FINAL REPORT

Attributing Building Energy Code Savings to Energy Efficiency Programs

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Northeast Energy Efficiency Partnerships

IEE INNOVATION ELECTRICITY EFFICIENCY
An Institute of The Edison Foundation

IMT Institute for Market Transformation

Prepared by:
The Cadmus Group, Inc.
Energy Services Division
720 SW Washington Street, Suite 400
Portland, OR 97205
503.467.7100

With:
Energy Futures Group
NMR Group, Inc.
Optimal Energy

Authors:
Allen Lee
Dan Groshans
Peter Schaffer
Alexandra Rekkas
The Cadmus Group, Inc.

With:
Richard Faesy, Energy Futures Group
Lynn Hoefgen, NMR
Phil Mosenthal, Optimal Energy

IEE

IEE is an Institute of the Edison Foundation focused on advancing the adoption of innovative and efficient technologies among electric utilities and their technology partners that will transform the power grid. IEE promotes the sharing of information, ideas, and experiences among regulators, policymakers, technology companies, thought leaders, and the electric power industry. IEE also identifies policies that support the business case for adoption of cost-effective technologies. IEE's members are committed to an affordable, reliable, secure, and clean energy future.

IEE is governed by a Management Committee of 23 electric industry Chief Executive Officers. IEE members are the investor-owned utilities who represent about 70% of the U.S. electric power industry. IEE has a permanent Advisory Committee of leaders from the regulatory community, federal and state government agencies, and other informed stakeholders. IEE has a Strategy Committee of senior electric industry executives and over 30 smart grid technology company partners.

Institute for Market Transformation (IMT)

The Institute for Market Transformation , founded in 1996, is a Washington, DC-based nonprofit organization promoting energy efficiency, green building, and environmental protection in the United States and abroad. The prevailing focus of IMT's work is energy efficiency in buildings. Our activities include technical and market research, policy and program development, and promotion of best practices and knowledge exchange. All our work involves many collaborators and targets a broad range of stakeholders in both the public and private sectors. In particular, IMT aims to strengthen market recognition of the link between buildings' energy efficiency and their financial value. IMT's efforts lead to important new policy outcomes, widespread changes in practice, and ultimately, lasting market shifts toward greater energy efficiency, with substantial benefits for the economy and the environment.

Northeast Energy Efficiency Partnerships (NEEP)

NEEP was founded in 1996 as a 501(c)(3) not-for-profit to serve the Northeast and Mid-Atlantic region to accelerate energy efficiency in the building sector through public policy, program strategies, and education. For 16 years, NEEP has successfully positioned the Northeast as a leader in energy efficiency, heading regional and national efforts to create lasting change in the market for energy efficient products, services, and best practices. NEEP achieves its mission through partnerships with a wide range of stakeholders in the field of energy efficiency. With an annual budget of $6 million, its work is supported by states, utilities, federal agencies, project fees and private foundations.

NEEP's overall goal is to keep the region a national efficiency leader by advancing innovation and best practices, and leading-edge policies, programs and strategies that deepen, broaden and accelerate energy efficiency on a regional-scale. Its vision is that the Northeast will fully embrace energy efficiency as a cornerstone of sustainable energy policy, a vibrant economy, and a healthy environment.

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ACRONYMS AND ABBREVIATIONS

ACC	Arizona Corporation Commission
ACEEE	American Council for an Energy Efficient Economy
ARRA	American Reinvestment and Recovery Act
BBRS	Board of Building Regulations and Standards
BCAP	Building Code Assistance Project
BCB	Building Code Bureau
BCC	Building Codes Commission
BECP	Building Energy Codes Program (United States Department of Energy)
BOP	Builder Option Package
BPS	Building Performance Standard
BSC	Building Standards Commission
C&S	Codes and Standards
CEC	California Energy Commission
CEE	Consortium for Energy Efficiency
CEEF	Connecticut Energy Efficiency Fund
CIP	Conservation Improvement Program
CPUC	California Public Utilities Commission
DCA	Department of Community Affairs
DCEO	Department of Commerce and Economic Opportunity
DEEP	Department of Energy and Environmental Protection
DOLA	Department of Local Affairs
DHCD	Department of Housing and Code Development
DPUC	Department of Public Utility Control
EEAC	Energy Efficiency Advisory Council
ECMB	Energy Conservation Management Board
EEB	Energy Efficiency Board
EERS	Energy Efficiency Resource Standard
EEPS	Energy Efficiency Portfolio Standard
EEU	Energy Efficiency Utility
ETO	Energy Trust of Oregon
EM&V	Evaluation, Measurement, and Verification
FCM	Forward Capacity Market
GEFA	Georgia Environmental Finance Authority
GSPC	Georgia Public Service Commission
HERS	Home Energy Rating System
IECC	International Energy Conservation Code

ICC	International Code Council
IRP	Integrated Resource Plan
IUB	Iowa Utilities Board
JCARR	Joint Committee on Agency Rule Review
MEEA	Midwest Energy Efficiency Alliance
MPSC	Maryland Public Service Commission
NEEA	Northwest Energy Efficiency Alliance
NEEC	Northwest Energy Efficiency Council
NOMAD	Naturally Occurring Market Adoption
NYPSC	New York Public Service Commission
NYSERDA	New York State Energy Research and Development Authority
PA	Program Administrator
PCT	Participant Cost Test
PGC	Public Goods Charge
PIP	Program Implementation Plan
PNNL	Pacific Northwest National Laboratory
PSB	Public Service Board
RIM	Ratepayer Impact Measure
SBC	System Benefits Charge
SBCC	State Building Code Council
SCT	Societal Cost Test
SEEA	Southeast Energy Efficiency Alliance
SWEEP	Southwest Energy Efficiency Project
TAG	Technical Advisory Group
TRC	Total Resource Cost
TVA	Tennessee Valley Authority
UCG	Utility Code Group
UCT	Utility Cost Test

DEFINITIONS OF CODE AND ENERGY EFFICIENCY PROGRAM ACTIVITIES

Allocation In cases where multiple program administrators (PAs) support building codes, determination of the share of energy savings that should be credited to a specific PA from the amount attributed to all of the PAs' efforts.

Attribution Determination of the amount of the energy savings that should be credited to PA efforts in the code development, adoption, and compliance processes.

Code Specifically, legal energy-efficiency requirements that apply to the design and construction of buildings, usually for new buildings and for renovations and additions applying to existing buildings.

Code Adoption The process and actions required to formally put a code in place, such as a rulemaking process.

Code Compliance The process of meeting the code requirements and demonstrating that these requirements have been satisfied. Compliance is the responsibility of the builder or contractor.

Code Development The process and activities that lead to establishing the requirements of a new building code.

Code Enforcement The process of verifying that a building meets the code. This process is typically conducted by a building code official.

Cost-Effectiveness A measure of the economic efficiency of an energy-efficiency program usually expressed as the ratio of or difference between the economic benefits and costs of the program.

Evaluation, Measurement, and Verification (EM&V) Analysis of savings from an energy-efficiency program. Evaluations can usually be categorized as process or impact evaluations.

Naturally Occurring Market Adoption (NOMAD) The proportion of savings or application of measures equivalent to the code that would have taken place in the market even if the code had not been adopted.

Potential Study A study that projects the amount of energy savings that can be achieved over time under different assumptions and scenarios.

Program Implementation Plan (PIP) A document that describes the implementation process for an energy-efficiency program.

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Jeff Harris	Alliance to Save Energy
Cindy Jacobs	Connecticut Dept. of Energy and Environmental Protection
Jared Lawrence	Duke Energy
Isaac Elnecave	Midwest Energy Efficiency Alliance
Phyllis Reha	Minnesota PUC
Jessica Burdette	Minnesota State Energy Office
Mary Sue Lobenstein	Minnesota State Energy Office
Diana Lin	National Association of State Energy Offices
Chris Wagner	National Association of State Energy Offices
Bill Blake	National Grid
Puja Vohra	National Grid
David Cohan	Northwest Energy Efficiency Alliance
Mark Frankel	New Buildings Institute
Priscilla Richards	NYSERDA
Cheryl Roberto	Ohio PUC
David Pirtle	PHI / Delmarva / PEPCO
Nathan Morey	Salt River Project
Jim Meyers	Southwest Energy Efficiency Partnership
Kym Carey	US Department of Energy (DOE)
TJ Poor	Vermont Public Service Department
Tami Gunderzik	Xcel Energy

EXECUTIVE SUMMARY

Introduction

Building energy-efficiency codes have received considerable attention lately because of the energy-savings opportunities they present for utilities and other program administrators (PAs). A recent report estimates that upgrades to building energy codes could offset as much as a third of all electricity consumption growth nationally through 2025. PAs are in a strong position to support and influence markets: they typically run programs that operate in the new construction arena and they have knowledgeable staff and resources. If they support energy code efforts, however, PAs' resources are diverted from other energy-efficiency opportunities and the possibility arises that savings from traditional energy-efficiency programs will be reduced as codes increase energy-efficiency baselines. By providing PAs with an incentive to support energy codes, their focus can move away from concerns about savings erosion due to codes increasing baselines and towards a productive engagement with code officials, builders, developers, contractors, architects, and the market. By receiving credit for energy savings, PA efforts become directed towards positively impacting code adoption and maximizing compliance.

