on the qualifications of the entity measuring and expressing the actual EUI, the ability of the entity to be unbiased in reporting results, and the existence of a third party to accept the report and verify the accuracy of the submitted documentation.

Penalties for noncompliance with the outcome-based energy code can include direct and indirect penalties based on the comparison of actual energy use and the EUI. Utilities may create a stepped rate structure that increases unit costs of energy for different degrees of noncompliance. For example, the degree of noncompliance could affect and determine the magnitude of a utility surcharge imposed for the subsequent year. A surcharge not only acts as a penalty, but also as an incentive to reduce the EUI into compliance. Other penalties could include fines or increased property taxes where the reported EUI is taken into account in setting tax rates or surcharges. Another penalty is the loss of a construction bond that is posted as a condition for a permit to construct. The bond is returned if compliance is achieved within a specified period and forfeited for use in re-commissioning the building if compliance is not achieved. An indirect penalty could also include the comparison of the building to buildings of similar size and use through EUI disclosure. Showing the actual EUI of various retail spaces in a shopping mall could reduce energy use simply by providing a basis for competition. Incentives are comparable to the penalties. Since incentives are financially based, the funding to support such incentives could be derived from the penalties collected for noncompliance.

The resources necessary to verify compliance and implement an outcome-based code approach are likely to be less than for compliance verification with current codes. Since the proof of compliance is actual building performance after occupancy, there is essentially no plan review or inspection for energy code compliance. At a minimum, an entity acting on behalf of the building owner would have to measure

and express the EUI of the building from utility bills, meter readings, or measurement records of energy delivery, and someone involved in compliance verification would have to receive that information and issue a certification of compliance. More reliable results would require either credentialing of those who measure and express performance or an entity used to audit information submitted. The resources associated with outcome-based energy codes are considered to be less than the plan review and construction inspection activities in the traditional path.

The compliance rate of outcome-based codes is not exactly comparable to current codes since an outcome-based approach assesses actual building performance and current codes assess design and construction. However, determining an EUI target for a building and assessing the actual building performance is a relatively simple task (e.g., gather the data and compare numbers), and as such, it is assumed that compliance will be high. The penalties and/or incentives will influence the rate of compliance as well.

Table 3.7. Outcome-Based EUI

Conformity Variable	
Adoption	As part of state or local law, rule, or regulation associated with buildings As a condition for utility service As policy by a public or private sector entity for their own buildings Voluntary by private sector entities
Scope	All building energy use, but could include only selected systems that are capable of being individually metered
Format	Singular metric for actual building performance (Btu/ft^2 of floor area) Ability to add additional metrics such as CO_2 emissions
Responsible Party	State or local agency staff or their authorized agents Accredited third parties
Verification	Once at 12 months after CO Annual until compliance is achieved Continuing annually
Penalties	Fines Increased utility costs Increased property taxes Loss of bond guaranteeing compliance Comparison with like buildings
Incentives	Reduced taxes determined by the degree of compliance Reduced utility rates Comparison with like buildings
Comparison to Traditional Path Baseline	
Resources	Less as the labor needed to measure and express EUI would be less intensive than plan review and construction inspection
Compliance Rate	Possible increase over current codes because there is a set, measurable goal that directly reflects on the building Degree to which compliance is achieved would depend on incentives available and/or penalties imposed associated with the level of compliance achieved

3.2.2 Capacity Limits on Energy System Connections

The format for traditional energy codes presents prescriptive design and construction criteria, or equivalent performance with those criteria, based on energy modeling/simulation. This format necessitates effort in plan review and construction inspection. An alternative and viable compliance path would be one that is readily assessed, easily verified for compliance, and takes few resources to enforce. Creating a

format that presents energy provisions in terms of maximum connected load (watts or Btu) as a function of a metric, such as floor area or conditioned volume, offers an opportunity for a new compliance path. This approach would be similar to the current limitation of lighting power density in buildings; a specific allowable connected load in terms of watts per square foot of floor area is presented without requirements for how it is to be applied or used in the building to provide the desired lighting outcome. The design team can be flexible in building design as long as the occupied building delivers the needed services (e.g., lighting, HVAC) while staying within the given budget of a project.

The scope of the capacity limit code would remain the same as current codes or could be increased to cover total building energy use. The scope must be capable of being metered, however, as compliance is determined based on the energy designated for use in each system. If the scope covers total building energy use, fossil fuels and electric power would have to be equitably combined and the energy use of the entire building would need to be metered.

Compliance could be verified during plan review or during final inspection. Adding together values of the connected utility service or capacity of the building to use energy and dividing by the established metric (e.g., floor area, volume) allows for a very fast and accurate determination of compliance. If compliance is not achieved, the building would have to be modified until compliance is achieved. The availability of a set capacity limit clarifies the expectations of the building and the singular metric the building will have to satisfy.

Adoption would occur as part of state or local building construction regulations or through rules adopted by serving utilities. This approach was used in state energy codes in the 1970s (North Carolina) as part of the building code wherein the peak connected load for commercial building types was set at particular limits that varied by building type. The entity checking for compliance would be the building department or the serving utility. The connected loads for electric service, natural gas, fuel oil, and propane are likely already addressed through building construction regulations and utility procedures and must be known to ensure the safety of such systems. The only additional work needed is to verify that unit loads in the building comply with the code.

Penalties would be similar to those associated with lack of code compliance. Plans would have to document compliance prior to the approval to construct and the building would have to be constructed in accordance with the approved plans as a condition for final approval and an occupancy permit. An incentive for capacity limits is to set graduated limits that tie utility rates with capacity. Having a capacity at minimum code garners no incentive, but going below the code capacity limit could be incentivized.

The resources to check for compliance compared to a traditional code compliance approach would be significantly less. The only additional task above compliance verification for traditional codes is relating the energy system's capacity in the building over some unit of measure such as floor area or volume. The rate of compliance would be expected to increased because of the simple manner in which compliance is determined.

Table 3.8. Capacity Limits

Conformity Variable	
Adoption	State or local building construction regulations Utility service conditions
Scope	All building energy use Traditional energy use (HVAC, lighting, SWH)
Format	Maximum allowable connected load for all or selected energy uses
Responsible Party	Building department Serving utility
Verification	During design and construction
Penalties	Failure of utility to provide permanent service No permit to construct No occupancy permit
Incentives	Lack of penalties Possible reduced utility rates if the capacity limits can be graduated to allow for awards for going beyond code
Comparison to Traditional Path Baseline	
Resources	Less in that only peak connected loads as a function of floor area need to be checked
Compliance Rate	Possible increase due to the simplicity of the statement of code criteria and process to verify compliance

3.2.3 Design, Construction and Energy Performance Disclosure

A variation on an outcome-based approach is the mandatory disclosure of all energy-related statistics of a building to the public. This disclosure could be made part of the annual report of public companies or required to be shown adjacent to the front door of a building. For example, in a retail environment, the energy use could be reported on a per square foot basis but also related in terms of cost (e.g., X% of the cost of the purchases you make today are to cover the energy use of this building). This is similar to building labeling programs such as those being proposed by ASHRAE, although this approach would provide more detail in disclosing actual energy use and possibly cost.

Unlike the outcome-based compliance path, this compliance path is not necessarily tied to any code or mandatory limit. Instead, disclosure is focused on energy use and possibly cost, with the public using the results to make purchasing decisions. This approach could be applied to all buildings. New buildings would have to simulate energy use and disclose a provisional statement of energy use and cost that would be augmented later with information from actual operation. Existing buildings would simply provide information from actual operation.

