National Institute of BUILDING SCIENCES

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Implementing an Outcome-Based Compliance Path in Energy Codes: Guidance for Cities

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I. Introduction

Many U.S. communities are in the process of creating and incorporating energy use reduction goals and objectives. Adjustments and modifications to the built environment provide significant opportunities for meeting these objectives, since buildings comprise 40% of the nation's primary energy consumption.[1] As a result, how well communities reduce energy use in buildings will be a central component of whether local governments achieve their energy reduction and climate action goals.

Historically, most plans to reduce building energy use have been in the form of prescriptive energy codes for design and construction, or mechanisms, such as financial incentives from utility companies, to address specific building components, such as efficient lighting and heating, ventilation, and air conditioning (HVAC) equipment. However, using a "whole building" perspective that looks at all stages of the building process, including design, construction, operation, maintenance, and occupancy, to address energy efficiency from a life-cycle energy performance approach maximizes the potential for jurisdictions to achieve their energy reduction goals through system-level efficiencies. The buildings industry is reaching a growing consensus that a systems approach is superior to analyzing individual components, a topic that has been explored in the Alliance to Save Energy's Systems Efficiency Initiative reports.[2] The ability to continue realizing the benefits of component-level efficiency gains is decreasing, in part because of technical and economic limitations on increased efficiency improvements for some individual components. According to the Alliance's first Systems Efficiency Initiative report, "estimates presented at a 2014 European workshop suggest that energy savings related to both HVAC and lighting could be roughly doubled by moving beyond single devices to systems-level efficiency…The American Council for an Energy-Efficient Economy estimates that system efficiency opportunities for energy savings dwarf component-based efficiency improvements by an order of magnitude."[3]

To accomplish their energy use reduction goals, communities should think holistically to establish a coordinated approach that captures energy efficiency opportunities across the life cycle of buildings. Traditional energy codes provide an important mechanism for addressing the design and construction of buildings. As outlined in this guidance and elsewhere, energy codes should be

[1] "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." *How Much Energy Is Consumed in U.S. Residential and Commercial Buildings? - FAQ - U.S. Energy Information Administration (EIA)*. EIA, n.d. Web. June 2017.
[2] "Greater than the Sum of Its Parts: The Case for a Systems Approach to Energy Efficiency." *Systems Efficiency Initiative*. Alliance to Save Energy, May 2016. Web. June 2017.

coupled with additional policies and incentives to drive actual, measured improvements in building energy use. This document outlines a potential mechanism that expands the role of existing codes to include provisions that address the impact of building operations on energy use.

As discussed below, this specific code-based approach may not be appropriate for all jurisdictions, but does set up an initial mechanism to begin shifting thinking and practice to a more holistic consideration of how buildings use energy and the role jurisdictions can play in assuring buildings are contributing to their community-wide goals. As leading jurisdictions apply this approach and approaches like it, the successes and lessons learned will inform broader policies and practices that engage departments and other stakeholders outside the code department.

Why Focus on Energy Codes First?

The current energy codes in the United States can only have a limited impact on overall energy use because they apply only to new construction, major renovations, and permanent building features. They don't address operation, maintenance, or occupant behavior that occurs after the issuance of a certificate of occupancy.

Existing codes are typically prescriptive or performance-based. Simple to use and enforce, prescriptive codes provide minimum values and characteristics for building components, such as R-values for insulation. They consist of a checklist of requirements to be met, so they are convenient to follow. However, prescriptive codes have shortcomings: they tend to be slow to incorporate novel technologies, apply best to projects seeking to meet the bare minimum requirements instead of high performance, and fail to address the entire building as a system. On the other hand, performance-based codes are more flexible, because they set a required energy performance level based on prescriptive codes' anticipated results. However, they require utilization of energy models, which may not provide consistent results. Due to the challenges and limitations associated with the prescriptive and performance codes currently in place, many building energy thought leaders are suggesting a move toward more outcome-based codes.[3]

As currently developed, energy codes have three fundamental shortcomings in their ability to address building energy use: 1) Energy codes are unable to address a wide range of building energy loads that are not related to basic building design, but instead are driven by building use patterns, portable equipment controlled by tenants (plug loads), and other unregulated loads; 2) energy codes do not (effectively) address poor building operation and maintenance strategies, which can significantly degrade overall building energy performance; and 3) energy codes apply only to new construction or major renovations, which represent a small subset of the building stock at large, and therefore can only impact a fraction of building sector energy use in the near term.

A need clearly exists to integrate and optimize building attributes across the entire life cycle of a building to address energy performance. Because an outcome-based approach has a holistic focus on actual, measured performance, jurisdictions should consider incorporating an outcome-based

[3] Colker, Ryan M. and Jessyca Henderson. "Developing Effective Codes and Standards for Net-Zero Energy Buildings." *Zero and Net-Zero Energy Buildings + Homes*, n.d. Web. June 2017.

compliance path within their energy code. Such an approach can serve as an initial mechanism to link code-based solutions with long-term energy reductions.

As identified by the New Buildings Institute (NBI) and others, the ability to further increase the efficiency requirements of certain pieces of equipment is limited by federal preemption.[4] An outcome-based approach enables cities to avoid challenges related to federal preemption on heating and cooling, and lighting equipment efficiency, as its holistic focus avoids a limiting focus on individual components and equipment.[5]

This implementation document serves to guide jurisdictions through the process of incorporating an outcome-based compliance path into their current energy codes. Though outcome-based compliance within energy codes is a departure from the current regulatory process, it provides important benefits for all stakeholders. To ensure buy-in and support successful implementation of this new compliance option, a community should engage architecture, engineering, construction, and building owner stakeholders early in the development and adoption process.

Why Consider an Outcome-Based Approach?

Outcome-based codes can be particularly beneficial for communities that are striving to achieve energy efficiency or greenhouse gas emission reduction goals.

To date, energy codes have focused on either prescriptive or performance-based requirements. While useful, these codes lack the advantages of outcome-based requirements. Challenges in the existing code include complex and overly detailed prescriptive requirements; performance-based codes that rely on underlying prescriptive codes; inconsistencies between design and construction requirements and actual performance; and a disconnect between policy priorities and the capability of codes to address actual energy use. Current use of energy simulations is similarly not intended to predict actual performance, but rather to compare proposed buildings to buildings assumed to just meet the code provisions.

The actual energy use of a building is highly variable and depends upon numerous factors, including building orientation, plug loads, operations and maintenance practices, quality of installation, and systems-level interactions—items not traditionally addressed in an energy code. The addition of an outcome-based compliance path to existing codes would establish a mechanism for codes and code departments to help support achievement of community-level goals and the code departments that would deliver on such results.

[4] See New Buildings Institute. Federal Preemption as a Barrier to Cost Savings and High Performance Buildings in Local Energy Codes. June 22, 2017. http://newbuildings.org/resource/federal-preememption-barrier-to-cost-savings/

[5] "Washington State Energy Code Roadmap." *New Buildings Institute*, August 2015. Web. July 2017.

Figure 1: Comparison of Energy Code Compliance Paths

Prescriptive	Performance	Outcome
• Sets minimum characteristics for individual components • Easy to use/enforce • Slow to incorporate new technologies • Depends on increasing efficiencies in individual components • Do not reward efficient design decisions • No assurance or requirement to measure results are met	• Set desired end-state—often based on anticipated results from prescriptive code • Flexibility for the design team (but more difficult for code officials) • Technology neutral • Based on building energy models • No assurance or requirement to measure results are met	• Establish a target energy use level and measurement and reporting to assure performance at established level • Includes all energy uses • Flexibility for design team • Assure actual results • Can recognize diversity across building types, even existing and historic buildings

Outcome-based requirements establish a target energy use level and measure and report actual energy use in relation to that target once the building is being operated. Such an outcome-based approach provides flexibility to the design team while assuring that the intent of the energy code is being met. In fact, the community and the building owner both obtain a higher degree of assurance of building performance than with current code compliance paths.

Many jurisdictions do not have the personnel or fiscal resources to adequately ensure compliance with energy requirements. By focusing on the outcome, code officials and communities can be assured that requirements are being met while not incurring additional enforcement burdens. If an owner and design team elect to pursue an outcome-based path, they ultimately bear the burden of demonstrating compliance and achievement of the outcome. This proposed outcome approach sets a clear target, allows for design options and flexibility, and then provides real answers as to whether the planned energy use for a building has actually been achieved.

The outcome-based path helps overcome limited enforcement resources because compliance with the energy code is determined based on measured energy performance once the building is in operation and not on the verification of specific requirements in the code. This should result in the building department spending less time on enforcement while better realizing the energy use results intended by the code. In addition, this compliance path addresses concerns that the code development and adoption process has become increasingly dominated by material interests, since it is based on the achievement of a target energy use that does not depend on materials used.