There is no single best way to involve PAs in supporting building energy codes: the approach selected is likely to be site-specific depending on state regulatory policies, preferences of regulators and PAs, existing programs, and numerous other factors. Consequently, it is important that the process of involving PAs in code support activities be done in a way that takes into account the full scope of policies and factors that guide PA energy-efficiency activities. Key questions need to be answered such as:

- What energy savings goals do PAs have?
- How are savings goals set?
- How are savings from energy codes tracked and treated in setting and measuring achievement of goals?
- What incentives or other mechanisms are used to encourage PAs to achieve their savings goals? How appropriate are they for application to activities supporting energy codes?

This study focuses on the development of PA code programs that would be recognized like conventional energy-efficiency programs for producing measurable energy savings. Based on the energy savings achieved, the PAs would receive incentives in a way similar to how other resource acquisition programs are rewarded. This study is not intended to imply that PAs should support building energy codes only if their efforts receive the same treatment as standard efficiency programs. In several states, including California[a] and Vermont,[1] PAs have provided substantial support in the form of educational programs for code officials and other stakeholders in the construction industry through programs that were defined to be non-resource acquisition programs. Programs of this type help PAs establish useful relationships with the building market, but they typically do not receive energy savings credits nor do the PAs receive incentives for

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[a] The California utilities' code development and adoption program started as a non-resource program that evolved into a resource program for which they claim savings and receive incentives as their other programs do. Their current education and training efforts are non-resource activities, but the utilities have raised the possibility of claiming savings for them in the future.

implementing them. The purpose of this report is to examine what mechanisms have been and could be used to encourage the development of PA code programs in an environment comparable to the resource acquisition one in which conventional energy-efficiency programs function. This report was prepared for the Northeast Energy Efficiency Partnerships (NEEP) and its funding partners, the Institute for Market Transformation (IMT) and IEE, an Institute of the Edison Foundation. The Cadmus Group, Inc. (Cadmus) and its partners, Energy Futures Group, NMR, and Optimal Energy (the Cadmus team) performed the study and produced this research report. The report is intended to inform and assist PAs and other organizations, such as utility regulators, interested in exploring and pursuing opportunities for supporting building energy codes. It presents information on the following:

- The building code adoption and implementation process
- Characteristics of energy-efficiency policies and programs that are relevant to PA activities to support building codes
- Assessment and selection of activities to support building codes
- Evaluation and attribution of savings from code development and adoption activities
- Evaluation and attribution of savings from code compliance enhancement activities
- Recommended pathways for pursuing PA code programs

Several states have taken the initial steps to develop a program in which PAs support various energy code activities and are credited with the energy savings from the program. California utilities and regulators have been at the forefront of these efforts, but several other states have started down this path. This report presents a high-level look at the situation in 17 states (see ES Table 1) that have started the process or expressed interest in expansion of energy-efficiency programs to capture savings from building codes. The four states where most progress has occurred to date to take steps to facilitate PA support of building energy code programs are shaded in the table.

ES Table 1. States Included in Study

Arizona	Iowa	Ohio
California	Maryland	Oregon
Colorado	Massachusetts	Rhode Island
Connecticut	Minnesota	Vermont
Georgia	New Hampshire	Washington
Illinois	New York	

Building Energy Code Process

It is essential to understand the building energy code process in a state to identify opportunities for PA involvement. ES Figure 1 displays key steps in the process in a decision tree framework. The dark-colored boxes indicate conditions and the light-colored boxes indicate actions that can be pursued. The boxes containing “P” indicate actions to pursue that involve major policy changes.

The first question is whether a state code exists. If it does, then efforts can focus on upgrading the existing, or adopting a new, code. If agencies enforce the code at a state level, then the PA could focus on helping the building industry comply or the state code enforcement entity to improve enforcement. If agencies enforce the code at the local level, which is the most common situation, then the PA could work with the local jurisdiction and building community to enhance compliance and enforcement. This report examines the situation in each of the 17 states.

Specific Code Process Activities

This study identified an array of activities that have been conducted in one or more states by PAs to support building energy codes. In the area of state code development and adoption they include the following:

- Participate in national model code processes
- Interact with building industry on code development
- Provide technical information and assistance to state entities
- Participate in formal state code adoption process

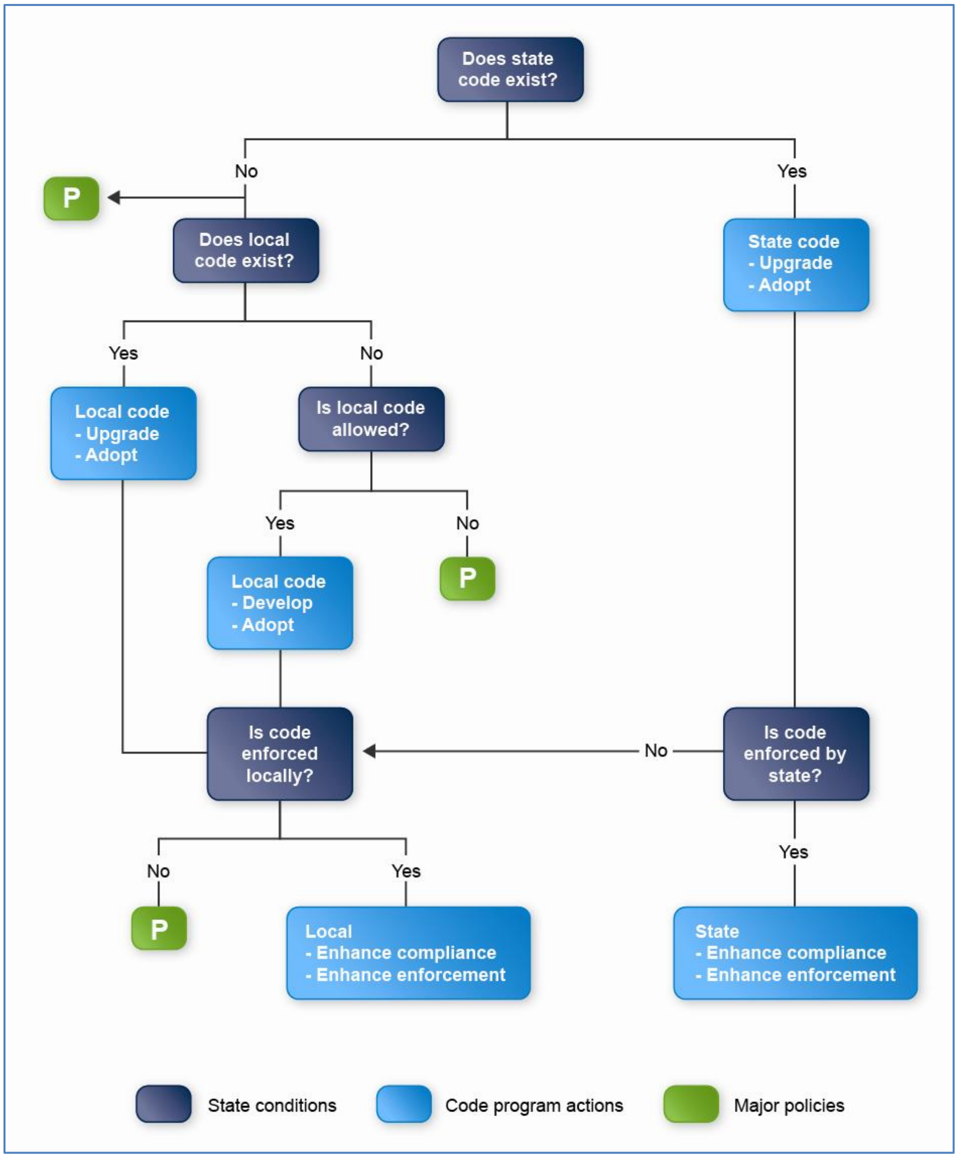
In the area of local code development and adoption, activities include these:

- Assist with local code development
- Advocate for and assist with local adoption

PAs have been involved, to date, mostly in supporting state and local code enforcement and building community compliance. PA activities have included the following:

- Assess compliance with the existing code
- Conduct training of code officials and industry
- Provide technical assistance, materials, and equipment to code officials and industry
- Support third-party enforcement or specialized inspection