Table 3.9. Energy Disclosure

Conformity Variable	
Adoption	State or local law or regulation
Scope	All building energy use
Format	Annual energy use on a unit basis, annual energy cost on a unit basis or other metric of relevance to the public
Responsible party	State or local agency, utility, or other third party or simply self-certification with random auditing
Determination	During occupancy
Penalties	Failure to provide disclosure could result in a fine
Incentives	Additional market advantage for those entities with positive results compared to their peers
Comparison to Traditional Path Baseline	
Resources	None associated with building regulatory compliance Resources would be needed to check on energy use reporting and disclosure
Compliance rate	Would depend on the degree to which public influence causes owners and developers to comply

3.2.4 Joint Commission Accreditation

The Joint Commission (TJC), formerly the Joint Commission on Accreditation of Healthcare Organizations, is a not-for-profit organization based in the United States. TJC accredits over 19,000 health care organizations and programs in the U.S. A majority of state governments have come to recognize TJC accreditation as a condition of licensure and the receipt of Medicare and Medicaid reimbursement. This is raised as a model from which a new compliance path could be developed. The focus would be an annual assessment of buildings with respect to energy and other sustainability issues. This path would consider issues beyond energy needed to make the program feasible. Two activities would have to occur in order for this to be a viable compliance path: (1) create a standard under which buildings are assessed and a program to undertake building assessment and compliance verification, and (2) enact a law, rule, or regulation that creates a demand for such a program and ties continued licensing of a facility to continued compliance.

If the necessary laws, rules, or regulations could not be promulgated, current provisions of TJC program could be amended to include energy-related matters as a condition for health care facility accreditation or for receiving approval to participate in Medicare and Medicaid programs.

Table 3.10. Joint Commission

Conformity Variable	
Adoption	Law, rule, or regulation
Scope	All building energy use
Format	Annual energy use on a unit basis
Responsible party	The Joint Commission
Determination	During occupancy
Penalties	Lack of accreditation affecting the business
Incentives	Continued accreditation and ability to conduct business
Comparison to Traditional Path Baseline	
Resources	Resources would be needed to check on energy use reporting and disclosure
Compliance rate	Would depend on the degree to which such a program could be tied to accreditation and seen as a “deal breaker” in retaining accreditation and the associated ability to conduct business

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Appendix A

Attachments

FIGURE 14B
COMMISSIONING COMPLIANCE CHECKLIST

Project Information	**Project Name:** **Project Address:** **Commissioning Authority:**
Commissioning Plan (Section 1416.3.1)	❑ **Commissioning Plan was used during construction and included items below** • A written schedule including Systems Testing and Balancing, Functional Testing, and Supporting Documentation • Roles and Responsibilities of the commissioning team • Functional Test procedures and forms
Systems Balancing (Section 1416.3.2)	❑ **Systems Balancing has been completed** • Air and Hydronic systems are proportionately balanced in a manner to first minimize throttling losses • Test ports are provided on each pump for measuring pressure across the pump.
Functional Testing (Section 1416.3.3)	❑ **HVAC Systems Functional Testing has been completed** (Section 1416.3.3) HVAC systems have been tested to ensure that equipment, components, and sub-systems are installed, calibrated, adjusted and operate in accordance with approved plans and specifications ❑ **HVAC Controls Functional Testing has been completed** (Section 1416.3.3) HVAC controls have been tested to ensure that control devices are calibrated, adjusted and operate properly. Sequences of operation have been functionally tested to ensure they operate in accordance with approved plans and specifications ❑ **Lighting Controls Functional Testing has been completed** (Section 1513.7) Lighting controls have been tested to ensure that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications
Supporting Documents (Section 1416.3.4)	❑ **Systems documentation, record documents and training have been completed or are scheduled** • System documentation has been provided to the owner or scheduled date: _____ • Record documents have been submitted to owner or scheduled date: _____ • Training has been completed or scheduled date: _____
Commissioning Report (Section 1416.3.5)	❑ **Commissioning Report submitted to Owner and includes items below** • Completed Functional Tests documentation • Deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction • Deferred tests, which cannot be performed at the time of report preparation due to climatic conditions or other circumstances beyond control of Commissioning Authority.
Certification	❑ I hereby certify that all requirements for Commissioning have been completed in accordance with Washington State Energy Codes, including all items above. ---------- Building Owner or Owner's Representative Date

CODE COMPLIANCE BOND

Principals Address: _____ *Bond Number: _____*

_____

_____

COUNTY OF COBB
STATE OF GEORGIA

KNOW ALL MEN BY THESE PRESENTS:

That we _____, as Principal, and _____, as Surety, Incorporated in the State of _____, and duly licensed to act as Surety in the State of Georgia, are held and firmly bound unto Cobb County, Georgia, in the just sum of TEN THOUSAND AND NO/100 ($10,000) DOLLARS, for payment of which, well and truly to be made, we bind ourselves, our successors and assigns,, each and every one of them, jointly and severally, firmly by these presents.

It is further understood and agreed that this bond is continuous and covers all construction done by the Principal, his Agents, or employees. Principal warrants that no construction has occurred prior to the enactment of this bond on work this bond covers. This bond is effective beginning on the _____ day of _____, 20 _____.

The condition of the above obligation is such that:

Whereas, the above bound Principal has made application to Cobb County as a contractor in accordance with the rules and regulations governing contractors in Cobb County, Georgia; and;

It is a condition of this bond that the said Principal is to comply with all of the requirements and provisions of the building and other codes of Cobb County and to correct any code violations discovered during construction and for a period of one (1) year from the date of final inspection; excepting routine maintenance, abuse, modification, and normal wear and tear. A further condition of this obligation is that if the Principal fails to correct any such code violations in accordance with Cobb County's Code Compliance Bond Ordinance, then the surety shall remedy the default within forty-five (45) days of notification by the county to do so. It is a further condition of these obligations that the Principal and Surety shall both be subject to suit, jointly and severally, by action by Cobb County, if in the discretion of the Chief Building Official of Cobb County it has been determined that said Principal has violated the building or other codes of Cobb County, or any provision thereof, for the purpose of requiring the necessary expenditure of funds to correct said violations on the part of said Principal, his Agents, or employees. Said Principal is hereby bound under said bond to faithfully perform all of his duties as such Principal and Contractor in compliance with the Building Code of Cobb County, and all other ordinances of Cobb County relating to buildings and the construction thereof.

Now should the said Principal faithfully perform all and singular his duties as a contractor during the term for which he has been licensed, and upon the terms required by the codes of Cobb County and by this bond, then the above bond is to be void; else to be of full force and effect.

Provided, further, that regardless of the number of years this bond shall continue or be continued in force and of the number of premiums that shall be payable or paid, the Surety shall not be liable hereunder for a larger amount, in the aggregate, than the amount of this bond; and

Provided, further, that if the Surety shall so elect, this bond may be canceled by the Surety as to subsequent liability by giving thirty (30) days notice in writing to said Principal and the Manager of the Development & Inspections Division of the Community Development Department of Cobb County. Subsequent liability shall mean liability for jobs that have not been permitted or begun at the time of termination.

Signed, sealed and dated this _____ day of _____, 20 _____

_____ *_____*
(Agent) *(Surety)*

By: _____ *By: _____*
Cobb County Bond Clerk
Cobb County Development & Inspections
191 Lawrence Street
Marietta, GA 30060

_____
(Contractor & Principal)

By: _____

Revised 01/07

VT RESIDENTIAL BUILDING ENERGY STANDARDS (RBES) CERTIFICATE

This certificate is for projects started after Dec. 31, 2004.

Property Address (street, town, ZIP Code) _____ Act 250 Permit # _____ ❑ NA

Electric Utility serving this address _____

Construction START Date _____ Construction FINISH Date _____

Units _____ # Stories _____ # Conditioned Sq. Ft. _____ #Bedrooms _____

Project Description

❑ Single Family ❑ Log Home
❑ Multifamily ❑ Addition

Foundation Type

❑ Basement ❑ Slab on Grade
❑ Crawl Space

R-_____ Basement/Crawl Space Walls
_____ Depth of Basement Insulation (ft)
U-_____ Basemt Windows ❑ NFRC ❑ Default
R-_____ Under Slab
R-_____ Floors over Unheated Spaces
R-_____ Sloped Ceilings
R-_____ Perimeter Slab Edge
R-_____ Above-Grade Walls
R-_____ Flat Ceilings
U-_____ Windows ❑ NFRC ❑ Default
U-_____ Doors ❑ NFRC ❑ Default
U-_____ Skylights ❑ NFRC ❑ Default

Space Heating Fuel: ❑ Oil ❑ Kerosene ❑ LP Gas ❑ Natural Gas ❑ Wood ❑ Electric Resistance ❑ Heat Pump ❑ Solar ❑ Other