A number of communities are particularly suited to begin including outcome-based pathways in their existing codes. Such communities have particular characteristics, including strong energy efficiency leadership at the city level. These communities often have in place guiding policy documents, such as climate action plans, resilience plans, or energy plans. As interest in outcome-based approaches expands and performance reaches beyond strictly code-based strategies, city leaders must be prepared and willing to undertake changes to existing departments or create new

roles to achieve these goals. A community needs a framework for the enforcement of these programs, buy-in at all levels of local government, and the responsibility and capability of collecting and analyzing data on building performance. For example, the city of Seattle, Washington, created a model energy code project in which these characteristics are apparent.

Typically, communities that are prepared for an outcome-based code already have adopted public and commercial building benchmarking policies[6]. To move in this direction, jurisdictions need advocates at the highest level of government. These advocates should be prepared to monitor progress and provide political and fiscal support, as well as engage key partners (building owners, designers, contractors, and utilities). To be successful in the adoption of an outcome-based code provision, communities likely have a well-established communication strategy and will require a shift in personnel training and responsibilities. As a community expands beyond a strictly code-based approach to performance outcomes, the jurisdiction will need the necessary infrastructure for data collection and management, including an open protocol for smooth exchange of information, such as the Environmental Protection Agency (EPA) EnergyStar Portfolio Manager and the U.S. Department of Energy (DOE) Standard Energy Efficiency Data Platform (SEED)[7]. The city also will need to invest in staff capable of implementing necessary strategies.

Implementing an Outcome-Based Compliance Path

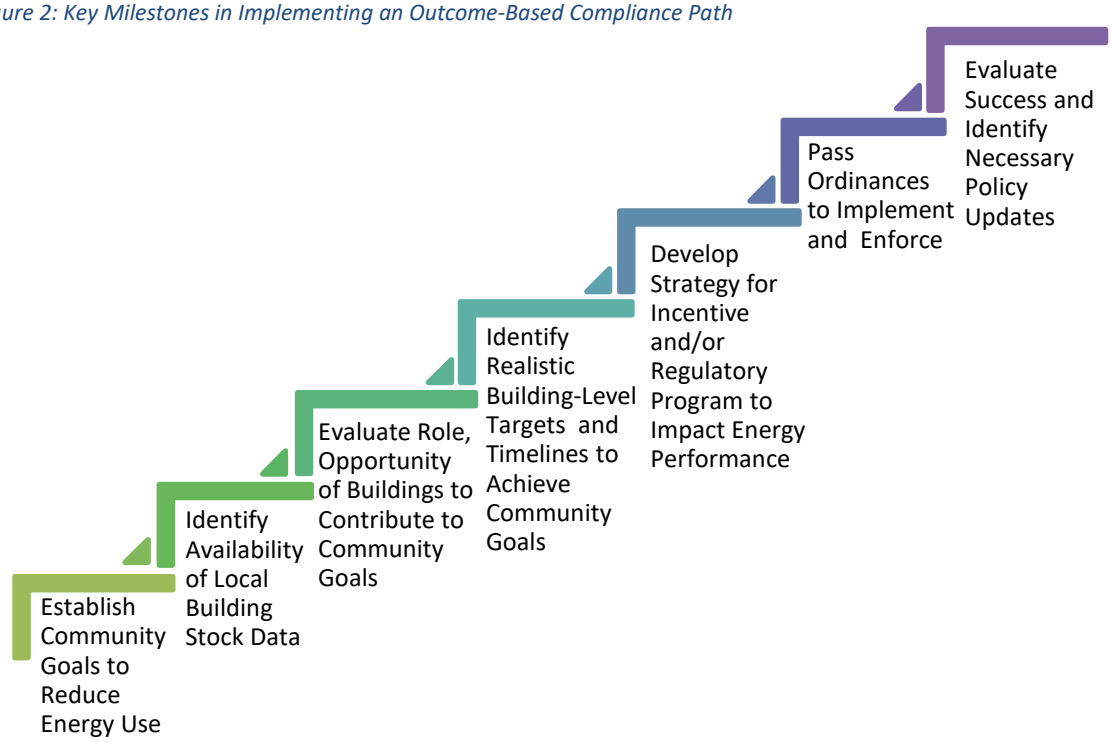
All communities are different, so it is important to identify a framework for each jurisdiction to implement their own outcome-based approaches to energy performance. Figure 2 identifies key milestones in the implementation process.

While outcome-based processes will assist communities in achieving their energy use reduction goals through measured and verified results, some challenges, discussed here and in the accompanying appendices, still will need to be overcome. Communities will need to invest time and effort to overcome these challenges.

As with anything new, building an interested base of engaged users is essential. An outcome-based compliance path in the code is no different. Communities will need to identify a combination of incentives, implementation mechanisms, and a compelling but fair target development and enforcement process. Engaging stakeholders in the development process will go a long way in helping address these issues.

[6] "U.S. Building Benchmarking and Transparency Policies." *Building Rating*. Institute for Market Transformation, n.d. Web. June 2017.
[7] "Standard Energy Efficiency Data Platform." *Office of Energy Efficiency & Renewable Energy*. U.S. Department of Energy, n.d. Web. June 2017.

Figure 2: Key Milestones in Implementing an Outcome-Based Compliance Path



The outcome-based compliance path offers owners and design teams increased flexibility in their compliance with the energy code, but it also places them on the hook to achieve measured energy performance—a departure from the current system. Overcoming this momentum requires making the approach attractive to potential users.

Jurisdictions may wish to identify a suite of incentives to encourage projects to utilize this new approach. The jurisdiction will need to balance the types of incentives given with the ability to remedy noncompliance. While it may be tempting to have such incentives parallel those offered within the jurisdiction for green building programs, such as expedited permitting or density or floor area bonuses, these benefits are not easily revoked if targets are not achieved. Therefore, enforcement strategies must be in place. (See Appendix B for additional discussion on these topics.)

Targets also need to be set at levels in the spirit of the expected results from existing code pathways. Too lax and the intended results will not be achieved, too stringent and the potential audience loses interest. (A discussion on setting targets appears in Appendix A.) The jurisdiction may want to develop a mechanism for allowing target adjustments post-occupancy to address extenuating circumstances. If a building is utilized more efficiently than the characteristics the initial target is based on, the owner should not be penalized. For example, a retail establishment may look to expand operating hours based on increasing sales or an office tenant may look to increase space efficiency by adding 50 percent more workers in its existing space.

Figure 3: Key Components and Activities Needed to Successfully Implement an Outcome-Based Approach

Find **champions** at the highest level of government and within responsible agencies to monitor progress and provide political and fiscal support, as well as engage key partners (building owners, designers, contractors, and utilities).
Set community-wide or building industry **goals** for energy performance or greenhouse gas emission reductions and the desire to implement policies to help achieve such goals.
Implement targets and outcome-based requirements for **municipal portfolio** to help drive local market and demonstrate commitment to the goals.
Establish realistic **target energy use levels** and measurement and reporting mechanisms to evaluate actual energy use in relation to that target.
Put in place mechanisms to **monitor progress** towards community-level goals and adjust targets as necessary, including public and commercial building benchmarking and transparency policies.
Engage all building industry stakeholders (architects, engineers, contractors, owners, code officials, and others) throughout the development and implementation of an outcome-based approach.
Identify opportunities to enhance additional sections of the energy code that will support addressing life-cycle energy performance, including end-use **metering and commissioning**.
Evaluate competencies of **code department staff,** including training needs, to implement a new compliance option.
Identify a suite of **incentives** that may encourage projects to utilize this new approach.
Develop a **framework for enforcement** of outcome-based provisions, including the responsibility and capability of collecting and analyzing data on building performance.
Identify approaches to **remedy non-compliance** that occurs post-occupancy.
Clearly define acceptable **modeling programs and parameters** to assure that results demonstrating potential to meet the targets are defensible.
Establish a mechanism to allow **verification of compliance** post-occupancy, whether a Temporary Certificate of Occupancy (TCO) or a Certificate of Occupancy and a Post Occupancy Verification Permit (POVP).

As a jurisdiction increases its involvement in setting, monitoring, and adjusting targets, and utilization of the approach increases, dedicated technical staff may be required (either within or outside the code department) to undertake these roles.

A Brief History of Outcome-Based Codes

Many communities have set significant energy efficiency goals that will be difficult to reach if the existing structural and enforcement characteristics of current codes are left unchanged. Due to the need for a change in approach, a group of industry leaders, led by the National Institute of Building Sciences (NIBS) and NBI, championed bringing together stakeholders and developing technical and policy guidance to support moving in this direction.