ES Figure 1. Energy Code Conditions and Opportunities



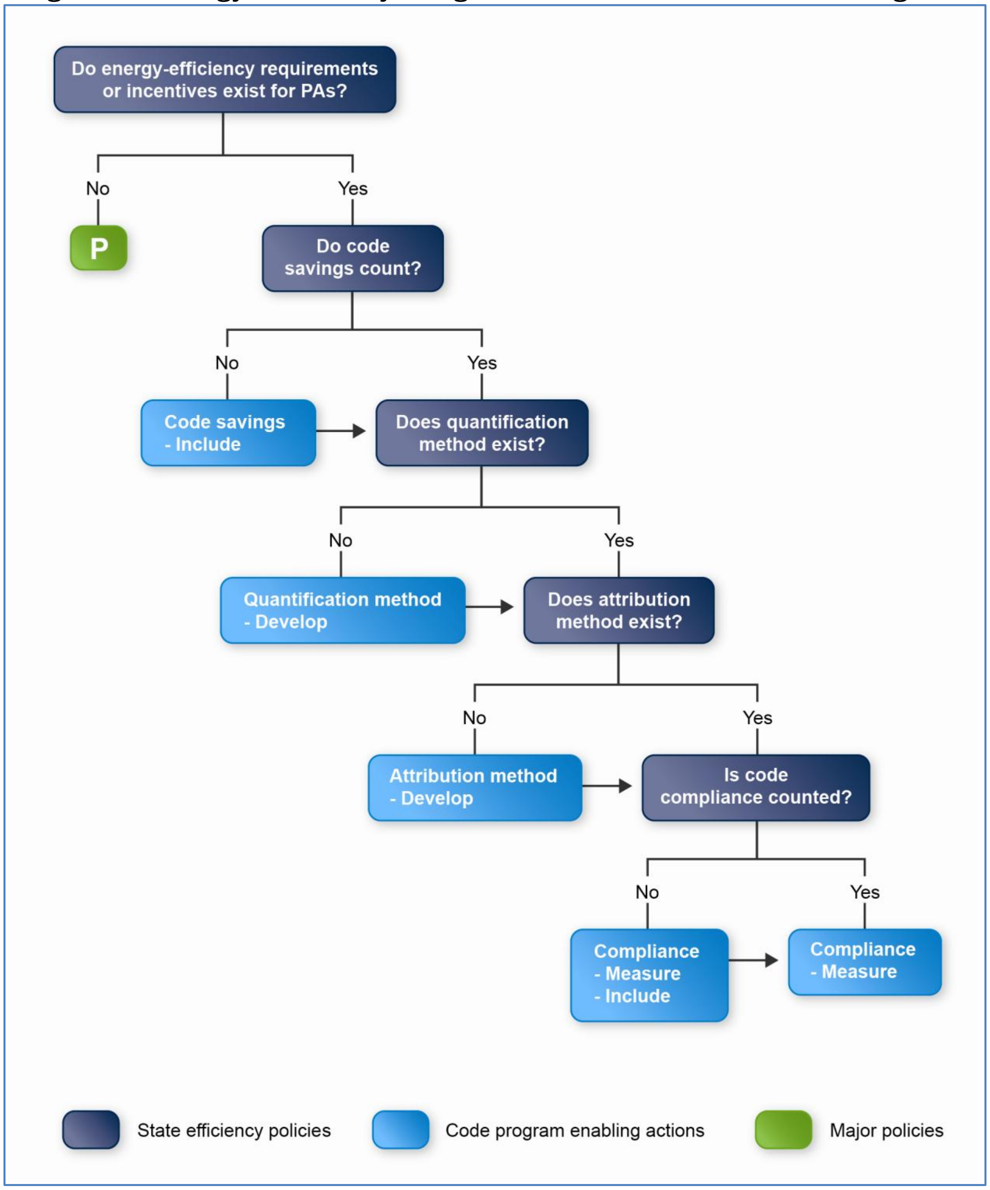
Energy-Efficiency Programs and Policies

ES Figure 2 shows the types of energy-efficiency policies that form the context in which PAs would make choices about what code activities to pursue. Code enabling actions that can lead to a PA getting credit for energy savings from a building energy code program are shown in light-colored boxes.

Most, but not all, states require PAs to meet energy-efficiency savings goals or provide incentives that encourage PAs to pursue energy efficiency. If such policies do not exist, however, the PA could undertake steps to advocate for such policies. This would likely require a significant effort by the PA over an extended period of time.

If such policies or mechanisms exist, the next step is to determine how savings from building energy codes are treated. If savings from energy codes are not recognized, they need to be incorporated. If code savings are recognized, then it is necessary to develop a method for quantifying the savings. For a PA seeking to gain credit for building code efforts, the next step is to focus on a method to assess attribution to assign credit to the PA for its efforts. Finally, it is necessary to have a method to take into account the degree of code compliance. This is especially important if an energy code exists and the PA dedicated resources to increasing compliance.

ES Figure 2. Energy-Efficiency Program Policies and Code Enabling Actions



Energy-Efficiency Program and Policy Enabling Activities

This study determined diverse enabling program and policy activities to establish conditions conducive to PAs supporting building codes. We identified the following approaches that PAs and others could take to establish policies and energy-efficiency programs that would facilitate PA pursuit of programs supporting building energy codes:

- Advocate for establishment of state energy savings goals, efficiency targets, or regulatory frameworks that encourage utilities and program administrators to improve energy efficiency
- Advocate for regulatory recognition of savings from code programs
- Establish methods to quantify savings from statewide code adoption
- Establish methods to quantify savings from local code adoption
- Support development of an attribution framework
- Support development of methods for quantifying savings from changes in compliance

Additional Activities and Strategies

There is a wide variety of other types of activities or strategies that PAs might want to consider to support building energy codes. Several are cross-cutting. Some have been tried on a limited basis; others are on the books, but have been rarely implemented; and others have been proposed, but never tried. The following list summarizes these activities:

- Integrate code adoption and compliance efforts into energy-efficiency resource planning
- Advocate for legislation that requires state to adopt latest national model codes automatically
- Advocate for legislation that allows local governments to adopt codes exceeding state code
- Implement a variable rate schedule based on a building's code compliance rating
- Require builders/owners to prove code compliance as a requirement for utility service and for program participation
- Provide plan review services, circuit riders,[b] and other innovative approaches to support enforcement
- Support development of compliance assessment tools and methods
- Initiate or support an energy code collaborative or task force

Selecting Activities to Pursue

ES Table 2 presents a simple matrix to illustrate the high-level strategic options available in a state interested in implementing a PA code program. The first column on the left lists major energy-efficiency policy questions. The top row presents questions related to the code situation in the state. Hypothetical states are represented by letters: A, B, C, and D. A state must answer "yes" to both the column and row question for it to move to the next row down. Only those states that can answer affirmatively to every energy-efficiency policy question for the corresponding code column have all the strategic conditions in place to implement a program involving that code aspect, such as state code adoption. Everywhere a "no" occurs (colored cells for the hypothetical states in the matrix) presents an opportunity that could be pursued.

[b] A circuit rider is any professional who travels a regular circuit of locations to provide services.

ES Table 2. Strategy Matrix for Developing PA Code Programs in Hypothetical States (A – D)

Energy-Efficiency Policy Condition		Does state code exist?		Does local code exist?		Who enforces code?		
		Yes	No	Yes	No	Local	State	Not enforced
1. Are there energy-efficiency goals and/or incentives for PAs?	Yes	A, B, C, D		A, D	B, C	A, B	A	C, D
	No							
2. Do code savings count towards an energy-efficiency goal?	Yes	A, B		A		A	A	
	No	C, D		D		B		
3. Does quantification method exist?	Yes	A, B		A		A		
	No							
4. Does a method exist to attribute savings to PAs?	Yes	A		A		A		
	No	B						
5. Is a change in code compliance counted?	Yes	A		A		A		
	No							

The following criteria can be used for screening and prioritizing activities PAs may consider undertaking to support building energy codes:

- Likely energy savings. Given that the ultimate goal driving PA interest and potential involvement in building energy codes is to reduce energy consumption, the amount of energy saved by a code advancement activity, if successful, is a primary criterion for assessing activities.
- Resource requirements. Specific activities to advance energy codes can draw upon a variety of PA resources including funding, staff, and capital equipment. Overall, code advancement activities that require fewer resources are preferred.
- Cost-effectiveness. Overall, more cost-effective activities are preferred. Knowing the cost-effectiveness will help guide decisions about which activities to prioritize.
- Feasibility. The feasibility of conducting code advancement activities will be influenced by what types of obstacles and constraints limit conduct of the activities. The fewer and less significant the obstacles and constraints are, the more feasible it will be to conduct specific code advancement activities.
- Time requirements. In general, time requirements are linked to resource requirements and resource availability. Some activities are dependent on external cycles, such as how often the state legislature meets or how often the state code adoption entity issues new codes. If the code adoption cycle is long (for example, six years), it may be more productive to put resources into activities such as assisting building departments with code enforcement than supporting development of new codes.
- Risks and uncertainties. PAs need to consider uncertainties in domains such as technical requirements, measure performance, political opposition, and others when selecting among possible code support activities.

Evaluating Savings from Code Development and Adoption Efforts

As with standard PA energy-efficiency programs, it is essential to evaluate the savings produced by programs supporting building energy codes. The unique characteristics of such programs, however, require adjustments to conventional evaluation protocols.