Space Heating System: ❑ Boiler ❑ Furnace ❑ Space Heater ❑ Stove ❑ Other

Primary Heating System Efficiency: _____ % ❑ AFUE ❑ HSPF

Central Air Conditioning Efficiency: _____ % ❑ SEER ❑ COP ❑ N/A

Water Heating Fuel: ❑ Oil ❑ Kerosene ❑ LP Gas ❑ Natural Gas ❑ Wood ❑ Electric Resistance ❑ Heat Pump ❑ Solar ❑ Other

Water Heating System: ❑ Stand-Alone Tank ❑ Indirect-Fired Tank ❑ On Demand ❑ Tankless Coil ❑ Other

Primary Hot Water System Efficiency: _____ % Energy Factor

Ventilation System: ❑ Exhaust ❑ Supply ❑ Balanced

Ventilation Air Flow: _____ CFM ❑ Rated ❑ Measured

OTHER ENERGY FEATURES: _____

Code-Compliance Method Used:

❑ Fast Track *Glazing Percentage:* _____ % *Package #:* _____

❑ Trade-Off *Glazing Percentage:* _____ % *Package #:* _____

❑ VT*check* Software *Maximum UA:* _____ *Your UA:* _____

❑ Home Energy Rating *Rating Score:* _____

Rated by: _____

I certify to _____ (Owner) that the above information is correct and that the premises listed HAVE been constructed in accordance with the Vermont Residential Building Standards (RBES) created under 21 V.S.A. §266.

Signature _____ Print Name _____ Company _____ Phone # _____ Date _____

21 V.S.A. §266 requires this certificate label to be permanently affixed to the inside electrical service panel *or* heating or cooling equipment *or* nearby in a visible location. Copies also must be provided, within 30 days following the sale of the property, to 1) the Dept. of Public Service, Energy Efficiency Division, 112 State St., Drawer 20, Montpelier, VT 05620-2601, and 2) the town clerk of the town where the property is located. NOTE: Noncompliance with RBES may result in action for damages under 21 V.S.A. §266. This label does not specify all 1997 RBES requirements.

QUESTIONS? CALL THE VT DEPT. OF PUBLIC SERVICE: 800-642-3281 (in state) OR 802-828-4056 (out of state).

Texas Building Energy Code Compliance Form For Residential Buildings in Unincorporated Areas

Effective Date: 9/1/2001

Texas law, Ch. 388, Subtitle C, Title 5, Health and Safety Code, requires a new residential structure to comply with the Texas Building Energy Efficiency Standards, which use the International Residential Code "IRC" and the International Energy Conservation Code "IECC" as it existed on May 1, 2001. This form can be used to document compliance outside of a municipal jurisdiction.

New Construction Address or Legal Description: _____

City _____ Zip _____ County: _____

Builder Name: _____

Builder Address: _____

This residence is (select **only one** of the following options):

__ 1. Certified by an accredited energy efficiency program
Complete **Part A. Certification Information** below and attach copy of certification documents; **or**

__ 2. Inspected by a code-certified inspector and determined to meet or exceed the minimum requirements.
Complete **Part B. Inspection Information** below, attach inspection documents; **or**

__ 3. Self-certified by the builder to meet or exceed minimum requirements.
Complete **Part C**. **Self-Certification Form** on page 2. The Texas Residential Building Guide to Energy Code Compliance on the web at http://eslsb5.tamu.edu can be used for guidance on prescriptive requirements.

Part A. Certification Information:

Attach copy of certificate and rating checklist.

Name of certifying program: _____

Program Sponsor/Agency: _____ Certificate Number_____

Project Rating or Home Energy Rating System Score:_____

Is rating based on performance testing of this project? Yes _____ No _____

Rater name/address: _____

_____

_____

Rater certified by: _____ Certification number: _____

Rater signature: _____ Date: _____

Part B. Inspection Information:

Attach a signed and dated copy of inspection checklist.

Inspector name/address: _____

_____

Inspector certified as Residential Energy Plan Examiner/Inspector by _____

Certification number _____ Inspector signature _____ Date: _____

Energy Systems Laboratory
Texas A&M University, College Station, Texas 77843
or go to the Internet at **http://eslsb5.tamu.edu**
Telephone: Toll Free - **877-AnM-CODE** (877-266-2633), Fax – 979-862-8687
©2002 TEES, This form may be reproduced but not modified

Texas Building Energy Code Compliance Form For Residential Buildings in Unincorporated Areas

Effective Date: 9/1/2001

Part C. Self - Certification Form

Compliance Features	Maximum Value	Minimum Value	Installed Value	Meets	Exceeds
1. Insulation (see the Texas Residential Building Guide to Energy Code Compliance)					
Wall Insulation				☐	☐
Floor Insulation (over unconditioned spaces or crawl spaces)				☐	☐
Attic / Ceiling Insulation				☐	☐
Duct Insulation (outside conditioned space)		R-5, R-6*		☐	☐
2. Windows and Doors (see the Texas Residential Building Guide to Energy Code Compliance)					
Glazing percent of total exterior wall area		N/A		N/A	
Window and Glazed Doors U-factor	See Table	N/A		☐	☐
Window and Glazed Doors SHGC**	See Table	N/A		☐	☐
Exterior doors (opaque) U-Factor	.35	N/A		☐	☐
3. HVAC Equipment (Equipment efficiency ratings must meet or exceed current NAECA standards)					
Water heater (NAECA std. or 80% thermal efficiency)		80%		☐	☐
Heat pump		6.8 HSPF		☐	☐
Air conditioner		10 SEER		☐	☐
Furnace		78%AFUE		☐	☐
4. Construction Requirements					
Air-tight recessed lights (ASTM E 283)				☐	☐
Sealed penetrations/gaps/holes. Duct connections must be properly sealed with mastic or UL 181 labeled tape at boots and joints (duct tape not allowed).				☐	☐
Caulking and weather-stripping must be properly installed; all holes, gaps and cracks properly sealed; recessed lights sealed.				☐	☐
Showerhead flow rate of 2.5 gal. per minute or less.				☐	☐
Insulate all circulating hot water pipes and HVAC refrigerant lines.				☐	☐
Thermostat for each HVAC unit or dwelling unit.				☐	☐
Electric meter for each unit in duplex or multi-family units.				☐	☐
HVAC contractor provided calculations showing equipment correctly sized and provided preventive maintenance manuals.				☐	☐

* When the window to wall area is less than 15%, R-5 is the requirement for attic duct insulation, per the IRC Chapter 11. When window to wall areas exceed 15% and per the legislative intent (see memo from Senator "Buster" Brown), it is the opinion of the Energy Systems Laboratory that R-6 insulated flexible duct may be substituted for the IECC required R-8 duct until February 1, 2003.

* SHGC - Solar Heat Gain Coefficient. For most of Texas (all zones south of the Red River), the area-weighted average of all windows and glazed doors may not exceed 0.40 unless an annual energy use analysis (must be attached) shows that permanent exterior shading and other measures will result in equivalent energy use/savings.

Builder Self-Certification:

I, _____, certify that all of the above information is correct and that the construction at the New Construction Address shown meets or exceeds the Texas Building Energy Efficiency Standards:

Builder name/address: _____

_____

Builder signature: _____ Date: _____

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Commercial Self-Certification Checklist

BUILT GREEN SANTA BARBARA

STEP 1: Complete Checklist

Check items you will be including in this project to qualify for a Built Green™ star rating.

HOW TO USE THE CHECKLIST

☐ (5) 2–9. **Use surfaces and appropriate shading to reduce the urban heat island effect**

- Action Item to be implemented (★ items are required)
- Order Action Item appears in Section (numerical)
- Section where Action Item description appears
- Point value of Action Item (when range of points, refer to Part I narrative.)
- Check (✓) when completed

STEP 2: Determine Rating

Requirements to Qualify at 1-Star Level – 50 Points Total

All ★ items, 50 points, plus orientation

- Attend Program Orientation (one time only).
- Earn 50 points. Minimum 10% of points from each of Sections Two, Three and Four.
- Build to Local Codes
- Prepare/Implement Construction Erosion & Sediment Control Plan
- Design/Install exterior lighting to eliminate light pollution
- Develop and Implement a Construction Waste Management Plan (Action Item 3-5)
  - Provide Waste Reduction Resource Sheet to trades (Appendix A)
  - Prepare/post a jobsite recycling plan (Appendix A).
- Provide Building Operations & Maintenance Manual (Action Item 5.1)

Requirements to Qualify at 2-Star Level – 100 Points Total

- Meet 1-Star requirements.
- Earn additional points to meet the minimum 100 points. Minimum 10% of points from each of Sections Two, Three and Four.
- Attend a BUILT GREEN™ approved workshop within past 12 months prior to certification.