In 2014, NIBS and NBI held a performance outcome summit intended to help advance the buildings industry toward a focus on actual, measured energy performance and life-cycle approaches. (The subsequent report of findings was released in May 2015[8].) The summit brought industry leaders together to provide their perspectives on research, policies, and solutions. The group identified two key areas of focus: "codes and policies" and "industry practice," and noted the importance of coordinating between design and construction and operations and maintenance to successfully realize performance goals. Participants at the summit identified a number of goals, among them:

[8] Frankel, Mark, Jim Edelson, and Ryan Colker. "Getting to Outcome-Based Building Performance." *Seattle Summit on Performance Outcomes*. National Institute of Building Sciences and New Buildings Institute, May 2015. Web. June 2017.

setting service-based models for delivery of comfort and occupant experience; refocusing the modeling industry to performance and design-making tools; moving toward requirements in which a project's energy use intensity (EUI) is able to be predicted based on building type; and developing a simple energy code focused on performance outcomes.[6] The group identified methods to overcome challenges affecting occupants, operations, policymakers, responsibility and performance, project team goals, valuation, integrated design, change over time, scale, operations phase, and building energy data.

In addition, NIBS and NBI, with the backing of key industry stakeholders, successfully proposed an outcome-based compliance path for inclusion in the 2015 *International Green Construction Code* (IgCC). The first outcome-based compliance path in any model code, this new section in the IgCC's energy chapter sets energy use targets based on building type and climate zone. A group of industry representatives, including NIBS, NBI, the Building Owners and Managers Association International (BOMA), Natural Resources Defense Council (NRDC), Institute for Market Transformation (IMT), Green Building Initiative (GBI), and others educated the industry on the subject prior to the addition to the IgCC.

Building upon progress made during development of the IgCC, NIBS submitted a code change proposal to include an outcome-based compliance path as an option in the 2018 *International Energy Conservation Code* (IECC). Following discussions with key stakeholders, the proponents elected to recommend including such a path as an appendix to the code for adoption by interested jurisdictions. Unfortunately, this shift in tactic did not result in the provision's inclusion in the 2018 IECC.

NBI also began working on a proposal to include an outcome-based pathway in ANSI/ASHRAE/USGBC/IES Standard 189.1-2017–*Standard for the Design of High Performance Buildings*. The proposal was not far enough along in the process to be included in the upcoming edition. However, NBI and NIBS plan to continue working with the development committee for potential incorporation in future editions.

As communities consider implementing the new 2018 model codes, the code language contained herein provides a vetted template for adding an outcome-based pathway for compliance to current energy codes.

II. Proposed Code Provision

The following text, which was built on the compliance path currently incorporated into the 2015 IgCC, and further modified as a proposed appendix to the 2018 IECC, serves as a template for jurisdictions interested in incorporating an outcome-based compliance path into their energy code. This template should serve as a model subject to amendment to meet the specific needs of the jurisdiction.

In particular, the jurisdiction will need to make decisions regarding the setting of targets, minimum mandatory provisions, and methods of enforcement. The provisions presented here contain placeholders where such provisions should be addressed. Strategies for determining these provisions are provided in the Appendix.

OUTCOME-BASED COMPLIANCE PATH

[NOTE: The jurisdiction will need to insert a reference to this Section as an acceptable compliance path alongside existing prescriptive and performance methods.]

SECTION CXXX
OUTCOME-BASED COMPLIANCE

XXX.1 Outcome-based Compliance. Compliance for buildings and their sites to be designed on an outcome basis shall be determined by actual measurement of all the energy being used after the building and the energy using elements associated with the building site are in full operation in accordance with this Section. Where a building has multiple occupancy types, the maximum allowable energy use shall be based on total gross floor area of each occupancy type in relation to the total gross floor area of all occupancy types within the building. Compliance shall be based on a determination of actual energy use in accordance with this section. Buildings having one or more uses or occupancies not listed in Table XXX shall not be eligible to demonstrate compliance with this code in accordance with this Section.

XXX.2 Application. To comply with this section, commercial buildings shall comply with this Section and the following mandatory provisions of this code: _____.

[NOTE: While an outcome-based compliance path is intended to provide maximum flexibility for the design team, the jurisdiction may wish to establish a small set of mandatory requirements. A discussion of potential requirements is contained in Appendix C. Jurisdictions should be cautious to balance the desire for mandatory requirements with the flexibility that makes following such a path desirable.]

XXX.2.1 Target EUI (EUI_t). The building shall demonstrate a measured source EUI (EUI_a) less than or equal to the energy target (EUI_t) in Table XXX for the building use and occupancy and for the climate zone in which the building is located.

[NOTE: A generic table is provided here for setting targets. Consult Appendix A for discussion of how such a table could be completed for a particular jurisdiction, including which climate zone(s) should be included.]

XXX.2.1.1 Weighted Occupied Floor Area. The target energy use intensity shall be determined utilizing Table XXX. The EUI_t value from Table XXX shall be adjusted based on the monthly weighted average of occupied floor area during the 12-month compliance period as documented in accordance with XXX.3.3. For buildings with multiple use or occupancy designations in Table XXX, the EUI_t shall be adjusted based on the weighted area average of the use or occupancy.

TABLE XXX
EUI TARGETS BY CLIMATE ZONE AND BUILDING TYPE (EUI_t)

CLIMATE ZONE[a]	XX	XX
	EUI_T (kBtu/sf/yr)	
BUILDING TYPE[b]		
Administrative/professional office		
Bank/other financial		
Government office		
Medical office (non-diagnostic)		
Mixed-use office		
Other office		
Laboratory		
Distribution/shipping center		
Nonrefrigerated warehouse		
Convenience store		
Convenience store with gas		
Grocery store/food market		
Other food sales		
Fire station/police station		
Other public order and safety		
Medical office (diagnostic)		
Clinic/other outpatient health		
Refrigerated warehouse		
Religious worship		
Entertainment/culture		
Library		
Recreation		
Social/Meeting		
Other public assembly		
College/university		
Elementary/middle school		
High school		
Preschool/daycare		
Other classroom education		
Fast food		
Restaurant/cafeteria		
Other food service		
Hospital/inpatient health		
Nursing home/assisted living		
Dormitory/fraternity/sorority		
Hotel		
Motel or inn		
Other lodging		
Vehicle dealership/showroom		
Retail store		
Other retail		
Post office/postal center		
Repair shop		
Vehicle service/repair shop		
Vehicle storage/maintenance		
Other service		
Strip shopping mall		
Enclosed mall		

a. Climate zones as determined in accordance with Section XXX.

b. Use and occupancy (building type) as determined by Chapter __ of the _____ Building Code.

XXX.2.2 Actual Energy Use Intensity (EUI_a). The actual energy use intensity (EUI_a) of the building and building site shall be calculated in accordance with Equation XX-1. On-site renewable energy generation shall be included in the calculation of the EUI_a.

$$EUI_a = (AEU_{bldg} - AEXP_{ren})/TCFA \quad \text{(Equation XX-1)}$$

Where:

$AEU_{bldg.}$ = the annual energy consumed by the building and building site from all forms of energy in Btus converted to source Btus. The source energy multiplier for electricity imported from the electricity grid shall be [3.15]. The source energy multiplier for imported fuels other than electricity shall be [1.09].

$AEXP_{ren}$ = the annual energy produced by onsite renewable energy systems exported to the electricity grid in Btus converted to source Btus. The source energy multiplier for onsite renewable energy exported to the electricity grid shall be [3.15].

TCFA = the total *conditioned floor area* of the building.

[NOTE: The jurisdiction may choose to use the national conversion factor of 3.15 or a local factor based on the electricity fuel mix within their eGrid (EPA) region. While less variable, the jurisdiction may also choose to set the source energy multiplier for specific imported fuels. See Appendix A for information on setting these factors.]

XXX.2.2.1 Measurement of AEUs. AEUs shall be determined from metering, utility billing or other form of measurement acceptable to the *code official* and converted into consistent units in accordance with Section XXX.2.2.

XXX.3 Compliance. Compliance with this Section shall be determined in accordance with Sections XXX.3.1 through XXX.3.4.

XXX.3.1 Demonstration of Ability to Meet XXX.3 Requirements. In advance of plan approval by the *code official*, the design team shall demonstrate to the *code official* the ability of the design to meet the EUI_t established in Section XXX.2.1 utilizing Section XXX.3.1.1 or XXX.3.1.2.

XXX.3.1.1 Modeled Approach. The demonstration of the ability to meet XXX.3

using a modeling approach shall be determined in accordance with Sections XXX.3.1.1.1 through XXX.3.1.1.2.

XXX.3.1.1.1 Energy Model. The design team shall develop a whole building energy model consistent with the requirements of this section using software and parameters approved by the *code official*.