In developing recommended approaches to evaluate code programs we have adhered to the following principles:

- Approaches for evaluating and attributing code savings should be as rigorous and defensible as evaluation approaches used to estimate the energy savings attributable to any other type of energy-efficiency program.
- The range of approaches should be adaptable to varying conditions, such as the level of new construction activity and the level of program effort.
- Attribution should involve examining whether the changes expected according to program theory have actually occurred.
- The key metric should be energy savings rather than interim metrics such as construction practices that are expected to lead to savings.

ES Figure 3 provides a general model of energy code program evaluation and attribution developed to apply primarily to code development and adoption programs. The terminology and logic used are analogous to those from conventional evaluation protocols.

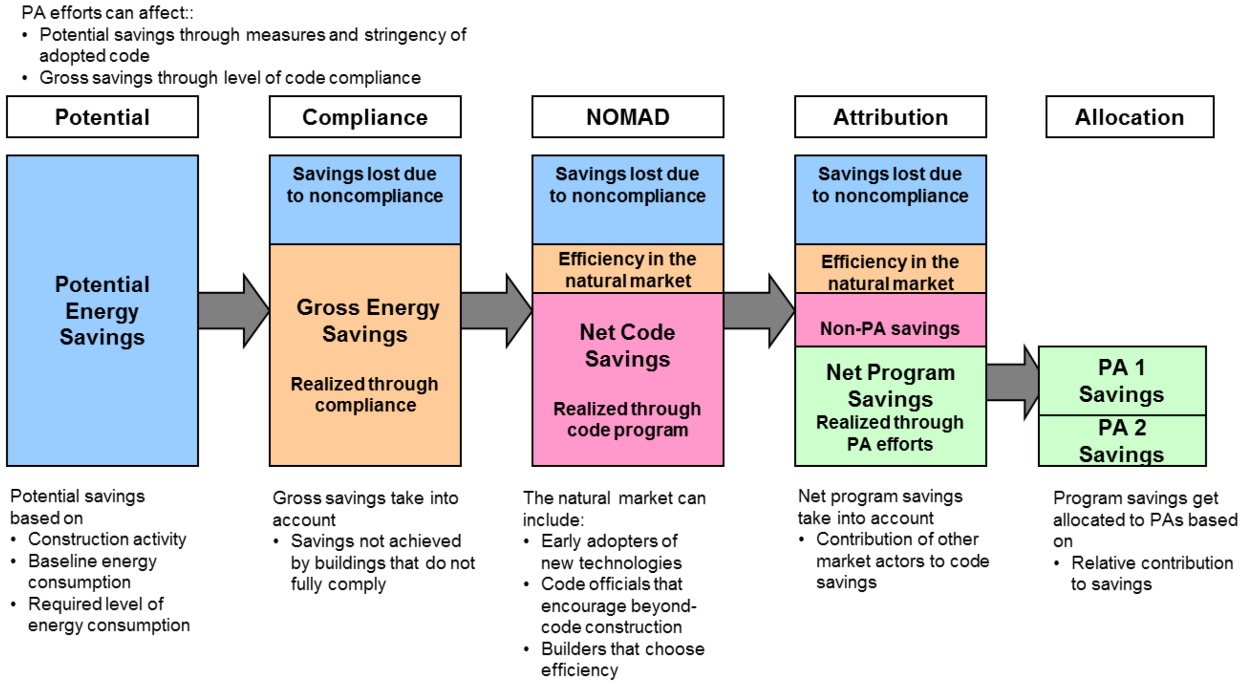
The starting point is to determine potential savings: the total amount of energy that could be saved in the market by an energy code/amendment, over a period of time, and assuming that all projects fully comply with the code requirement. There are two general approaches for estimating potential savings:

- Direct empirical
- Indirect

Gross savings are the energy savings actually realized in buildings permitted under the new code requirements. As shown in the figure, gross savings are less than the potential savings by the amount lost due to non-compliance. There is a range of methods to assess gross savings, the effect of code non-compliance, and changes in compliance. For simplicity, the report discusses three different approaches:

- Direct empirical
- Indirect estimation
- Expert judgment

ES Figure 3. General Model of Energy Code Evaluation and Attribution to Utilities / PAs



Net savings are defined as the amount of gross savings due directly to the code. The amount of energy savings that would have occurred through naturally occurring market adoption (NOMAD) is deducted from gross savings to estimate the net savings. NOMAD can be estimated through various techniques including these:

- Trends based on market data
- Expert judgment using techniques such as the Delphi approach[c]

Net program savings due to the PA efforts are determined by adjusting the net code savings by an attribution factor to reflect the influence of the PA program on code development and adoption. Decisions that need to be made in applying an attribution estimation approach are dependent on the timing of the estimation, how the estimate will be used, and who will determine attribution. There is no meter for measuring attribution so all ways of determining attribution are dependent on judgment and employ varying degrees of rigor.[2] Options for determining attribution of savings to PAs can include *ex-ante* deeming, *ex-post* estimation, or a hybrid approach.

Evaluating Savings from Code Compliance Enhancement Efforts

With the main exception of California, the focus of PA efforts to date has been more on activities related to increasing code compliance than on developing and adopting new energy codes. Given the conditions that must be in place for PAs to affect code development and adoption

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[c] Note that a Delphi approach not only relies on a panel of experts, but also incorporates a systematic iterative process of reviewing estimates and the reasoning behind the estimates, with the opportunity for the experts to revise their estimates. In most cases, this process leads to development of consensus with a basis of reasoning supporting the resulting estimate.

successfully, and the more familiarity PAs are likely to have with activities such as providing training and technical assistance, the focus of PAs on compliance enhancement activities is likely to continue for the near term. Consequently, it is important to examine how code compliance can be determined and how increased compliance might be attributed to PA efforts.

ES Figure 4 portrays the process of evaluating and attributing savings related to enhancement of code compliance. When a code goes into effect there is likely to be some level of non-compliance that results in less energy savings than anticipated from the code. “Initial savings” are equivalent to “gross savings” as shown in ES Figure 3. The term “initial savings” is used here to reflect that energy savings can be increased through PA efforts focused on compliance enhancement. As industry and code officials gain more experience with the code, compliance is likely to increase. Other parties may also work with the industry and code officials to improve compliance. The PAs or utilities can be involved by carrying out the types of activities described above. The combined effect of all these influences is an increase in code compliance and energy savings. Because several influences could contribute to an observed increase in compliance, an attribution analysis is required to determine the contribution of the PA activities.

The three critical analytical steps in the evaluation process are the following:

1. Define and measure code compliance before and after an intervention by PAs.
2. Determine the change in energy savings associated with the change in compliance.
3. Estimate what proportion of the change in compliance and energy savings was due to the PAs’ activities.

The first principle in selecting an approach to estimate code compliance enhancement program energy savings is to ensure the level of rigor is consistent with the level applied in evaluating other programs.

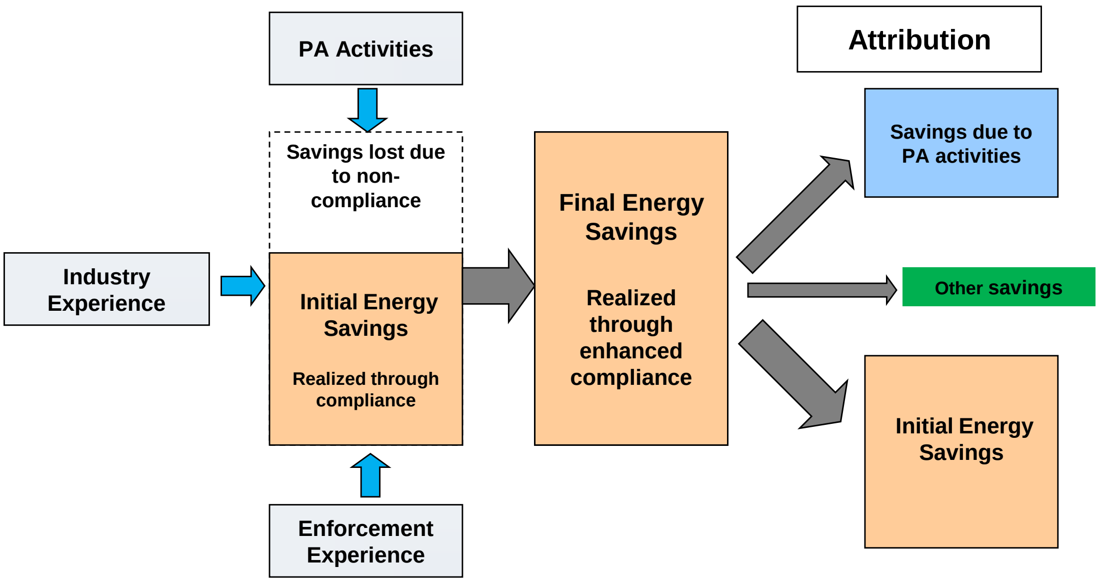
As in evaluating activities supporting code development and adoption, there are the following three basic alternative approaches, going from most to least rigorous:

- Direct empirical
- Indirect estimation
- Expert judgment

Determine Baseline Compliance Level and Energy Use

Initial energy savings are determined by the baseline compliance level. In the approach using expert judgment, experts can be polled using a Delphi process to estimate the compliance level prior to PAs’ compliance enhancement efforts and estimate energy usage. This process would benefit significantly from providing the experts with any available data.