Requirements to Qualify at 3-Star Level – 175 Points Total

- Meet 2-Star requirements.
- Earn 75 additional points to meet the minimum for your project category. Minimum 10% of points from each of Sections Two, Three and Four.

Section One: Build to Green Codes and Regulations

- ❑ (★) 1-1. Meet California State Water Use Efficiency Standards
- ❑ (★) 1-2. Meet applicable Stormwwater/Site Development Standards
- ❑ (★) 1-3. Meet California State Energy Code – Title 24
- ❑ (★) 1-4. Meet California State Ventilation/IAQ Code

_____ Subtotal for Section One

Section Two: Site Selection and Development

SITE PROTECTION

Site Selection

- ❑(3-5) 2-1. Reuse or renovate an existing building
- ❑(3) 2-2. Build on a infill lot
- ❑(3) 2-3. Develop a mixed-use property
- ❑(10) 2-4. Locate in an established, pedestrian-friendly community with a minimum density of 60,000 square feet per net acre (two story downtown development), OR walkable access within ¼ mile of 6 or more specified community services
- ❑(2-6) 2-5. Provide onsite cafeteria, day care center, gym or other tenant/employee amenities if these are not available within ¼ mile (See Item 2-4)
- ❑ (5) 2-6. Locate within ½ mile of a commuter rail, light rail or subway station, or ¼ mile of two or more campus bus lines usable by tenant occupants

Site Development

- ❑ (★) 2-7. Provide and Implement construction erosion and sedimentation control plan
- ❑ (3-6) 2-8. Orient building to optimize a) solar access; and b) access to prevailing breezes. (3 points each)
- ❑ (2-10)2-9. Use surfaces and appropriate shading to reduce the urban heat island effect
- ❑ (5) 2-10. Use light-colored materials for roofing to reduce urban heat island effect
- ❑(10-15) 2-11. Install a vegetated roof. (50% of roof – 10 points, 80% of roof -15 points)
- ❑ (5) 2-12. Optimize accessibility beyond ADA compliance
- ❑ (★) 2-13. Design and install exterior lighting to eliminate light pollution (Ref. City of Santa Barbara Light Pollution Ordinance)
- ❑ (5) 2-14. Provide secure bicycle storage, with convenient changing/shower facilities
- ❑ (3-5) 2-15. Minimize parking and provide preferred parking for carpools, vanpools and hybrid/alternative fuel vehicles:
  a) Meet, not exceed code req. MIN. parking – 3-pts
  b) Reduce parking by 10% or better BELOW req. MIN. parking – 5-pts
- ❑ (3) 2-16. Provide lease/on-site parking for car-share program
- ❑ (5) 2-17. Provide improved pedestrian and non –motorized access to the site.

Water Quality Protection and Conservation

- ❑ (5) 2-18. Minimize disturbance to site
- ❑ (3) 2-19. Use low-toxic construction and landscape materials
- ❑(3-15) 2-20 Implement Low Impact Development strategies to reduce and/or treat stormwater runoff.
  3 points for each strategy (see list) in an integrated stormwater management plan. Max 15 points
- ❑ (2) 2-21 Preserve in place/reuse existing landscaping where appropriate
- ❑ (2) 2-22. Landscape with water wise plants, native plants, and no turf.
- ❑ (10) 2-23. Use greywater in place of potable water for allowable uses
- ❑ (5) 2-24. Install efficient irrigation system (or see 2-23)
- ❑ (10) 2-25. Install no permanent irrigation system (or see 2-22)

Innovation

- ❑(4-10) 2-26. Include innovative design, equipment and operation solutions to protect the site's natural features, conserve water and reduce impact on water resources

0 Subtotal for Section Two

Section Three: Building

Design

- ❑ (1) 3-1. Use standard building sizes/dimensions in design (i.e. two foot modules)
- ❑ (2-5) 3-2 Employ material-efficient framing techniques in construction
  a) Intermediate framing – 2 points
  b) Advanced framing with double top plate – 4 points
  c) Advanced framing with single top plate – 5 points
- ❑ (2-5) 3-3. Design to keep water out and off of the building
- ❑ (5-20) 3.4 Design a thermally-efficient building envelope to reduce heating and cooling loads

Construction

- ❑ (★) 3-5. Develop and implement a construction waste management plan designed to maximize diversion of construction waste from the landfill
- ❑ (4) 3-6. Develop and implement a construction indoor air quality management plan designed to protect workers and occupants from airborne pollutants. Pay special attention to measures designed to prevent later moisture and mold problems

Systems

- ❑ (10) 3-7. Conduct fundamental building systems commissioning
- ❑ (5) 3-8. Conduct enhanced commissioning (in addition to 3-7 above)

- ❑ (5-40) 3-9. Design base building HVAC and lighting systems to achieve energy efficiency exceeding code – Performance Approach. Energy improvement beyond code baseline:
  a) 10% - 5 points
  b) 20% - 10 points
  c) 30% - 20 points
  d) 40% - 30 points
  e) 50% - 40 points
- ❑ (2) 3-10. Zero use of CFC- or HCFC-based refrigerants in base building HVAC&R systems
- ❑ (1) 3-11. Zero use of Halon in fire extinguishing systems
- ❑ (5) 3-12. Design and construct building for easy installation of solar heat and electricity systems in the future
- ❑(10-20) 3-13. Supply a portion of the base building's energy requirements from renewable sources:
  a) on-site: 10% of electrical load or 50% of water heating load;
  b) off-site: 50% of total energy load purchased through an approved green power purchasing plan on a 2-year contract
- ❑ (5) 3-14. Implement an Measurement and Verification Plan and install equipment to provide continuous monitoring of energy-consuming equipment
- ❑(5-20) 3-15. Employ strategies that, in aggregate, use less water than the water use baseline calculated for the building after meeting Energy Policy Act of 1992 fixture performance requirements.
  Consumption reduction below baseline:
  a) 20% - 5 points
  b) 30% - 10 points
  c) 40% - 20 points

Materials

- ❑(5-10) 3-16. Use salvaged, refurbished or reused (including left in place) materials for building, excluding furniture and furnishings:
  a) 5% of material costs – 5 points
  b) 10% of material costs – 10 points
- ❑(1-10) 3-17. Use building and finish materials made with recycled content:
  1 point for each qualifying material - max 10
- ❑(1-10) 3-18. Install locally-manufactured building and finish materials:
  1 point for each qualifying material - max 10
- ❑(2-10) 3-19. Install building materials, finishes and furnishings made from rapidly renewable raw materials, e.g. cork, bamboo, linoleum, agrifiber board
  2 points for each qualifying material - max 10
- ❑ (3-10) 3-20. Use certified wood:
  a) 50% by cost of all wood used: FSC – 5 points, SFI and CFS – 3 points
  b) 75% or more by cost of all wood used: FSC – 10 points, SFI and CFS – 6 points
- ❑ (3) 3-21. Use engineered wood products
- ❑ (2) 3-22. Provide easily-accessible, dedicated area that serves for the collection, storage and pick-up of materials for recycling, beyond City- or County-required containers

Innovation

- ❑ (4-10) 3-23. Include innovative design, equipment and operation solutions to enhance the performance, comfort and resource efficiency of the building