XXX.3.1.1.2 Design Submittal. Results of the model and cut sheets of equipment and characteristics contained within the compliant model developed under Section XXX.3.1.1 shall be provided to the *code official* for use in verification during inspections.

XXX.3.1.2 Pre-Approved Specifications Approach. The design team shall provide the *code official* with design documents containing prescriptive requirements for all building systems impacting energy use that are published or certified by an entity acceptable to the *code official* to meet the relevant EUI_t requirements.

XXX.3.2 Issuance of Temporary Certificate of Occupancy. Where the *code official* determines a building and its site are in compliance with this code other than Section XXX, the *code official* shall issue a Temporary Certificate of Occupancy as authorized in Section ____ of the _____ Building Code.

XXX.3.3 Reporting of Energy Use. Within 24 months of issuance of the *temporary certificate of occupancy*, the building owner shall provide the *code official* with documentation, certified by a *registered design professional*, of a continuous 12-month period where the building complies with this Section utilizing a form *approved by* the *code official*. The occupancy or use type for the occupied period utilized in Section XXX.2.1 shall be indicated in the documentation and include the time periods and square footage of the building occupied by all building tenants.

[NOTE: Sample forms for both the submission phase (demonstration of design to achieve) and the demonstration of compliance phase are provided in Appendix B and may be used or modified by a jurisdiction.]

[*NOTE: Some jurisdictions issue Temporary Certificates of Occupancy in very limited circumstances. In that case, the jurisdiction may elect to establish a new mechanism for addressing requirements remaining following issuance of a Certificate of Occupancy—the Post Occupancy Verification Permit. In that case, the following definition should be provided within the General Definitions section of the code and the alternate provision XXX.3.2 and XXX.3.3 enacted.]*

GENERAL DEFINITION

POST OCCUPANCY VERIFICATION PERMIT. A permit issued before a certificate of occupancy to address requirements of this code that occur post-occupancy.

XXX.3.2 Issuance of Post Occupancy Verification Permit: Where the *code official* determines a building and its site are in compliance with this code other than this Section, the *code official* shall issue a Certificate of Occupancy and a *Post Occupancy Verification Permit* in accordance with Section XXX.3.3.

XXX.3.3 Post Occupancy Verification Permit. Within 24 months of issuance of a post occupancy verification permit, the building owner shall provide the *code official* with documentation in a form acceptable to the *code official* and certified by a registered design professional of a continuous 12-month period during which the building complied with Sections XXX.2. The documentation shall include occupancy or use type for the occupied period, the beginning and ending dates of the 12-month period, and the total conditioned floor area of the building. The post occupancy verification permit shall remain in effect until the *code official* has received the documentation verifying compliance with Sections XXX.2.

[*Note: Some jurisdictions may wish to incorporate a mechanism whereby an owner can demonstrate that extenuating conditions (e.g., weather or occupancy conditions) could reasonably result in a required adjustment to the target. In such a case, the following language could be incorporated.]*

XXX.3.4 Normalization for Abnormal Conditions. At the discretion of the *code official*, the owner or owner's representative may submit documentation demonstrating that abnormal weather or occupancy conditions during the compliance period are responsible for the variance between the

energy consumed by the building and building site and the renewable energy associated with the building and building site and that the building would comply with XXX.3 under normal conditions.

[Note: Most jurisdictions have provisions regarding notice of violations and penalties for noncompliance elsewhere within their code, which should be sufficient as the basis for enforcement actions. Specific enforcement actions a jurisdiction may undertake are discussed in Appendix B.]

III. Explanation of Proposed Code Provisions

The following section provides commentary on the proposed code provisions. This commentary can be used to inform stakeholders on the intent of this amendment.

Establish New Chapter XXX: Outcome-Based Compliance Path

XXX.1 Provides general methodology and requirements for compliance through the outcome-based provisions. For buildings with multiple occupancy types, the gross floor area of each type is used to determine compliance. This path cannot be used if an occupancy type is not included in the table.

XXX.2 Establishes the outcome-based pathway as an actual measurement of energy use once a building is in full operation, requiring compliance with Sections of the Energy Code.

> **XXX.2.1** Establishes that the building's actual source energy use (EUI_a) be less than or equal to the target source energy use (EUI_t) for the building, based on building use and occupancy and climate zone as contained in Table XXX.
>
> > **XXX.2.1.1** Provides methodology for calculating a target for buildings with multiple occupancy types or changes in occupied floor area.
>
> **XXX.2.2** Methodology for calculating the actual energy use (EUI_a). The building's actual energy use in Equation XX-1 is calculated based on non-renewable source energy used onsite on a square foot basis minus renewable energy generated onsite. See previous note and Appendix A for information on setting multipliers.
>
> > **XXX.2.2.1** Metering or utility billing shall be used to determine the annual energy consumption.

XXX.3 The following sections indicate how to demonstrate compliance with this section.

> **XXX.3.1** The design team must provide assurance to the code official that the proposed design has the capability to meet the EUI_t.
>
> > **XXX3.1.1** Modeling may be used to demonstrate capability to meet the target with the following requirements:
> >
> > > **XXX.3.1.1.1** A whole building energy model shall be developed using software and parameters approved by the code official. The code official may wish to consult the list of software programs approved by DOE to model for calculation of Internal Revenue Service (IRS) incentives.[9] The code official also may set modeling parameters per COMNET.[10]

[9] https://energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions
[10] https://comnet.org/

XXX.3.1.1.2 Results from the model shall be provided to the code official including demonstration that the modeled EUI_a is less than or equal to the EUI_t and the specifications of individual components that the code official can use during inspection. The components contained within the model shall become the basis for inspection rather than the other provisions contained within the code (except any mandatory provisions specified).

XXX.3.1.2 A prescriptive package of building components previously approved by the code official or a certifying entity to meet the EUI_t may be used to fulfill this requirement.

XXX.3.2 Upon the satisfaction of the code official that all other code requirements are met, a temporary certificate of occupancy is issued.	This adds a definition for Post Occupancy Verification Permit to support the compliance mechanisms established in XXX.3.2.
XXX.3.3 The building owner will provide the code official with sufficient documentation showing achievement of the EUI_t within a 12-month period during the first 24 months of occupancy. The documentation will be certified by a registered design professional and reported to the code official in an acceptable format (which may include forms from ANSI/ASHRAE Standard 105-2014).	**XXX.3.2** Upon the satisfaction of the code official that all other code requirements are met, a certificate of occupancy and a post occupancy verification permit is issued. **XXX.3.3** Where the code official chooses to issue a post occupancy verification permit, the building owner must provide the code official with sufficient documentation that they have achieved the EUI_t within a 12-month period during the first 24 months of occupancy. The documentation will be certified by a registered design professional and reported to the code official in an acceptable format (which may include forms from ANSI/ASHRAE Standard 105-2014).

XXX.3.4 Allows jurisdictions to establish a mechanism recognizing that weather or other conditions may impact the building's ability to meet the target while still meeting the intent of the code to demonstrate efficient design, construction, and operations.

Appendix A: Setting Targets for Your Jurisdiction

Effective implementation of an outcome-based approach depends on the establishment of targets that reflect the goals of the jurisdiction, the capacity of the local building community to meet the targets, and the relationship to current code pathways. A jurisdiction has several options for calculating the targets, dependent on their technical capacity and the availability of local or regional building performance data. In addition to or in lieu of energy-based targets, a jurisdiction could set greenhouse gas emissions targets through minor modifications to the code language provided.

With goals and a system of measuring results in place, jurisdictions should select realistic performance targets to aid in the realization of the jurisdiction's energy performance (or greenhouse gas emissions) goals. The level of stringency, in terms of how the target relates to anticipated prescriptive and performance code outcomes and to the existing building stock, would also be a necessary consideration. Targets should be able to support evaluation in order for necessary adjustments to be made, yet they should be broad enough to avoid industry or agency frustration.[11] When possible, targets should be set for each building type and climate zone under the purview of the jurisdiction.[12]

This Appendix outlines various strategies for identifying realistic targets and key decisions that will need to be made during the development process. Table XXX below provides an example set of targets that was derived using these strategies. These values could be the basis for local targets. The values in this table were proposed to the ICC for use in the 2018 IECC.

How to Apply National-Level Targets

Jurisdictions that may not have building performance data for the local building stock or access to technical expertise to calculate targets from local performance data may elect to use targets derived from national level data sets. One potential set of targets based on national data is provided in Table XXX. When adopted within a jurisdiction, the actual table contained in the code may be limited to those climate zones occurring within the jurisdiction.