ES Figure 4. General Model of Energy Code Compliance Enhancement Evaluation and Attribution to Utilities / PAs



Using either the indirect or direct empirical approaches, data would need to be acquired on actual buildings. With the direct empirical approach, building simulations or utility billing data could be used to estimate energy use compared to use of code compliant buildings. The indirect approach could use observed building characteristics and analyses of prototypical buildings to estimate compliance and energy use.

Determine Enhanced Compliance Level and Energy Use

In an approach using expert judgment, the same experts could be asked to estimate the compliance level and energy use after the PAs implement their compliance enhancement efforts. The experts should be informed fully about the type of compliance enhancement activities conducted. The authors recommend employing a Delphi panel process that would share feedback on the views of the experts.

Applying the more rigorous indirect or empirical approaches, the same method could be implemented that was used for the baseline compliance analysis.

Estimate Energy Savings Due to Enhanced Compliance

Savings would be based on the baseline energy use and the enhanced compliance energy use in all cases. Estimates by building or building type would need to be extrapolated to the estimated population of buildings affected by the code and program.

Determine Savings Attributable to PAs' Compliance Enhancement Activities

The final step would be determining what proportion of savings was attributable to the PAs' efforts. In all cases, expert judgment would be required. The approach relying on expert judgment throughout the process could use a simplified expert judgment process. One option would be for the experts to estimate in advance what the attribution would be and deem the value. A more stringent approach would assess attribution *ex post* based on which activities the PAs had completed using a scoring type system. In the more rigorous scenario, an evidentiary approach would be employed with a group of impartial experts who would judge information provided by the PAs documenting their activities and how they theorized the activities affected code compliance changes.

Recommended Regulatory Pathways

In terms of program design, PAs and other parties should review the matrix in ES Table 2 to establish the status in their state and where opportunities exist. We recommend that the PAs use the following steps as a guideline for actions to undertake:

- Identify one or more code program actions to pursue since these are the source(s) (eventually) for savings from code programs. These are the three major categories that have been used to date:
    - State code development and adoption
    - Local code development and adoption
    - State and local code enforcement and compliance
- Identify one or more enabling activities since these are on the critical path to eventually receiving credit for any savings achieved.
    - Advocate for regulatory recognition of savings from code program
    - Establish methods to quantify savings from statewide code adoption
    - Establish methods to quantify savings from local code adoption
    - Develop methods for quantifying savings from changes in compliance
    - Support development of an attribution framework
- Consider the additional activities and strategies discussed in this report since these can help to build support for the program with little additional cost. For example, PAs can pursue efforts to integrate code adoption and compliance into energy-efficiency resource-planning.
- Analyze program activities using the assessment criteria presented and any additional criteria that are required by the PA's organization. The criteria to consider include these:
    - Potential energy savings
    - Resource requirements
    - Cost-effectiveness
    - Feasibility
    - Time requirements
    - Risks and uncertainties

Based on experiences in California, Arizona, Massachusetts, Oregon, and Washington, there has been a common ingredient that appears to be critical to the development of the programs. This is referred to as the code collaborative or task force. In most cases, a group of stakeholders has shared a common interest in the development of a code program throughout the stages described in the roadmap. Based on this, the authors recommend that PAs begin the development of code programs by identifying stakeholders in their state and region and verifying if an energy code collaborative has been set up either by Building Code Assistance Project (BCAP) or a regional alliance, and to explore their interest in developing this concept into a functioning program.

A second emergent tactic for the introduction of code programs is the adoption of a local code. In states where there is no statewide code, such as Arizona and Colorado, this is the only way that code savings have become possible to date. When a statewide code is in force, adoption of a more stringent local code, as in California and Massachusetts, has the benefit of introducing the higher efficiency code without requiring statewide approval. This effectively creates a pilot or test environment that can ease statewide adoption of the higher efficiency code at some point in the future.

As code programs have matured in states like California, savings from the adoption of new codes become more difficult since the base code has become more stringent over time. In this situation, PA code program should continue to look for opportunities and again, the adoption of local codes is one approach to avoiding statewide resistance. Other tactics that may be complementary include advanced home initiatives or Zero Net Energy programs. Although these are not code programs, they also may enable demonstration of advanced concepts that could become code at a later date.

ES Table 3 summarizes a process roadmap developed to characterize the code program process. The table applies it to the 17 states included in this study. It includes a brief description of each stage, the role of the PA, the role of the regulator, and some of the barriers that energy code programs typically encounter.

ES Table 3. Process Roadmap for PA Energy Code Program Development

	Initial Stage	Intermediate Stage	Final Stage
State Status	**CO, GA, IL, IA, MD, MN, NH, OH, VT**	**AZ, CT, MA, RI**	**CA, NY, OR, WA**
Description	Situation analysis in progress Code program not yet staffed, funded Stakeholders not connected	Code program established and funded Enabling issues are being addressed Savings not yet claimed Evaluation and attribution processes not exercised	Code program produces savings (claimed) Evaluation process validates savings Attribution process assigns savings to PAs
PA Role	Initiate code collaborative / task force Develop code program proposal State / local code adoption Compliance enhancement Plan to address enabling issues Define resources and timeline	Continue collaborative / workshops Engage with stakeholders Administer program Drive code adoption / compliance Propose solutions for EM&V, attribution	Plan for ongoing program operation Claim program savings Support evaluation Provide evidence for attribution Continue to plan for future code actions
Regulator Role	Participate in code collaborative Support program funding Work to address enabling issues	Continue to work with stakeholders Support longer-term funding needed Consider proposals on enabling issues	Recognize program savings Support future funding Expect code savings in portfolio
Barriers	Potential studies do not include savings from building energy codes Regulatory processes do not recognize savings from code programs Multiyear timeline of code programs fails single year cost-effectiveness tests Evaluation methods are not defined for energy savings from code		

1. INTRODUCTION

Building energy-efficiency codes have received considerable attention lately because of the energy-savings opportunities they present for utilities and other program administrators (PAs). A recent report estimates that upgrades to building energy codes could offset as much as a third of all electricity consumption growth nationally through 2025. PAs are in a strong position to support and influence markets: they typically run programs that operate in the new construction arena and they have knowledgeable staff and resources. If they support energy code efforts, however, PAs' resources are diverted from other energy-efficiency opportunities and the possibility arises that savings from traditional energy-efficiency programs will be reduced as codes increase energy-efficiency baselines. By providing PAs with an incentive to support energy codes, their focus can move away from concerns about savings erosion due to codes increasing baselines and towards a productive engagement with code officials, builders, developers, contractors, architects, and the market. By receiving credit for energy savings, PA efforts become directed towards positively impacting code adoption and maximizing compliance.

There is no single best way to involve PAs in supporting building energy codes: the approach selected is likely to be site-specific depending on state regulatory policies, preferences of regulators and PAs, existing programs, and numerous other factors. Consequently, it is important that the process of involving PAs in code support activities be done in a way that takes into account the full scope of policies and factors that guide PA energy-efficiency activities. Key questions need to be answered such as:

- What energy savings goals do PAs have?
- How are savings goals set?
- How are savings from energy codes tracked and treated in setting and measuring achievement of goals?
- What incentives or other mechanisms are used to encourage PAs to achieve their savings goals? How appropriate are they for application to activities supporting energy codes?