0 Subtotal for Section Three

Section Four: Health and Indoor Air Quality

- ❑ (5) 4-1. Install appropriate zoning and controls
- ❑ (5) 4-2. Use salvaged, refurbished or used furniture and furnishings
- ❑ (5) 4-3. Use natural fiber upholstery materials and non-toxic glues
- ❑ (10) 4-4. Design ventilation system to EXCEED by 30% the required ventilation rates under with ASHRAE 62.1-2004, Ventilation for Acceptable Indoor Air Quality
- ❑ (5) 4-5 Install permanent monitoring and alarm systems to monitor ventilation system performance (e.g. CO2 or outside air flow measurement devices as applicable
- ❑ (3) 4-6 Provide built-in atrium or other indoor plant areas with appropriate irrigation and plumbed drainage system
- ❑ (3-9) 4-7. Use low-emitting adhesives and sealants, paints, carpets and insulation
- ❑ (5) 4-8. Composite wood and laminate adhesive must contain no added urea-formaldehyde
- ❑ (3) 4-9 Provide regularly-occupied areas of the tenant space with new air filtration media prior to occupancy, with Minimum Efficiency Reporting Value (MERV) of 12 or better
- ❑ (3) 4-10. Comply with ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy
- ❑ (3) 4-11. Provide permanent monitoring to ensure ongoing performance to maintain thermal comfort conditions
- ❑ (5) 4-12. Maximize access to natural daylight and views using good design (avoid overheating, glare, etc.)
- ❑ (3) 4-13. If installing skylights, make operable and with a minimum u value of 0.45 or better
- ❑ (3) 4-14. Provide individual controls for lighting, ventilation and temperature
- ❑ (2) 4-15. Install exhaust fans in printer/ copy rooms and server rooms
- ❑ (3) 4-16. Install permanent entryway system designed to prevent soil from being tracked into the building
- ❑ (5) 4-17. Install operable windows
- ❑ (3) 4-18. Install operable clerestories to capture indirect daylight (and sea breezes where applicable) and aid natural ventilation
- ❑ (3) 4-19. Install drinking water filtration system in employee break rooms and kitchens

❑ (3) 4-20. When elevators are provided, encourage stair use by building stairways that are clearly marked, easily accessible and comfortable to use

Innovation

❑(4-10) 4-21. Include innovative design, equipment and operation solutions to protect human health and enhance indoor air quality during construction and/or occupation

0 Subtotal for Section Four

Section Five: Operations

❑ (★) 5-1. Provide Operations and Maintenance manual for building systems and equipment

❑ (5-15) 5-2. Provide Tenant Improvement Manual (Developer to provide)

Innovation

❑ (4-10) 5-3. Include innovative design, equipment and operation solutions to ensure the long-term economic, environmental and human wellbeing performance of the project

0 Subtotal for Section Five

Project Address/Location _____

_____

Total Project Points 0

Program Level Obtained:

☐ 1-Star ★ ☐ 2-Star ★★ ☐ 3-Star ★★★

By my signature, I certify that I have performed all Action Items checked above:

_____

(Builder Signature and Date)

Appendix B

Referenced Programs

Document Section	Location	Program	Date	Description	Link
Code Adoption	Alabama	Alabama Building Commission Chapter 170-X-1, Section 170-X-1-.03 (e)	2002	The adoption process and the code or standard adopted determine which buildings will be covered by the energy code. The Alabama State Building Code applies only to "state building and construction, schoolhouses, hotels, and moving picture theaters."	http://www.bc.alabama.gov/chapter170x24.htm
Code Adoption	California, Los Angeles	Los Angeles Municipal Code, Sections 151 to 151.21	2011	Rent control of multifamily properties can affect adoption wherein uninhabitable conditions that are uncorrected can affect the deductibility of expenses for state income tax purposes and prevent raising rents until code violations are corrected (Los Angeles Municipal Code, Sections 151 to 151.21).	http://www.amlegal.com/library/ca/losangeles.shtml
Code Adoption	Florida	Florida Atlantic University Regulation 6.010	1987	Mandatory means of adopting an energy code can include a property lease that stipulates that the building owner/operator provide continued compliance as a condition for the lessee who may be responsible for payment of utilities. Florida Atlantic University Regulation 6.010 on leasing at Section (5) provides specific details associated with fire code compliance in leased space.	http://www.google.com/url?sa=t&rct=j&q=florida%20atlantic%20university%20regulation%206.010&source=web&cd=1&sqi=2&ved=0CBgQFjAA&url=http%3A%2F%2Fwww.fau.edu%2Fregulations%2Fchapter6%2F6.010_Leasing.pdf&ei=ctGETpfpF8zbiAKfkJysDA&usg=AFQjCNFuKAZdwY_34hfviwplPwWrcgjnuA
Code Adoption	Texas	Texas Utilities Code	____	Mandatory means of adoption can include utility service, wherein a contract between the utility and building owner/operator or tenant specifies the satisfaction of certain criteria as a condition for continued service, rate incentives, avoiding penalties, or other utility involvement in adoption. The Texas Utilities Code requires the Utility Commission to adopt standards for rating solar energy devices (Title 4, Chapter 185).	http://www.statutes.legis.state.tx.us/Docs/UT/htm/UT.185.htm
Code Adoption	Virginia	Virginia Uniform Statewide Building Code	2011	The adoption process can also stipulate when and if local government is allowed to amend the state-adopted code. The Virginia Uniform Statewide Building Code cannot be amended by local governments.	http://www.dhcd.virginia.gov/StateBuildingCodesandRegulations/Virginia_Uniform_Statewide_Building_Code.htm

Document Section	Location	Program	Date	Description	Link
Code Format	National	ASHRAE 90.1-2007	2007	The Energy Cost Budget (ECB) Method of ASHRAE Standard 90.1-2007 (90.1-2007), found in section 11, allows the designer to trade off levels of increased and decreased efficiency between the building envelope, mechanical system, service water heating system, and lighting system.	http://www.google.com/url?sa=t&rct=j&q=ashrae%2090.1-2007%20section%2011&source=web&cd=2&sqi=2&ved=0CCIQFjAB&url=http%3A%2F%2Fwww.energycodes.gov%2Ftraining%2Fpdfs%2F90.1-2007_final.pdf&ei=7tSETs3MBcPKiAKP6sjVDA&usg=AFQjCNGGiwJN85u8OpZx8XBKQO-r7vwHpQ
Code Format	National	Housing and Urban Development Code	1993	Subpart F of 24 CFR Part 3280 of the U.S. Department of Housing and Urban Development (HUD) Code provides minimum standards for the design and construction of manufactured homes. The thermal provisions of the HUD Code are provided in terms of a maximum allowable U_o associated with the entire thermal envelope of the home.	http://law.justia.com/cfr/title24/24-5.1.3.1.1.6.html
Code Format	National	2009 IECC	2009	A prescriptive approach for residential occupancies is included in Chapter 4 of the 2009 IECC. The approach includes a look-up table to determine the minimum insulation R-value requirements for the walls, roof/ceiling, and floor assemblies, in addition to determining the maximum limitations for window U-factor and SHGC.	http://reca-codes.org/pages/iecc2009.html
Code Format	National	REScheck	____	REScheck is used to determine the compliance of residential structures with section 402.1.4 of the IECC using the UA alternative. The REScheck approach provides builders with several combinations of insulation levels, glazing U-factors, glazing areas, and other envelope requirements that meet the prescriptive requirements for each climate zone on a thermal equivalency basis. REScheck was created by DOE and can be downloaded for free from the Building Energy Codes Program (BECP) website.	http://www.energycodes.gov/rescheck/