The targets in Table XXX are derived from data on the U.S. building stock within each climate zone. Given this national scope and climate zone-wide treatment, the selected targets may not accurately represent local conditions. The values in Table XXX were calculated based on ANSI/ASHRAE Standard 105-2014 national conversion factors (Table J2-A) and ANSI/ASHRAE/IES Standard 100-2015 Appendix J supplemented by tables for the EUIs of the 25th percentile of the building stock based on the Energy Information Administration (EIA) 2003 Commercial Buildings Energy Consumption Survey (CBECS) provided by DOE's Oak Ridge National Laboratory in December 2015.[13] The Table XXX targets were derived from the 25th Percentile numbers with a targeted

[11] https://energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions may be a helpful reference for code officials in identifying qualified modeling software.
[12] Meres, Ryan and Jayson Antonoff. "Linking Building Energy Codes with Benchmarking and Disclosure Policies." *Institute for Market Transformation.* March 2014. Web. June 2017.
[13] The target values provided in Table XXX are derived from 2003 CBECS data and national conversion factors based on eGrid 2013. CBECS 2012 and eGrid 2014 are currently available, but the necessary analysis to derive similar values has yet to be conducted. As work in this area continues, updated target values will become available.

reduction factor of 72.8%. These EUI_t values are a 5.5% improvement from ANSI/ASHRAE/IES Standard 90.1-2013. If a jurisdiction wishes to calculate alternative targets, a mechanism for doing so is provided in ANSI/ASHRAE/IES Standard 100, Appendix J.

An option to adjust the target based on heating degree day (HDD_{65}) variations from the reference city in each climate zone is provided to allow greater consideration of local conditions. Variations in cooling degree days have been determined to have little impact on target values across climate zones, so a parallel adjustment mechanism is not provided here.

For the targets provided in Table XXX, a source energy basis is utilized to assure that all energy use related impacts are identified and addressed by this policy. A jurisdiction may elect to utilize another basis for target setting, including greenhouse gas emissions or site energy. If the jurisdiction already made such a decision in other buildings-related policies, consistency may be desired. If a jurisdiction chooses to use greenhouse gas emissions (as an alternative to energy performance) as a basis for setting targets, a similar approach to the one described in this document should be used. In this case, code officials should consult ANSI/ASHRAE Standard 105-2014.

While used as a metric in other energy code provisions, energy cost is not recommended as the basis for an outcome-based approach. While energy cost may be useful for evaluating compliance or making design decisions at a single point in time, costs can be highly variable across the compliance period. Additionally, costs based on utility bills may result from a variety of rate structures and fees not strictly tied to the amount of energy consumed. Complex calculations may be required to allow comparison of utility bill-based costs and cost-based targets.

TABLE XXX

SOURCE EUI TARGETS BY CLIMATE ZONE AND BUILDING TYPE (EUI_t)

CLIMATE ZONE[A]	1A	2A	2B	3A	3B-C	3B-O	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
REFERENCE HDD_{65} (HDD_r)	200	1509	1350	3082	1458	2708	3016	4707	4425	4927	6536	5861	5267	7771	8031	9818	13940
USE AND OCCUPANCY[b]	EUI_t kBtu/sf/yr																
Administrative/professional office	89	92	83	95	69	82	68	79	66	86	66	66	66	73	69	79	111
Bank/other financial	127	131	117	134	98	116	97	113	94	122	94	93	95	104	97	112	157
Government office	112	115	103	118	86	102	85	99	82	107	83	82	84	91	86	99	138
Medical office (non-diagnostic)	76	78	70	81	59	69	58	68	56	73	56	56	56	62	58	67	94
Mixed-use office	103	107	96	110	80	94	79	92	76	99	77	76	77	85	79	92	128
Other office	86	89	80	92	67	79	66	77	64	83	64	63	65	71	66	76	107
Laboratory	409	404	359	399	309	347	324	337	289	380	287	294	309	317	306	341	453
Distribution/shipping center	28	36	35	45	22	37	29	47	38	46	49	47	41	67	58	82	154
Nonrefrigerated warehouse	14	17	17	22	11	18	14	23	18	22	24	23	20	33	28	40	75
Convenience store	309	335	285	347	267	292	289	288	250	334	245	254	285	265	260	285	360
Convenience store with gas	249	270	230	279	215	235	232	232	201	269	197	205	230	213	209	230	290
Grocery store/food market	257	279	237	289	223	243	240	240	208	278	204	212	237	221	216	238	300
Other food sales	78	84	72	87	67	74	73	73	63	84	62	64	72	67	65	72	91
Fire station/police station	151	149	132	147	114	128	119	124	106	140	106	108	114	117	113	126	167
Other public order and safety	137	136	121	134	104	116	109	113	97	127	96	99	104	106	103	114	152
Medical office (diagnostic)	77	74	68	73	63	68	55	55	51	60	42	47	48	43	44	42	48
Clinic/other outpatient health	115	111	103	110	95	102	82	83	76	90	63	70	72	64	66	63	72
Refrigerated warehouse	158	156	139	155	120	134	126	131	112	147	111	114	119	123	119	132	175
Religious worship	54	53	47	52	41	46	43	44	38	50	38	39	41	42	40	45	59
Entertainment/culture	53	53	47	52	40	45	42	44	38	49	37	38	41	41	40	44	59
Library	141	139	123	137	106	119	112	116	99	131	99	101	106	109	105	117	156
Recreation	61	60	53	59	46	51	48	50	43	56	43	44	46	47	45	51	67
Social/meeting	63	62	56	62	48	54	50	52	45	59	44	45	48	49	47	53	70
Other public assembly	65	64	57	63	49	55	51	53	46	60	45	47	49	50	49	54	72
College/university	141	141	127	142	94	122	103	125	100	137	107	102	111	124	113	136	201
Elementary/middle school	87	85	76	85	64	73	65	71	60	77	58	58	60	63	59	67	99
High school	103	103	92	104	69	89	75	91	73	100	78	75	80	90	82	99	147
Preschool/daycare	112	110	97	110	82	94	84	91	77	99	75	75	78	82	77	86	127
Other classroom education	58	57	52	58	38	50	42	51	41	56	44	42	46	51	46	55	82
Fast food	600	615	553	632	499	559	515	532	467	603	455	473	503	497	484	538	680
Restaurant/cafeteria	324	333	296	343	265	300	280	288	253	331	246	256	283	267	262	291	367
Other food service	177	182	162	187	145	164	153	158	138	181	135	140	155	146	143	159	200
Hospital/inpatient health	325	328	295	322	281	291	266	249	215	287	191	199	230	195	189	196	227
Nursing home/assisted living	193	191	169	188	146	164	153	159	136	179	135	139	145	150	145	161	214
Dormitory/fraternity/sorority	92	98	89	108	66	91	82	101	81	115	90	87	89	103	96	117	163
Hotel	114	116	102	117	98	102	98	95	87	111	79	86	90	84	85	89	103
Motel or inn	127	121	110	116	100	106	95	90	83	102	73	79	84	76	76	78	94

Other lodging	121	115	105	111	96	101	91	86	79	97	69	76	80	73	73	75	90
Vehicle dealership/showroom	112	115	103	120	79	100	86	104	86	110	93	92	99	107	100	119	170
Retail store	64	66	59	69	45	57	49	59	49	63	53	53	56	61	57	68	97
Other retail	112	115	102	119	79	100	86	103	86	110	93	91	97	106	100	118	170
Post office/postal center	98	97	86	96	74	83	78	81	69	91	69	70	73	76	73	82	108
Repair shop	65	64	57	64	49	55	52	54	46	61	46	47	49	51	49	54	72
Vehicle service/repair shop	76	75	66	74	57	64	60	62	54	70	53	54	56	59	57	63	84
Vehicle storage/maintenance	33	32	29	32	25	28	26	27	23	30	23	24	26	25	25	27	36
Other service	138	137	121	135	105	117	110	114	98	128	97	99	104	107	104	115	153
Strip shopping mall	135	135	121	142	96	120	104	124	103	135	112	110	121	129	122	145	207
Enclosed mall	129	128	115	135	92	114	99	118	98	128	107	105	116	123	116	138	197

a. Climate zones as determined in accordance with Section XXX.
b. Use and occupancy as determined by Chapter 3 of the *International Building Code.*

Adjustments for Heating Degree Days

If a jurisdiction elects to use national data as the basis for its targets but its HDD_{65} is significantly different than that of the reference city for a climate zone (as identified in ANSI/ASHRAE/IES Standard 90.1-2013, Appendix D), a more in-depth methodology is provided to support fairness and accuracy in application of the EUI_t. The values to be applied in Equation XX-2 are provided in Table XXX.2. The Table values are a derivative (base and slope) of quadratic regression curve fit of EUI_t across climate zones based on ASHRAE Standard 100 Appendix J reference city HDD_{65} for each climate zone. ASHRAE's Building Energy Quotient (bEQ) Labeling Program uses the same methodology for its HDD adjustment factors.