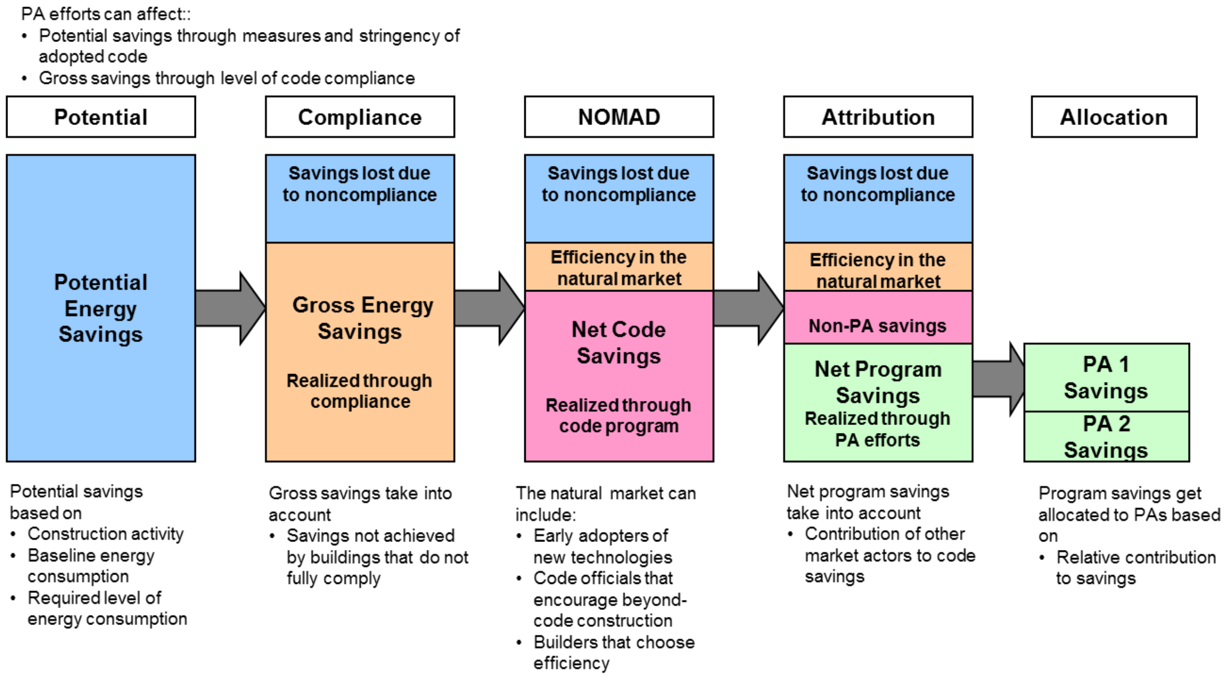
This study focuses on the development of PA code programs that would be recognized like conventional energy-efficiency programs for producing measurable energy savings. Based on the energy savings achieved, the PAs would receive incentives in a way similar to how other resource acquisition programs are rewarded. This study is not intended to imply that PAs should support building energy codes only if their efforts receive the same treatment as standard efficiency programs. In several states, including California and Vermont, PAs have provided substantial support in the form of educational programs for code officials and other stakeholders in the construction industry through programs that were defined to be non-resource acquisition programs. Programs of this type help PAs establish useful relationships with the building market, but they typically do not receive energy savings credits nor do the PAs receive incentives for implementing them. The purpose of this report is to examine what mechanisms have been and could be used to encourage the development of PA code programs in an environment comparable to the resource acquisition one in which conventional energy-efficiency programs function.

This report was prepared for the Northeast Energy Efficiency Partnerships (NEEP) and its funding partners, the Institute for Market Transformation (IMT) and the Institute of the Edison Foundation (IEE). The Cadmus Group, Inc. (Cadmus) and its partners, Energy Futures Group, NMR, and Optimal Energy (the Cadmus team) performed the study and produced this research report. The report is intended to inform and assist PAs and other organizations, such as utility regulators, interested in exploring and pursuing opportunities for supporting building energy codes. It presents information on the following:

- The building code adoption and implementation process
- Characteristics of energy-efficiency policies and programs that are relevant to PA activities to support building codes
- Assessment and selection of activities to support building codes
- Evaluation and attribution of savings from code development and adoption activities
- Evaluation and attribution of savings from code compliance enhancement activities
- Recommended pathways for pursuing PA code programs

Figure 1 illustrates the general process an evaluator can use to assess energy savings attributable to the code efforts of utilities or PAs.

Figure 1. General Model of Energy Code Evaluation and Attribution to Utilities / PAs



PAs can affect the savings from codes in two ways: (1) influencing the scope or stringency of codes (resulting in the potential energy savings) through the development and adoption processes and (2) influencing the amount of savings actually achieved by the code (the gross energy savings) through support of the enforcement and compliance processes to minimize lost savings due to non-compliance.

In its most comprehensive formulation, the analysis of savings attributable to PAs' code programs also adjusts for:

- **Naturally Occurring Market Adoption:** The proportion of savings or application of measures equivalent to the code that would have taken place in the market without influence of a program;
- **Attribution:** Determination of the amount of the energy savings that should be credited to PA efforts in the code development, adoption, and compliance process; and
- **Allocation:** Determination of the share of energy savings that should be credited to a specific PA from the amount attributed to all PAs' efforts.

This report presents more information on each of these elements of the evaluation and savings attribution methodology.

The objectives established by NEEP for this project include the following:

- Advance knowledge on how to capture and account for energy-efficiency benefits available from policies and utility program activities that advance residential and commercial building energy codes by building and expanding on the progress made in the workshop.
- Recommend the next steps available to policymakers to help capture energy-efficiency benefits from codes.
- Encourage quality and consistency in EM&V approaches used (or available for use) to account for energy-efficiency benefits by interested states within the region and country.

This study covers the following major topic areas:

- Existing code policies and energy-efficiency program policy environments in selected states and potential savings from programs to support building codes.
- Activities and strategies that utility and other energy-efficiency program administrators have implemented, or could implement, to support building energy codes.
- Methods for evaluating and attributing energy savings from code support activities.
- Recommended pathways for establishing the regulatory mechanisms to permit program administrators to support codes and receive credit for the resulting energy savings.

These research topic areas were selected to provide a logical foundation for satisfying the project objectives. Given the objectives and scope of this project, Cadmus relied substantially on published secondary research, the Cadmus team's extensive knowledge and experience, the regular review and input of the NEEP project team, and input from the Advisory Committee NEEP established to share invaluable knowledge and insights throughout this study.

2. OVERVIEW OF CODE POLICIES AND ENERGY-EFFICIENCY PROGRAMS

To design and implement a process through which utilities and other PAs in a specific state can successfully support building energy codes, it is essential to understand three things: (1) the energy code process; (2) energy-efficiency program requirements and polices; and (3) what mechanisms energy-efficiency PAs can leverage to influence energy codes. This chapter outlines the status of code and energy-efficiency policies and practices in 17 states including a number that fall within NEEP's geographic profile, as well as some additional states where there is interest in expansion of energy-efficiency programs to capture savings from building codes.

The first section introduces a process chart for characterizing the energy code process and based on the building code policy information collected for the 17 states.

The next section presents a process chart for characterizing the energy-efficiency policy environment in a state and identifies enabling actions for developing an energy code program..

This chapter concludes with observations about how these two policy realms are connected and introduces a strategy assessment matrix to help PAs assess the steps required to develop a building energy codes support program.

A series of state-specific reports and tables that describe the energy code process and EE program requirements and policies by state can be found in Appendix B.

2.1. Building Energy Code Processes and Policies

Determining what code activities are good candidates for PA involvement depends on the local code processes and policies. To provide guidance, we developed a generalized process chart that illustrates the types of code process conditions that are possible in a state and the opportunities that PAs could pursue. Figure 2 shows the range of conditions within a state that involve the energy-efficiency code and identifies specific activities for each type of condition that a PA could pursue to enhance the savings of the energy code.

The first consideration is whether a state energy code exists. If none exists, then policymakers may need to introduce a state code requirement.[d] Major policy initiatives that would require significant effort and action by policymakers, such as the introduction of a state code requirement, are indicated in Figure 2 with a "P" in the figure to denote major policy initiative. Because of the effort required, major initiatives would likely require several years to accomplish and necessitate the development of broad support; consequently, it would likely be necessary for them to be part of a long-term strategy in order for a PA to pursue them.

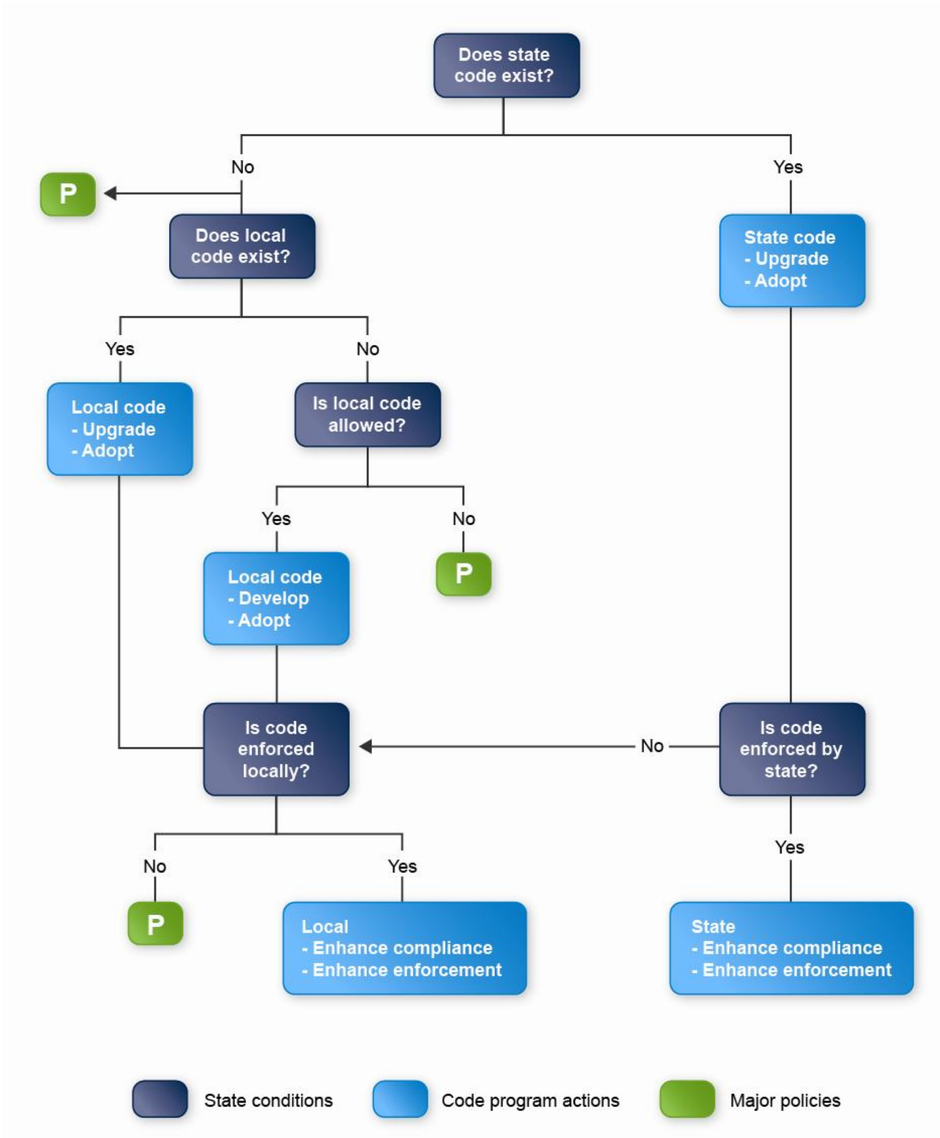
Figure 2 shows that even if a state code does not exist, it is possible a local code is in place in some jurisdictions. This is often the case in "home rule" states that do not have a mandatory