Document Section	Location	Program	Date	Description	Link
Code Format	National	RESNET	____	RESNET standards are recognized by many states and the federal government as alternatives to minimum code compliance. RESNET is a national membership corporation that specializes in the energy efficiency rating systems of buildings. RESNET ratings result in a number on the HERS (Home Energy Rating System) Index that corresponds to the amount of energy used by a building compared to the 2006 IECC.	http://www.resnet.us/home3
Code Format	National	COMcheck	____	COMcheck was created by DOE to simplify energy code compliance. COMcheck gives builders and code officials a computer-based alternative to physical computation and provides forms and checklists to help document compliance. The majority of states accept COMcheck as a method for verifying compliance; visit the BECP website for a complete list of states and jurisdictions currently using COMcheck.	http://www.energycodes.gov/comcheck/download.stm
Code Format	Pennsylvania	Pennsylvania's alternative residential energy provisions.	2009	The Pennsylvania Alternative Energy Provisions, or PA-ALT. PA-ALT is one of three compliance path options in Pennsylvania and was designed as an easy alternative to the mandated energy code. PA-ALT is intended to supplement chapter 11 of the IRC and has the same scope, intent, and general layout as both the IRC and IECC. However, PA-ALT focuses primarily on Pennsylvania's climate and is more flexible, easier to enforce, and simpler to build to than the IRC and IECC. In terms of energy efficiency, the most current version of PA-ALT is equivalent to the 2009 IECC.	http://www.portal.state.pa.us/portal/server.pt?open=18&objID=722749&mode=2
Code Format	Washington, Seattle	Seattle Outcome-Based Code	2009	The City of Seattle, in partnership with New Buildings Institute and the Preservation Green Lab, is developing and piloting a new outcome-based regulatory framework for improving existing building energy performance. The goal is to develop regulations for improving older and historic buildings that will make this building stock more energy efficient. An outcome-based format was selected to give building owners the flexibility to increase energy efficiency through techniques and technology that may not be included in building energy codes.	http://www.preservationnation.org/issues/sustainability/green-lab/additional-resources/Seattle-Outcome-Based-Energy-Codes-Report.pdf

Document Section	Location	Program	Date	Description	Link
How and When Compliance is Verified	New York, New York City	Local Law 967-A	2009	ASHRAE level II audits for commercial and multi-family buildings 50,000 square feet and greater. Required once every 10 years with initial compliance from 2013 to 2022. Results reported to city. Exemptions for LEED EB certification or multiple Energy Star labels.	http://www.imt.org/files/FileUpload/files/Benchmark/Int%20967.pdf
How and When Compliance is Verified	Alaska	Alaska Senate Bill 289	2008	The state Housing and Finance Corporation may not make, participate in the making of or the purchase of a loan for a residential building if construction began after a certain date unless the building complies with thermal and lighting energy standards, and requires certification and training for contractors, architects, engineers, and building inspectors.	http://www.ncsl.org/?tabid=13011
How and When Compliance is Verified	Maine	Resolve, Regarding Building Energy Efficiency and Carbon Performance Ratings	2009	The Maine Public Utilities Commission developed voluntary rules on Energy Star benchmarking.	http://mainelegislature.org/legis/bills/bills_124th/billpdfs/SP035702.pdf http://www.maine.gov/tools/whatsnew/attach.php?id=90756&an=1
How and When Compliance is Verified	Texas, Austin	Energy Conservation Audit and Disclosure (ECAD) Ordinance	2008	This ordinance requires Energy Star benchmarking for commercial buildings by mid-2011 in addition to disclosure to the city and ongoing disclosure upon building sale to transactional counterparties.	http://www.austinenergy.com/About%20Us/Environmental%20Initiatives/ordinance/ordinance.pdf
How and When Compliance is Verified	Washington	Senate Bill 5854	2009	This bill requires Energy Star benchmarking for commercial buildings at time of sale, lease or financing as well as disclosure to transactional counterparties. It will be phased in over 2 years beginning in 2011. It also requires utility data support.	http://apps.leg.wa.gov/documents/billdocs/2009-10/Pdf/Bills/Session%20Law%202009/5854-S2.SL.pdf
How and When Compliance is Verified	Washington, Seattle	Council Bill 116731	2010	This bill requires annual Energy Star benchmarking for commercial and multi-family buildings, and disclosure to the city. It phases in over 2 years beginning in 2011. It also requires utility data support. The Dept. of Planning is in rulemaking.	http://clerk.ci.seattle.wa.us/~scripts/nph-brs.exe?s1=&s3=116731&s4=&s2=&s5=&Sect4=AND&l=20&Sect2=THESON&Sect3=PLURON&Sect5=CBORY&Sect6=HITOFF&d=ORDF&p=1&u=%2F%7Epublic%2Fcbory.htm&r=1&f=G

Document Section	Location	Program	Date	Description	Link
How and When Compliance is Verified	Washington	WAC 51-11-1416 Commissioning and Completion requirements	2009	The state of Washington requires new building commissioning as part of the state building code, as does the 2012 IECC for commercial buildings. Per the Washington code, commissioning compliance checklists must be completed and signed by the building owner and submitted to the building official upon project completion. Commissioning checklists are intended not only to ensure all systems are performing as designed, but to hold builders and contractors responsible for completing all mandatory code provisions	http://apps.leg.wa.gov/wac/default.aspx?cite=51-11-1416
How and When Compliance is Verified	Kansas	Chapter 9 of Kansas Energy Plan KSA 66-1228	2007	Energy disclosure is mandatory for all new and used homes in Kansas. It is the responsibility of the builder or owner when a home is sold to disclose such information to the buyer.	www.kec.kansas.gov/energy_plan/07Plan-Ch9-Section9_2-Recs.pdf
How and When Compliance is Verified	Nevada	Senate Bill No. 358	2009	Buildings owned by the state or occupied by a state agency must record utility bills in an effort to track the amount of energy used in each building and buildings of like construction. Incentives for reducing energy consumption are required.	www.leg.state.nv.us/75th2009/Bills/SB/SB358.pdf
Responsible Party	Rhode Island	Contractors Registration and Licensing Board	____	The Contractors Registration and Licensing Board in Rhode Island have issued minimum standards that prescribe the quality level for materials and performance for the construction or alteration of residential structures. These standards include using certain HVAC components and the performance standards of systems; noncompliance can result in a fine and/or loss of license.	http://www.crb.ri.gov/
Responsible Party	Texas	Texas HVAC Contractor Licensing Regulations	2011	A similar example is found in the Texas HVAC contractor licensing regulations. Section 75.110 (Applicable Codes effective April 1, 2011, 36 TexReg 1975) indicates that the Texas Department of Licensing and Regulations adopted the 2009 edition of the Uniform Mechanical Code and 2009 editions of the International Mechanical Code, the IRC, and other applicable codes. Texas requires the use of the codes effective September 1, 2011, as part of the state contractor licensing requirements.	http://www.google.com/url?sa=t&rct=j&q=texas%20hvac%20contractor%20licensing%20regulations.%20%20section%2075.110%20&source=web&cd=1&ved=0CBgQFjAA&url=http%3A%2F%2Fwww.license.state.tx.us%2Facr%2Facrrules.htm&ei=ItuETpOoINPTiAKr5OnTDA&usg=AFQjCNGKv5rLLe1twLdkg8Z_gWKzfzX7PQ

Document Section	Location	Program	Date	Description	Link
Responsible Party	Wyoming, Casper	Municipal Code. Chapter 15.12	2011	Chapter 15.12 Board of Examiners and Appeals, and Contractor Licensing ties revoking a contractor license to failure to construct a building in accordance with the building plans approved by the building department based on compliance with the adopted codes.	http://library.municode.com/index.aspx?clientID=16253&stateID=50&statename=Wyoming
Responsible Party	Minnesota	RJ Ahmann Company	____	RJ Ahmann Company, an insurance group based out of Minnesota, recommends an extended coverage of property insurance on solar energy systems and the benefits associated with such.	http://www.rja.com/Business_Insurance/commercial-solar-energy-insurance-2/
Responsible Party	Mississippi	The Mississippi Residential Property Insurance Underwriting Association	____	The Mississippi Residential Property Insurance Underwriting Association has rules and rates that address aspects of code compliance that members must follow. The construction practices of certain portions of the building, such as the roof, affect the insurance rates that are applied to the property.	http://www.google.com/url?sa=t&rct=j&q=the%20mississippi%20residential%20property%20insurance%20underwriting%20association&source=web&cd=1&ved=0CCoQFjAA&url=http%3A%2F%2Fwww.msplans.com%2Fmrpiua%2F&ei=R-CETqzBNIPRiAKa4YjJDA&usg=AFQjCNEXDyaQ5k3PqnzRR8zggIKHaFHzDA
Responsible Party	National	Insurance Services Office	____	The Insurance Services Office, a program within the insurance industry, evaluates the competency of building departments. Based on the Insurance Services Office rating, insurance rates are adjusted on properties in the area covered by the building department.	http://www.iso.com/
Responsible Party	California, North Bay	Assembly Bill 1103	2010	In North Bay, California, a formal report regarding the energy use of a building is required as part of the sale, lease or financing of nonresidential buildings under a new state benchmarking law. Assembly Bill 1103 requires owners to provide 12 months worth of comparable energy-use information to prospective buyers or full-building tenants as well as financiers	http://www.northbaybusinessjournal.com/14771/new-law-to-require-energy-rating-on-commercial-buildings/