If the jurisdiction elects to make the HDD_{65} adjustment, it may wish to do so as it develops the target values rather than as a separate calculation for the design team. Such an approach will provide consistency and relieve the code official of verifying the calculation for each project. The following language could be included following XXX.2.1 or used as the basis to adjust the targets provided in the code:

> Where the *code official* requires an adjustment of EUI_t due to a variation in the building location's heating degree days base 65 (HDD_{65}) from the reference HDD_{65} in Table XXX for the climate zone in which the building is located, an adjusted energy target (EUI_{tadj}) shall be determined in accordance with Equation XX-2.
>
> $$EUI_{tadj} = EUI_t + EUI_{adj} \qquad \text{(Equation XX-2)}$$
>
> Where:
>
> EUI_t = the Target Annual Source Energy Use Index in Table XXX for the building use and occupancy and for the *climate zone* in which the building is located.
>
> EUI_{adj} = HDD_{65} adjustment factor as determined by Equation XX-3.
>
> $$EUI_{adj} = (HDD_a - HDD_r) * ((HDD_r * EUI_{slope}) + EUI_{base}) \qquad \text{(Equation XX-3)}$$
>
> Where:
>
> HDD_a = the annual HDD_{65} at the building location as listed in ANSI/ASHRAE Standard 90.1, 2013, Appendix D.
>
> HDD_r = reference HDD_{65} in Table XXX for *climate zone* in which the building is located.
>
> EUI_{slope} = the change in EUI per HDD_{65} in Table XXX.2 for the building use and occupancy.
>
> EUI_{base} = a constant value for EUI in XXX.2 for the building use and occupancy.

TABLE XXX.2
CHANGE IN EUI_t PER HDD_{65}

USE AND OCCUPANCY[a]	EUI_{slope}	EUI_{base}
Administrative/professional office	1.21E-06	-0.00727
Bank/other financial	1.70E-06	-0.01027
Government office	1.50E-06	-0.00905
Medical office (non-diagnostic)	1.03E-06	-0.00621
Mixed-use office	1.40E-06	-0.00842
Other office	1.16E-06	-0.00700
Laboratory	4.75E-06	-0.03038
Distribution/shipping center	1.49E-06	-0.00190
Nonrefrigerated warehouse	7.15E-07	-0.00089
Convenience store	2.60E-06	-0.01653
Convenience store with gas	2.09E-06	-0.01328
Grocery store/food market	2.17E-06	-0.01378
Other food sales	6.58E-07	-0.00418
Fire station/police station	1.74E-06	-0.01116
Other public order and safety	1.59E-06	-0.01018
Medical office (diagnostic)	7.25E-07	-0.00745
Clinic/other outpatient health	1.09E-06	-0.01117
Refrigerated warehouse	1.84E-06	-0.01178
Religious worship	6.21E-07	-0.00398
Entertainment/culture	6.14E-07	-0.00393
Library	1.63E-06	-0.01046
Recreation	7.02E-07	-0.00449
Social/meeting	7.34E-07	-0.00470
Other public assembly	7.48E-07	-0.00479
College/university	2.17E-06	-0.01097
Elementary/middle school	1.23E-06	-0.00804
High school	1.59E-06	-0.00804
Preschool/daycare	1.58E-06	-0.01030
Other classroom education	8.81E-07	-0.00445
Fast food	5.79E-06	-0.03700
Restaurant/cafeteria	2.97E-06	-0.01884
Other food service	1.62E-06	-0.01028
Hospital/inpatient health	3.03E-06	-0.03040
Nursing home/assisted living	2.24E-06	-0.01437
Dormitory/fraternity/sorority	1.12E-06	-0.00297
Hotel	8.55E-07	-0.00721
Motel or inn	1.31E-06	-0.01175
Other lodging	1.25E-06	-0.01121
Vehicle dealership/showroom	1.60E-06	-0.00708
Retail store	9.16E-07	-0.00407
Other retail	1.60E-06	-0.00711
Post office/postal center	1.14E-06	-0.00730
Repair shop	7.56E-07	-0.00484
Vehicle service/repair shop	8.84E-07	-0.00566
Vehicle storage/maintenance	3.76E-07	-0.00241
Other service	1.61E-06	-0.01029
Strip shopping mall	1.90E-06	-0.00805
Enclosed mall	1.80E-06	-0.00764

a. Use and occupancy as determined by Chapter ____ of the _____ *Building Code.*

How to Establish Local-Based Targets

While national level data is useful in understanding the energy performance of the U.S. building stock as a whole, conditions at the state or local level may vary widely from this national picture. Some jurisdictions are beginning to collect data and conduct analysis to better understand their building stock. Benchmarking and transparency policies provide a valuable tool for jurisdictions. At the local scale, one could use benchmarking data or a state or local-level building stock survey, such as the California Commercial End-Use Survey (CEUS)[14], as the underlying data for target setting.

Benchmarking is the process of assessing a building's energy performance and, based on that assessment, establishing a baseline from which future efficiency improvements can be implemented. Energy performance data can be gathered from utility bills or meters. Benchmarking and transparency policies can be used to encourage energy code compliance, since they serve to enable the market to value energy consumption.[15]

Additionally, the community must make the decision as to whether the target will be set based on a site or source basis.

National or Local Source Energy Multipliers

In many cases, buildings rely on multiple energy sources. Effective energy policy must account for all such sources. This proposed methodology uses an EUI in the form of kBtu/sq.ft./yr. Therefore, all energy use must be converted into a common metric (kBtu).

While the energy contained in most energy sources used on site (natural gas, fuel oil, etc.) are fairly consistent irrespective of where they are used, the fuel mix used to generate electricity that enters a building can vary significantly depending on the region.

Section XXX.2.2 provides jurisdictions with an opportunity to use national-level fuel conversion factors or local-level conversion factors based on the fuel mix within their electrical grid region. If jurisdictions wish to be even more granular, they may provide specific conversion factors for non-electric fuels rather than an aggregate number. ANSI/ASHRAE Standard 105-2014, Appendix J provides the methodology and sources for setting such local-level or individual fuel conversion factors.

Once values are selected, the jurisdiction should incorporate them into Section XXX.2.2 and in Form XXX.3.

ANSI/ASHRAE Standard 105-2014, Table J2-C provides source energy multipliers by eGrid region.[16] A jurisdiction can determine its eGrid region by consulting Figure 4 or referring to the U.S.

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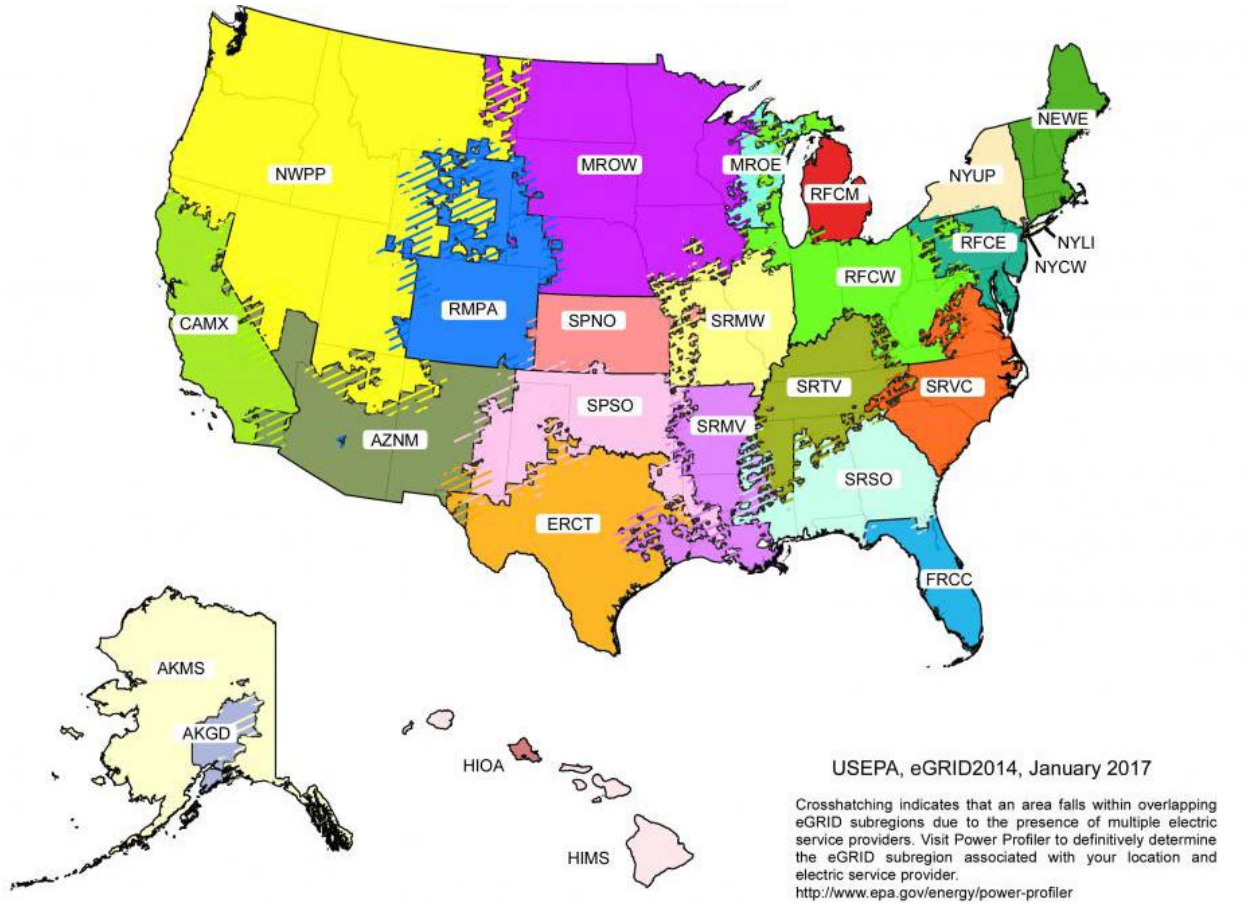
[14] http://energy.ca.gov/ceus/