[d] Currently, there are 10 states that do not have mandatory statewide energy codes for either residential or commercial buildings: Alaska, Arizona, Colorado, Kansas, Mississippi, Missouri, North Dakota, Oklahoma, South Dakota, and Wyoming. Source: http://www.argusleader.com/assets/pdf/DF195522106.PDF

statewide code, but local governments have the option to adopt and implement a code. Home rule describes the relationship between the authority of local governments *vis-à-vis* the state government. Home rule also provides for local government autonomy, but the degree of autonomy and the areas in which local autonomy is allowed varies. Various sources provide information on the home rule situation in states, but the research effort did not find a source related specifically to energy codes that catalogs home rule provisions for all states. In a few states, sources cite home rule provisions as a rationale for not adopting a statewide building energy code.

If one or more jurisdictions have local codes, then the PA could engage in efforts to support a code upgrade and adoption. If no jurisdiction has adopted a local code, then the PA could explore whether local jurisdictions have this authority. If they do not, then the PA could focus on advocating for legislation to provide this authority, though this would likely require significant effort. If local jurisdictions have the authority, but have not exercised it, then the PA could work with the jurisdiction to develop and adopt a new code. In summary, 7 of the 17 states reviewed have a local code in place.

Figure 2. Energy Code Conditions and Opportunities



In cases where a state code exists, the PA could invest its efforts in either upgrading the existing code or adopting a new code. If agencies enforce the code at a state level, then the PA could focus on helping the building industry comply or the state code enforcement entity to improve enforcement. If agencies enforce the code at the local level, which is the most common situation, then the PA could work with the local jurisdiction and building community to enhance compliance and enforcement. In summary, 15 of the 17 states have a statewide code in place.

For PAs interested in developing an engagement strategy related to building energy codes the following three categories can be used to summarize, simplify, and organize information:

- Code development and adoption
- Code compliance and enforcement
- Stakeholders in the code process

Development and adoption refer to the activities that are required to design the code requirements and put them in place. In some cases, specific agencies adopt codes and, in other cases, the legislature adopts codes. The compliance process includes the steps that the industry market actors (such as a builder, developer, or architect) must take to comply with the code. Enforcement involves the process of reviewing and certifying that a building meets the code requirements.

Appendix A includes a summary of the IMT Assessment of *Energy Savings Achievable from Improving Compliance with US Building Energy Codes (2013-2030)*. The tables in the appendix summarize the IMT analysis of potential gas and electric energy savings that could be achieved by increasing current code compliance levels for residential and commercial buildings.

Appendix B provides a series of state-specific reports and tables that describe the energy code process and EE program requirements and policies in the 17 states reviewed.

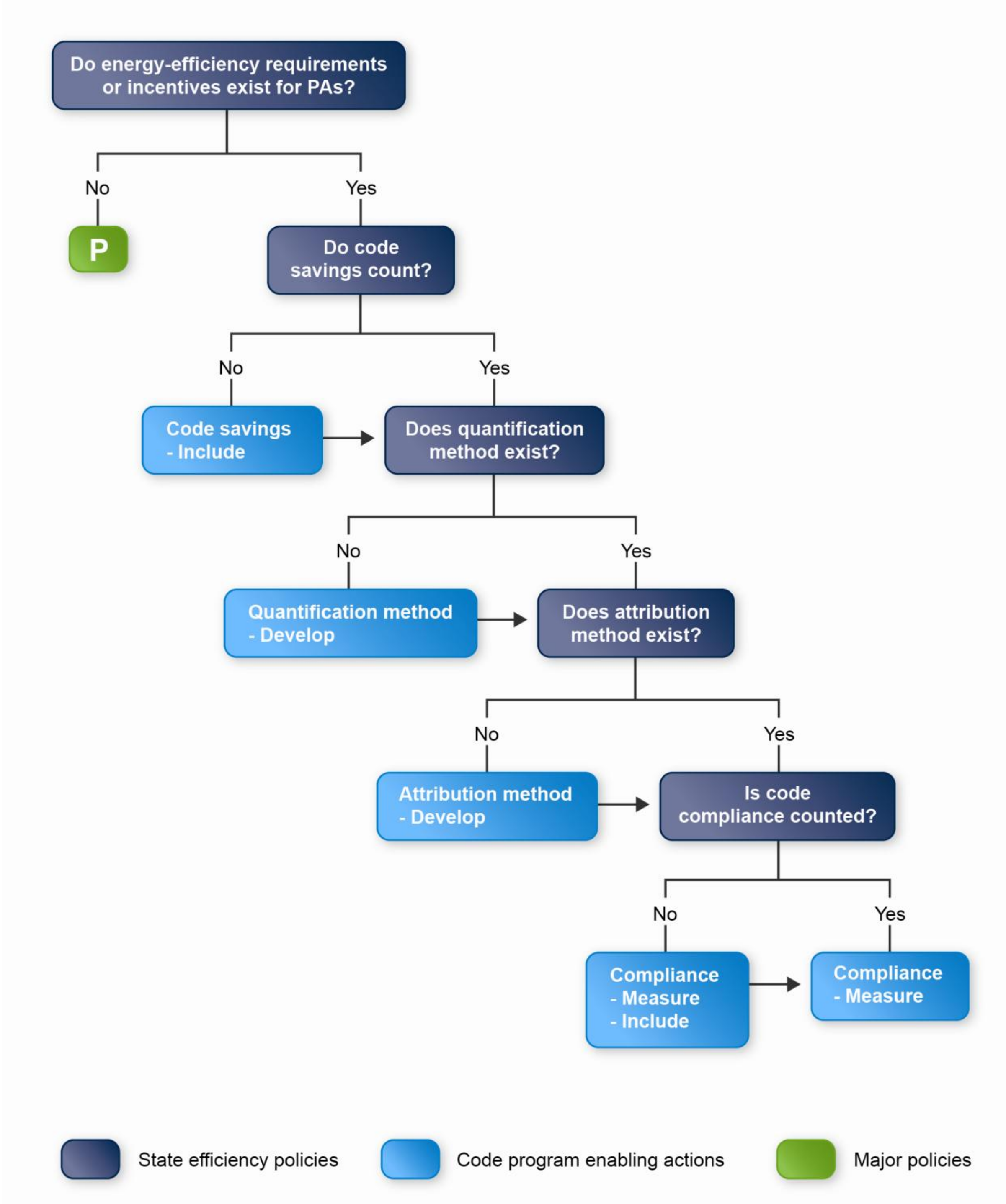
2.2. Energy-Efficiency Program Policies

Figure 3 shows the types of energy-efficiency policies that form the context in which PAs would make choices about what code activities to pursue. Also outlined, are code enabling actions that can lead to a PA getting credit for energy savings from a building energy code program.

If a state does not require PAs to meet energy-efficiency savings goals or does not provide incentives that encourage PAs to pursue energy efficiency, then there is no regulatory driver for PAs to support energy code activities to influence development, adoption, or compliance. Most states do place such requirements on PAs or provide an incentive structure that encourages PAs to invest in energy efficiency. If such policies do not exist, however, the PA could undertake steps to advocate for such policies. This would likely require a significant effort by the PA over an extended period of time.