Document Section	Location	Program	Date	Description	Link
Responsible Party	California, Santa Barbara	Commercial Self-Certification Checklist	2006	Built Green programs in cities and counties such as Santa Barbara, California, and Tacoma, Washington, encourage environmentally friendly and resource-efficient building. The program assists builders and architects by providing training materials, building information, and a self-certification checklist to ensure green building compliance in addition to compliance with state energy codes and standards. Both commercial and residential structures can rate at a one-, two-, or three-star level.	http://www.google.com/url?sa=t&source=web&cd=1&ved=0CBYQFjAA&url=http%3A%2F%2Fsantabarbaracontractorscaassoc.weblinkconnect.com%2Fexternal%2Fwcpages%2Fwcwebcontent%2Fwebcontentpage.aspx%3Fcontentid%3D468&rct=j&q=Santa%20Barbara%20energy%20code%20self-certification&ei=imJmTvPwJKbliALD6tW1Cg&usg=AFQjCNGQv11nJdLtghEFVWJSL5g2MQv4rQ&cad=rja
Responsible Party	Texas	Texas Building Energy Code Compliance Form For Residential Buildings in Unincorporated Areas	2001	Texas allows self-certification as one of three compliance options in areas outside of a municipal jurisdiction. To verify compliance with the Texas Building Energy Efficiency Standards, residential structures must attain certification from an energy efficiency program, a completed inspection by a code-certified professional, or a checklist completed by the builder.	http://www.google.com/url?sa=t&source=web&cd=1&ved=0CBsQFjAA&url=http%3A%2F%2Fwww-esl.tamu.edu%2Fdocs%2Fterp%2Fbuilders_info%2FBuilderSelfCertForm15-NonMuni.pdf&rct=j&q=Texas%20Building%20Energy%20Efficiency%20Standards%20self%20certification&ei=S2JmTrW7JOPKiALD0_C3Cg&usg=AFQjCNEIARwFfoN_wx59xfWELcAqZ9u6VQ&cad=rja
Responsible Party	Vermont	Vermont Residential Building Energy Code Handbook.	2005	The Vermont Residential Building Energy Standard is a mandatory statewide energy code for new residential construction that requires a compliance certificate, completed by the builder, for each residential project. It is the responsibility of the builder to understand, design, and build to the minimum requirements of the energy code and to determine compliance using one of four compliance methods: fast track method, trade-off method, VTcheck software method, or home energy rating method.	http://www.google.com/url?sa=t&source=web&cd=1&sqi=2&ved=0CB0QFjAA&url=http%3A%2F%2Fpublicservice.vermont.gov%2Fenergy%2Fee_files%2Frbes%2Fenergy_code_handbook_09-04.pdf&rct=j&q=Vermont%20Residential%20Building%20Energy%20Code%20Handbook&ei=Y0d6TuOONvTTiALg3JzXDw&usg=AFQjCNHdu2DubFC3SOR62eiuyM63zXy8TA&cad=rja

Document Section	Location	Program	Date	Description	Link
Responsible Party	Texas, Austin	Austin Green Building Program	1991	Austin Energy offers a green commercial rating program to drive sustainable building practices, including energy efficiency. After receipt of a nominal fee, owners and developers receive assistance to ensure that a building will meet certain program requirements throughout the design and construction phases of the project. In this manner, while the energy provisions are what could be considered above minimum code, the utility is directly involved in evaluating compliance with the program provisions	http://www.austinenergy.com/
Use of Penalties and Incentives	Alabama	Utility Rate Reduction	2011	Reduced utility rates based on energy consumption are an incentive for many small business owners in Alabama. Beginning June 2011, businesses that use less than 20,000 kWh per month qualify for the lowest business rate available and businesses that utilize unused storefronts are eligible for a 15% monthly discount with a one-year service agreement. In addition, businesses that increase the number of employees and increase power usage will receive a 24-month rate reduction, 10% the first year and 5% the second with a one-year service agreement.	http://www.google.com/url?sa=t&rct=j&q=alabama%20utility%20rate%20reduction&source=web&cd=1&ved=0CBsQFjAA&url=http%3A%2F%2Fwww.psc.state.al.us%2FCavanaugh%2FApril_2011_Incentives.pdf&ei=0OSETrqAKNTRiALBpK3DDA&usg=AFQjCNEquuRoNcgB3bR7BKZQwopNcOTU3g
Use of Penalties and Incentives	Florida, Charlotte County	Ordinance 2009-020	2009	All residential and commercial buildings can be considered for the green building program and must meet the standards of LEED, the Florida Green Building Coalition (FGBC), the Green Building Initiative (GBI), or the National Association of Home Builders (NAHB) Green Building Program. Incentives include fast-track permitting, possible parking and Floor Area Ratio (FAR) reduction, and county marketing incentives including press releases, green building signage, and recognition awards.	http://www.google.com/url?sa=t&source=web&cd=4&ved=0CDEQFjAD&url=http%3A%2F%2Fcharlottecountyfl.com%2FBCS%2FGreenBuilding%2Fpdfs%2FGrnBldOrd.pdf&rct=j&q=CHarlotte%20County%20Green%20BUilding%20Program&ei=0UXRTeuLEIvWtQOf2tmvCw&usg=AFQjCNHjBB_VqjNiwRK317ZTHJpssoI-5Q&cad=rja
Use of Penalties and Incentives	Maine, Bar Harbor	Density Bonuses	2006	An additional market-rate dwelling unit will be offered as a density bonus for construction projects in which all dwelling units meet LEED standards. This bonus applies to projects within a Planned Unit Development and compliance is determined by either application or by affidavit for adherence during construction.	http://www.google.com/url?sa=t&rct=j&q=bar%20harbor%20maine%20density%20bonus&source=web&cd=2&ved=0CB8QFjAB&url=http%3A%2F%2Fwww.usgbc.org%2FShowFile.aspx%3FDocumentID%3D2021&ei=mM6ETsTWJoTkiAK7h_m8DA&usg=A

Document Section	Location	Program	Date	Description	Link
					FQjCNHDa8xz5xC99YiNc9ENTpQM8DSZfA
Use of Penalties and Incentives	Maryland, Carroll	Green Building Tax Credit	2009	The Green Building Tax Credit provides a 25% tax credit for new buildings that achieve LEED Silver certification, a 50% tax credit for new buildings that achieve LEED Gold, and a 75% tax credit for new buildings that achieve LEED Platinum for a period of 5 consecutive years. This tax credit only applies to business, commercial, or industrial projects.	http://www.energy-grants.net/md-carroll-county-green-building-property-tax-credit/
Use of Penalties and Incentives	Michigan	Construction Management Program at Michigan State University	2011	The construction management program at Michigan State University provides training to building officials to ensure that new projects comply with Michigan's updated energy code. The program uses grant money to develop materials, such as classroom training sessions and web guides that will help Michigan achieve a goal of 90% compliance with the energy code.	http://www.google.com/url?sa=t&rct=j&q=michigan%20state%20university%20energy%20code%20training&source=web&cd=1&sqi=2&ved=0CCMQFjAA&url=http%3A%2F%2Fwww.espp.msu.edu%2Fclimatechange%2Fpresentations%2Fres_comm_industrial_final.pdf&ei=_IeDTuycEMjjiAKAsOWFCA&usg=AFQjCNE4Ij4ivyitRR72-kioHoCJqpBrrQ
Use of Penalties and Incentives	Minnesota, Bloomington	Zoning Area Bonus	2005	Floor Area Ratio (FAR) bonuses are awarded to LEED certified projects, based on level of certification within the High Intensity Mixed Use With Residential HX-R Zoning District.	http://www.ci.bloomington.mn.us/cityhall/dept/commdev/planning/regs/zoneproject/hxr/hxr.pdf
Use of Penalties and Incentives	Nevada, Las Vegas	Expedited Plan Review	1995	The City of Las Vegas, Nevada has developed an expedited plan review process that has proven to save both plan review time and money. The city initiated the program in 1995 and it has grown in popularity. Two processes are available based on the type and size of the project, expedited plan review and over the counter express plan review.	http://www.lasvegasnevada.gov/Apply/20806.htm