[15] Meres, Ryan and Jayson Antonoff. "Linking Building Energy Codes with Benchmarking and Disclosure Policies." Institute for Market Transformation, March 2014.

[16] The target values provided in Table XXX are derived from 2003 CBECS data and national conversion factors based on eGrid 2013. CBECS 2012 and eGrid 2014 are currently available, but the necessary analysis to derive similar values has yet to be conducted. As work in this area continues, updated target values will become available.

Environmental Protection Agency (EPA) Emissions & Generation Resource Integrated Database (eGrid)'s website.[17]

Figure 4: Map of eGRID Subregions[18]



[17] https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

[18] "Emissions & Generation Resource Integrated Database (eGRID)." *EPA*. Environmental Protection Agency, 01 June 2017. Web. 03 July 2017.

Appendix B: Methods of Determining Compliance and Strategies for Enforcement

Most jurisdictions have well-established mechanisms for addressing code violations, ranging from issuance of a citation requiring remedy of the non-compliance to a stop work order and/or fine. However, unlike other code provisions, compliance with an outcome-based requirement is not limited to actions undertaken in design and construction. Compliance is determined within a limited time post-occupancy. Therefore, enforcement strategies must be designed to address this reality. The jurisdiction will need to consider approaches to remedy non-compliance that occurs post-occupancy.

In the early stages of implementing an outcome-based code, a city may wish to implement incentives to drive participation in what could initially be a pilot program. Such incentives could vary from public recognition to city-wide competition for rebates. Benefits that accrue and are not easily revoked if targets are not achieved (density bonuses, expedited permitting, etc.) may not be appropriate during the incentives stage. In establishing compliance, a city must clearly define who bears the obligation to demonstrate compliance and who would be subject to consequences. In most cases, this would be the building owner.

Design and Construction Phase

Checkpoints do exist within the proposed code language to assure that the design and construction process are on track to meet the designated targets. Under the proposed process, plan review would be conducted much like it is done today under projects utilizing a performance-based compliance path. Plan reviewers would evaluate the outputs of an energy model to determine if they meet the code requirements. However, in the outcome-based case, comparison would be to the specified EUI target rather than a minimally compliant clone of the project. This should provide plan reviewers with a less complex evaluation process. The jurisdiction will need to clearly define acceptable modeling programs and parameters to assure that results provided in this stage are defensible and actually do provide a level of assurance on the capability to meet the targets. DOE and COMNET have been working on providing this type of information.[19]

In lieu of an energy model developed specifically for the project, the proposed code provision establishes a means by which small or replicable buildings may demonstrate their capacity to meet the established energy target.[20] In this case, the building characteristics will be developed by the design team or others and then verified and certified by a third party acceptable to the code official. The prescriptive requirements identified in the pre-approved pathway would then become the basis for inspection. If desired by the code department, all models submitted under this pathway could be required to go through the third-party verification and certification process.

[19] https://energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions may be a helpful reference for code officials in identifying qualified modeling software. See http://www.comnet.org/ for modeling guidelines and standards.

[20] See Colker, R.M., "Advancing Achievement of Outcomes through Certified Prescriptive Packages," Proceedings of the 2016 ACEEE Summer Study in Energy Efficiency in Buildings, August 2016.

Once plan review is complete, the building characteristics as defined by the acceptable energy model or pre-approved prescriptive requirements and any mandatory requirements identified in Section XXX.2 will become the basis for any level of inspection done by the jurisdiction. Any deviation from the modeled characteristics could influence the ability of the building to meet the assigned target. Therefore, the code official may request that the non-compliant attribute be remedied or request an updated energy model showing that the ability to reach the target is unaffected.

Once the code official is satisfied that the building as designed and constructed meets the provisions of the code applicable to date, they would issue a Temporary Certificate of Occupancy (TCO) or a Certificate of Occupancy and a Post Occupancy Verification Permit (POVP).[21] The post-occupancy requirements are then triggered.

Post-Occupancy

Once the building is occupied, the owner has 24 months to present the code official with utility bills for a 12-month period where total energy use falls below the EUI target. Sample forms are provided at the end of this appendix to help facilitate the collection and reporting of data and any calculations necessary to demonstrate compliance.

The burden remains on the building owner to provide the necessary documentation, and until this data is provided, the TCO or POVP will remain open. Because the existence of the TCO or POVP would be known by financiers, potential buyers, and insurance providers, in addition to the owner, there is an incentive to provide the necessary documentation to close the TCO or POVP.

If the owner is unable to comply within the designated period, the code official may issue a violation and require remedial action. The extent of the remedial action may vary. Depending on the deviation from the target and the type of remedial action required, the code official may "reset" the compliance period requiring the submission of energy use data for a future 12-month period. Once the remedial action is conducted, the code official would close the TCO or POVP.

Jurisdictions may employ a variety of strategies to assure that the intent of the code is achieved with minimal impact on the ability of the owner to continue to utilize the building. Revocation of the TCO or CO is not a reasonable enforcement strategy. The viability of a specific enforcement strategy will vary from jurisdiction to jurisdiction based on existing policies and practices. Several potential strategies are outlined below. A combination of strategies may be required, depending on the project's level of deviation from the target.

Audit, Retrofit and Retro-Commissioning or Recommissioning

If a project is unable to meet the target within the compliance period, the jurisdiction may require the conduct of an energy audit and the implementation of all energy conservation measures (ECMs) that would result in compliance. If the required ECMs are expensive or highly invasive, the jurisdiction may set a maximum cost coupled with additional penalties. ASHRAE has defined

[21] See Section XXX.3.2 in Chapters II and III of this document for an explanation of these options.

procedures for energy audits in its guide, *Procedures for Commercial Building Energy Audits,* and in *Standard 211-Standard for Commercial Building Energy Audits*, which is currently in development.[22] The jurisdiction may require such an audit to be conducted by an energy auditor certified to a credential recognized under the DOE Better Buildings Workforce Guidelines.[23]

The jurisdiction may also require the building to undergo retro-commissioning or recommissioning to identify deviations from the original design intent and bring systems and practices back into alignment. Details on the commissioning process are available from the WBDG Whole Building Design Guide®.[24] Commissioning providers also can be specified using the DOE Better Buildings Workforce Guidelines.

Offsetting Noncompliance

In lieu of requiring a building owner to remedy his/her own building to meet the target levels and potentially prolonging code department engagement, the jurisdiction may elect to provide an alternative means to achieve the intended result. This offset requirement could take several forms, but should be in direct proportion to the funding necessary to offset the difference between the target and the actual performance (e.g., $(EUI_a - EUI_t) \times TCFA$). The jurisdiction may wish to identify a pre-approved mechanism for securing such offsets to limit necessary oversight and assure intended offset amounts are actually achieved. Such mechanisms may include installation of community solar resources, capital for a revolving loan fund for energy efficiency programs, funds for a utility or government energy efficiency program, or a retrofit fund for improvements in affordable housing.

Fee-bates

Fee-bates (fines and rebates) serve as an alternative to applying penalties to buildings that fail to meet target levels. This would be a mechanism through which poorly performing buildings are fined based on how much they deviate from the set targets, whereas well-performing buildings are allocated rebates proportionate to how far below a set target they are. Fee-bates would involve data analysis and program modeling in the process of fee and rebate level setting.