Document Section	Location	Program	Date	Description	Link
Use of Penalties and Incentives	New Mexico	Sustainable Buildings Tax Credit	2009	The Sustainable Buildings Tax Credit provides an income tax credit based on square footage and the level of LEED certification achieved by commercial or residential projects. Building sustainability must be validated by a third-party. Effective June 30, 2009, all Build Green New Mexico projects must be certified under new BGNM standard, which has three levels of certification- silver, bronze, emerald. BGNM certified homes will receive the same tax credit as LEED certified homes.	http://www.governor.state.nm.us/priorities.php?mm=4
Use of Penalties and Incentives	New York	New York Training Requirements	____	New York has a mandatory 15-hour builder training requirement for that New York State Energy Research and Development Authority's Green Residential Building Program. Builders may fulfill the requirement by receiving green building credits from an accredited educational institution or by participating in green building training from a professional builders association, such as the National Association of Home Builders, the National Association of the Remodeling Industry, and the Building Performance Institute.	http://www.getenergysmart.org/greenbuilding.aspx
Use of Penalties and Incentives	Tennessee, Nashville	Ordinance BL2008-217	2008	The voluntary green certificate program in Nashville offers density bonus incentives in designated neighborhoods. To receive a green certificate, commercial buildings must attain a LEED Certified rating, specifically reducing water used by 20%. Residential buildings must submit proof of LEED or Earth Craft Homes certification. In the downtown area, development in the Central Business District is eligible to increase the Floor Area Ratio (FAR) cap from 15 to 17 in projects that achieve a LEED Silver rating and a FAR of 19 if the project achieves LEED Gold. In the SoBro neighborhoods, developments are eligible to increase the FAR cap from 5 to 7 if the project achieves LEED Silver and a FAR cap of 9 if LEED Gold is achieved.	http://www.nashville.gov/mc/ordinances/term_2007_2011/bl2008_217.html

Document Section	Location	Program	Date	Description	Link
Use of Penalties and Incentives	Virginia, Arlington	Green Building Density Incentive Policy for Site Plan Projects	2009	The Arlington County Green Building Density Incentive Policy applies to special exception site plan requests for bonus density and/or height. The program uses the LEED rating system as a standard for measuring each project. The floor area ratio (FAR) bonus depends on the level of LEED Certification and building type (commercial, high-rise residential). The County established a Green Building Fund; builders that do not commit to a LEED rating contribute to the Fund. The contribution is calculated at a rate of $0.045 per square foot. (This calculation is based on the fees assessed by the U.S. Green Building Council for registration and evaluation of a formal LEED application.) The Green Building Fund is used to provide education and outreach to developers and the community on green building issues. Developers must post a bond or letter of credit before a certificate of occupancy is issued. If a project receives LEED certification from the USGBC, the Fund contribution is refunded upon receipt of the final LEED certification. If 3 LEED points are missed, 50% of the bond is forfeited to the county. If 4 or more points are missed, the entire bond is forfeited to the county.	http://www.arlingtonva.us/departments/EnvironmentalServices/epo/PDFfiles/file69951.pdf
Use of Penalties and Incentives	Virginia, Virginia Beach	Ordinance 3134	2010	Eligible buildings may apply for an energy-efficiency certification and will be classified separately from other property classifications for property tax reductions.	www.vbgov.com/file_source/dept/planning/3134ord.pdf
Use of Penalties and Incentives	Washington, Seattle	Density Bonus	2006	The City of Seattle, Washington offers a density bonus to provide greater heights and/or greater floor area for commercial and residential projects that meet or exceed LEED Silver certification.	http://www.seattle.gov/dpd/cms/groups/pan/@pan/@sustainableblding/documents/web_informational/dpdp_018423.pdf

Document Section	Location	Program	Date	Description	Link
Use of Penalties and Incentives	Washington, Seattle	Online Coaching		Seattle Online Coaching is an interactive tool available for builders and designers constructing single-family homes in the Seattle area. Seattle Online Coaching provides information on submittal requirements for compliance with the Seattle Residential Code in an easy to follow format that generally takes no more than 30 minutes.	http://www.google.com/url?sa=t&rct=j&q=seattle%20online%20coaching&source=web&cd=1&sqi=2&ved=0CDsQFjAA&url=http%3A%2F%2Fwww.seattle.gov%2Fdpd%2FPermits%2FOnline_Coaching%2Fdefault.asp&ei=E8CETsdUxpeJB9uekYUP&usg=AFQjCNE60-gD4sJ2M2yjdTN1ZwlT3DzubA&sig2=erk6w0BcXqOUYOREr6Fojg
Use of Penalties and Incentives	California, City of San Mateo	Ordinance 2009-14	2010	San Mateo, California amended the San Mateo Municipal Code with Ordinance No. 2009-14 to include the use of a stop work order. If, during any inspection throughout building construction, a code official determines that proceeding with construction activities will prohibit the project from complying with the required code, a stop work order will be issued. The order will remain in effect until a compliance official determines that the approved plan changes will bring the project back into compliance. Stop work orders are critical in ensuring builders and contractors are not deviating from approved building plans or modifying construction practices partway through a project.	http://www.ci.sanmateo.ca.us/DocumentView.aspx?DID=5884

Document Section	Location	Program	Date	Description	Link
Use of Penalties and Incentives	Colorado, Telluride	Ordinance 1331	2010	With the 2010 Ordinance 1331, the city of Telluride adopted a green building program that applies to all new construction, additions, and remodels of commercial, residential, and multi-family homes and requires compliance with energy and green building codes. The city has created a TEMP program, or an Energy Mitigation Program, that requires all excessive exterior energy use, larger homes, and heated garages mitigate or offset the impacts of the additional energy requirements by either using an on-site renewable energy source or making a payment in lieu. This includes outdoor pools, heated garages, and spas/ hot tubs. An energy code review fee equal to 20% of the project's building permit fee must be paid to cover the costs associated with verifying compliance. Funds from the energy code review and TEMP program will be used on town projects. Violating any portion of the ordinance will result in a misdemeanor, punishable upon conviction by a penalty as set in section 1-4-10 (a)(1) of the municipal code for each offense.	http://www.telluride-co.gov/Modules/ShowDocument.aspx?documentid=2036
Use of Penalties and Incentives	Georgia, Cobb County	Code Compliance Bond	2010	Cobb County, Georgia, for example, requires contractors to post a code compliance bond. The bond, which totals $10,000, is used to ensure that a project complies with the provisions and requirements of the building and other codes adopted by the county.	http://www.google.com/url?sa=t&rct=j&q=cobb%20county%20code%20compliance%20bond&source=web&cd=2&sqi=2&ved=0CDcQFjAB&url=http%3A%2F%2Fcomdev.cobbcountyga.gov%2Fdocuments%2FCodeComplianceBond_001.pdf&ei=Q72ETuH8M86ZiQf5m5XDDw&usg=AFQjCNGDKPe2zmJ5nAc3uUJUdBr9A32CXg&sig2=U1ZQI3DuL4jaCoWrvzbfYg

Document Section	Location	Program	Date	Description	Link
Use of Penalties and Incentives	New Hampshire	New Hampshire Energy Code Challenge	2010	New Hampshire has provided comprehensive energy code workshops on the 2009 IECC, funded by state utilities, to building and design professionals and code officials. Starting in 2010, New Hampshire planned to conduct 24 trainings statewide over a two-and-a-half year period, specifically focusing on communities and jurisdictions that might need additional assistance with the state code update. These training sessions are free and provide continuing education credits to the participants.	http://www.nhenergycode.com/live/index.php?go=workshops

The U.S. Department of Energy's Building Energy Codes Program is an information resource on national model energy codes. We work with other government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger building energy codes and help states adopt, implement, and enforce those codes.

BECP Website
www.energycodes.gov

BECP Technical Support
techsupport@becp.gov
www.energycodes.gov/support/helpdesk.php

EERE Information Center
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