Performance Bonds

Performance bonds, or bonds surrendered if requirements are not met, could be required when a building owner and design team elect to utilize the outcome-based compliance path. The bond provides a jurisdiction with a level of assurance that performance targets are being met. If the project does not meet the required targets, a proportion of bond funds could be utilized for building upgrades to help meet the targets. If the project meets the targets, the bond funds are returned to the building owner. The city of Seattle has used this type of program as a component of its target-based energy code provisions.

[22] https://www.ashrae.org/resources--publications/bookstore/procedures-for-commercial-building-energy-audits
[23] https://betterbuildingssolutioncenter.energy.gov/workforce/better-buildings-workforce-guidelines
[24] http://wbdg.org/building-commissioning

Utility Rates

A variable utility rate structure in which funds collected above the baseline rate could be funneled into energy efficiency programs is an additional enforcement option, especially for jurisdictions with municipal utilities or a strong public utility commission. The implementation of this mechanism would include the application of a rate (or fee) by the utility. The basis for this rate would be the annual consumption relative to the target use. Any funds above the baseline rate would be available to redirect energy efficiency initiatives and programs to improve the efficiency of non-compliant buildings. Since, at this time, the remedy is intended to address a one-time violation, the elevated rate should be for a duration sufficient to recover the lost opportunity. If the jurisdiction elects to pursue a life-cycle approach for addressing energy use in buildings, this mechanism can be transitioned into an ongoing enforcement mechanism.

Tax Structures

A jurisdiction's taxation authority could be utilized in the enforcement process. This approach could include a fee-bate system (in which a credit or deduction is allocated to buildings that meet targets, whereas a fee or additional assessment would be allocated to those that do not meet or those that are non-compliant with the code). To promote use of the outcome-based compliance path, a jurisdiction could elect to apply a fee to all buildings while providing a waiver to those which demonstrate compliance or that they meet a program's target. The state of Oregon has implemented this type of tax credit program.

In order for any energy performance program to succeed, robust enforcement mechanisms must be available, meaning that jurisdictions must have coordination across departments, including those responsible for setting targets, tracking performance, administering design and construction codes and implementing the enforcement strategies outlined above.

FORM XXX.1—SUBMISSION DEMONSTRATING COMPLIANCE UNDER CHAPTER PART XXX

Name of Building _____

Street Address _____

City _____ State _____ Zip Code _____

Building Owner _____

Building Owner's Representative _____

Street Address _____

City _____ State _____ Zip Code _____

Telephone Number _____ E-Mail _____

Certifying Registered Design Professional _____

Street Address _____

City _____ State _____ Zip Code _____

Telephone Number _____ Registration #_____

Registering Authority _____

Use Form XXX.2 to identify building type(s) and percentage of total conditioned floor area as defined in Table XXX of Chapter Part XXX. Attach Form XXX.2 to this form.

List the energy target for this building (as calculated on Form XXX.2 and under Section XXX.2.2).
_____ kBtu/ft2yr

List the Actual measured EUI for this building (as calculated on Form XXX.3 and under Section XXX.2.2).
_____ kBtu/ft^{2}yr

List the months/year of period for which compliance data is submitted (mm/yyyy-mm/yyyy).
_____ to _____

We state that this building complies with Chapter Part XXX of the _____ Energy Code:

Signature of certifying registered design professional: _____ Date: _____

FORM XXX.2—IDENTIFICATION OF BUILDING TYPES AND ENERGY TARGETS (EUI_t)

Building Identifier: _____

Address: _____

City _____ State _____ Zip Code _____ Building climate zone _____

BUILDING TYPE[a]	CONDITIONED FLOOR AREA (ft^2)	ENERGY TARGET (EUI_t)	TOTAL (ft^2 x EUI_t)
Administrative/professional office			
Bank/other financial			
Government office			
Medical office (non-diagnostic)			
Mixed-use office			
Other office			
Laboratory			
Distribution/shipping center			
Nonrefrigerated warehouse			
Convenience store			
Convenience store with gas			
Grocery store/food market			
Other food sales			
Fire station/police station			
Other public order and safety			
Medical office (diagnostic)			
Clinic/other outpatient health			
Refrigerated warehouse			
Religious worship			
Entertainment/culture			
Library			
Recreation			
Social/Meeting			
Other public assembly			
College/university			
Elementary/middle school			
High school			
Preschool/daycare			
Other classroom education			
Fast food			
Restaurant/cafeteria			
Other food service			
Hospital/inpatient health			
Nursing home/assisted living			
Dormitory/fraternity/sorority			
Hotel			
Motel or inn			
Other lodging			
Vehicle dealership/showroom			
Retail store			
Other retail			
Post office/postal center			
Repair shop			
Vehicle service/repair shop			
Vehicle storage/maintenance			
Other service			
Strip shopping mall			
Enclosed mall			
Total conditioned floor area		**Total Building EUI_t**	

a. Use and occupancy (building type) as determined by Chapter __ of the _____ Building Code.

FORM XXX.3—ENERGY-USE INTENSITY CALCULATIONS

	FUEL TYPE	ENERGY USE FOR 12-MONTH COMPLIANCE PERIOD	NATIVE ENERGY UNITS	CONVERSION MULTIPLIER TO kBtu	ENERGY (kBtu)
Energy Delivered to Site					
AEU_{bldg}	**Electricity**				
	Gas				
	Natural Gas				
	Other (explain)				
	Fuel Oils				
	#1				
	#2				
	#4				
	#5L				
	#5H				
	#6				
	District Energy				
	Steam				
	Hot Water				
	Chilled Water				
	Bulk Fuel				
	Coals				
	Anthracite				
	Semianthracite				
	Low-volatile bituminous				
	Medium-volatile bituminous				
	High-volatile bituminous A				
	High-volatile bituminous B				
	High-volatile bituminous C				
	Sub-bituminous B				
	Sub-bituminous C				
	Propane				
	Biomass				
	Hardwood				
	Softwood				
	Other (explain)				
	Waste streams				
	Hot water				
	Cold water				
AEU_{bldg} Total					
Energy Exported from Site					
$AEXP_{ren}$	**Hot Water from fossil fuels**				
	Electricity from solar/wind				
	Waste steam				
	Hot water				
	Cold water				
	Electricity from cogeneration				
	Hot water from cogeneration				
	Steam from fossil fuels				
$AEXP_{ren}$ Total					
Total net energy: AEU_{bldg}-$AEXP_{ren}$; (kBtu)					
Actual Energy Use Intensity: $EUI_a = (AEU_{bldg} - AEXP_{ren})/TCFA$ (per Section XXX.2.2) (kBtu/ft^2/yr)					
Building energy target (EUI_t) (per Section XXX.2.1) (kBtu/ft^2/yr)					

Appendix C: Considerations of Mandatory Provisions

While an outcome-based compliance path is intended to provide maximum flexibility for the design team, the jurisdiction may wish to establish a small set of mandatory requirements just as is done for the modeling compliance path. A discussion of potential requirements is included below; however, jurisdictions should exercise caution in order to balance the desire for mandatory requirements with the flexibility that makes following an outcome-based path desirable.

Mandatory requirements may be desired to assure energy-saving strategies with long life spans are favored over less-permanent features that may degrade over the life of the building (particularly after the compliance period). Such long-term strategies include building enclosure requirements, such as acceptable air leakage rates.

Additionally, code requirements that may not directly impact energy use over the compliance period but influence the effective management of energy use over the building's life cycle should be considered as mandatory. These elements are necessary for an outcome-based path to succeed in enabling a high degree of efficiency, yet they do not directly impact energy efficiency on their own as individual components. As a result, designers may not include them unless required to do so in the code provision.

Metering and sub-metering requirements facilitate awareness of building energy use and the ability to respond to unexpected variances.

Commissioning is a valuable tool, both for building owners and the jurisdiction. It serves to assure that the owner's performance requirements and the design intent are consistently applied and verified throughout design and construction and into operations. It also provides operations personnel with the information and training necessary to effectively operate the building.

It is recommended that jurisdictions select mandatory provisions based on their facilitation of target achievement, support of long-term operations, or their status as long-term components that are likely to influence energy use for the life of the structure.

Additional Resources

ANSI/ASHRAE/IES Standard 100-2015, Energy Conservation in Existing Buildings

ANSI/ASHRAE Standard 105-2014, Standard Methods of Measuring, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions

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This document was assembled and edited by Mary-Michael Robertson, NIBS Policy Intern and Civil and Environmental Engineering student at the University of Virginia, under the supervision of Ryan Colker.

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National Institute of Building Sciences
1090 Vermont Avenue, NW Suite 700
Washington, DC 20005-4950
Phone: (202) 289-7800
Fax: (202) 289-1092
www.nibs.org

New Buildings Institute
623 SW Oak St.
Portland, OR 97205
Phone: (503) 761-7339
Fax: (503) 968-6160
www.newbuildings.org