If policies and mechanisms exist to encourage PAs to implement energy-efficiency programs, the next step is to determine how savings from energy codes are treated. If savings from energy codes are not recognized in the existing framework, they need to be incorporated. If code savings are recognized, then it is necessary to develop a method for quantifying the savings. For a PA seeking to gain credit for efforts supporting building codes, the next step is to focus on an attribution method that would assign credit to the PA for its efforts. Finally, it is necessary to have a method to take into account the degree of code compliance. This is especially important if an energy code exists and the PA dedicated resources to increasing compliance.

Figure 3. Energy-Efficiency Program Policies and Code Enabling Actions



For PAs seeking to develop an overview of energy-efficiency program policies in their state an effective approach to organizing the information is to group it into the following categories:

- Framework, requirements, and program approval policies. This category includes an overview of the state's energy-efficiency programs and policies including what the energy-efficiency requirements are, who establishes them, and how programs are approved.
- Program funding. This category provides information on the magnitude of the budgets for PAs' energy-efficiency programs in the state.
- Description of resource potential study status. This information includes a description of the most recent studies conducted to assess the energy-efficiency potential in the state and, where known, how building codes and appliance standards are treated in the study.
- Reporting, EM&V, and cost-effectiveness policies and requirements. This category summarizes information on required reporting for energy-efficiency programs; the EM&V process, and how efficiency program cost-effectiveness is assessed.

Appendix B provides a series of state-specific reports and tables that describe the energy code process and EE program requirements and policies in the 17 states reviewed. For some states, the Cadmus team used information provided by the NEEP team and the Project Advisory Committee.

2.3. Observations

It is essential to understand the energy code process in a state and the policies and procedures guiding PA energy-efficiency activities to determine what approaches PAs can, and should, explore to support building energy codes. The review of information in Appendix B covers over one-third of all states, providing essential information on the processes for adopting and implementing building codes, as well as the policies that influence energy-efficiency programs. The states investigated for this report are fairly representative of US states overall, but were selected for this study because some energy code or energy-efficiency program activity has occurred within the state. The information compiled on these states covers the spectrum of conditions in most states, and provides useful insights into the opportunities and obstacles that will shape the strategies that should be pursued by PAs, their regulators, and government bodies to enable constructive involvement by PAs in energy codes.

Primary observations from this review include the following:

- It is important to determine whether significant gaps, such as a formal adoption procedure, exist in the codes process
- A process for upgrading energy codes needs to be identified
- It is essential to determine which significant code activities occur at the state level and which occur at the local level
- The code enforcement process needs to be determined and whether there are opportunities to enhance enforcement and compliance

- The code process involves some stakeholders who are key actors in PA efficiency programs (such as builders) and others who are not (such as code officials)
- The way in which energy savings from codes are incorporated in resource potential studies needs to be determined
- It is essential to determine the types and extent of incentives or policies that exist to promote PA energy-efficiency programs
- The process for evaluating program energy-efficiency savings and cost-effectiveness needs to be characterized along with any potential challenges for evaluating code support programs

Table 1 provides a starting point for assessing the strategic situation and options PAs and others can pursue to establish a code support program. The table presents a simple matrix to illustrate the high-level strategic options available in a state interested in implementing a PA code program. The matrix combines the energy code flowchart shown in Figure 2 (on the horizontal axis) and major energy-efficiency policy questions Figure 3 (on the vertical axis) to categorize the strategic situation in a state regarding the options for implementing a PA code program.

A state must answer “yes” to both the column and row question for it to move to the next row down. Only those states that can answer affirmatively to every energy-efficiency policy question for the corresponding code column have all the strategic conditions in place to implement a program involving that code aspect, such as state code adoption. Shaded cells indicate that a specific condition is not met. In most cases, effort should be focused on the areas where a condition is not satisfied. Therefore, every time that a state appears in a shaded area a strategy for PA engagement should be considered.

Table 1. Strategy Matrix for Developing PA Code Programs

Energy-Efficiency Policy Condition		Does state code exist?		Does local code exist?		Who enforces code?			Row No.
		Yes	No	Yes	No	Local	State	Not enforced	
1. Are there energy-efficiency goals and/or incentives for PAs?	Yes	CA, CT, GA, IL, IA, MD, MA, MN, NH, NY, OH, OR, RI, VT, WA	AZ, CO	AZ, CA, CO, IL, MD, MA, NY	CT, GA, IA, MN, NH, OH, OR, RI, VT, WA	AZ, CA, CO, CT, GA, IL, IA, MD, MA, MN, NH, NY, OH, OR, RI, VT, WA	GA, IA, NH, OH, OR, VT, WA	MN*	1
	No								2
2. Do code savings count towards an energy efficiency goal?	Yes	CA, NY, OR, RI, WA		AZ, CA, NY		AZ, CA, NY, OR, WA	OR, WA		3
	No	CT, GA, IL, IA, MA, MD, MN, NH, OH, VT		CO, IL, MA, MD		CO, CT, GA, IL, IA, MA, MD, MN, NH, OH, RI, VT	GA, IA, NH, OH, VT	MN	4
3. Does a quantification method exist?	Yes	CA, NY, OR, RI, WA		AZ, CA, NY		AZ, CA, NY, OR, WA	OR, WA		5
	No								6
4. Does a method exist to attribute savings to PAs?	Yes	CA, NY, OR, RI, WA		AZ, CA, NY		AZ, CA, NY, OR, WA	OR, WA		7
	No								8
5. Is a change in code compliance counted?	Yes	RI							9
	No	CA, NY, OR, WA		AZ, CA, NY		AZ, CA, NY, OR, WA	OR, WA		10

Observations of the 17 states researched in Table 1 above (based on detailed state information provided in Appendix B), include the following:

- There are 6 states in which code savings count towards an energy efficiency goal: Arizona, California, New York, Oregon, Rhode Island, and Washington (rows 3, 5 and 7), and which have regulatory structures that define how to *quantify* savings from code programs and *attribute* code program savings to PAs. These states are unique in their development among the group of 17 states researched for this study, and moreover are unique in their level of development among all of the 50 states.
- None of the 6 states identified above (which have regulatory structures that recognize savings from code programs) have defined processes for recognizing savings *from a change in code compliance*. While states are defining these methods now, no state has yet exercised the process.

The information presented in this chapter provides a view of the factors that need to be considered by a PA, or others, interested in developing and implementing a code support program and provides a strategic perspective on the conditions required for such a program. The next chapter discusses examples of the activities some PAs have undertaken and others that could be considered to support codes.

3. REVIEW OF CODE SUPPORT ACTIVITIES

This chapter describes activities that program administrators can engage in to support building energy codes. It describes three categories of activities. The first category corresponds to actions PAs can take to affect the processes related to building energy codes shown in Figure 2. These actions include:

- Upgrading or initiating adoption of state or local code if state or local code exists;
- Developing or initiating adoption of local code if local code is allowed, but does not exist; and
- Enhancing compliance and enforcement.

All these actions are currently in use by one or more of the existing PA code programs in direct support of their objective to increase efficiency and to receive credit for the resulting energy savings.

The second category corresponds to the energy-efficiency program enabling actions illustrated in Figure 3 above. These actions are to:

- Include code savings,
- Develop a quantification method and an attribution method, and
- Measure and include compliance within programs.

Many of these actions have also been employed by utilities and program administrators; they are generally targeted at creating a policy environment that makes it possible for code programs to receive credit for savings from code programs.

The third category includes additional activities. This categories comprises activities that have been underutilized or do not fit into the prior two categories.

Cadmus identified many of the activities described during a review of the information collected on code and energy-efficiency program policies and practices. Cadmus identified other activities using recent papers, as well as drawing on the experience of the Cadmus team, the NEEP team members, or the Advisory Committee.

This report presents information on these three categories of activities in the following sections, beginning with a summary of the activities conducted to date by states that have been most engaged. The last section of this chapter presents criteria that can be used to assess and select among possible actions.

3.1. Code Program Actions

Table 2 provides a high level summary of instances where PAs have been engaged in code development, adoption, enforcement, or compliance. The table is focused on five states where PAs are active in code programs. Note that two PA activities identified in Figure 2 are combined in the table: Statewide and Local Code Compliance. This was done since most code compliance efforts are intended to improve compliance across an entire state (or utility service territory in a state) through training of code officials who are usually responsible for a single jurisdiction or region of the state.

More detail on these activities is provided below. These descriptions include other activities and cover several other states where utilities or PAs have taken some actions in support of codes or have proposed specific actions. This section combines some categories of activities for simplicity and identifies states where such activities have occurred.

Table 2. Summary of PA Activities Related to Building Energy Codes

PA Activity	Arizona	California	Massachusetts	New York	Vermont
State Code Development	Utilities have played a role by providing technical assistance for code development. The governor's office and SWEEP facilitate the process of development as well.	1. IOU program develops a prioritized list of potential building codes 2. Program funds research (C&S Enhancement or CASE Reports) for most promising measures. Reports include assessment of technology/energy savings, feasibility/market readiness, and cost effectiveness (lifecycle cost as required by CEC)	Advocacy groups and PAs have been involved in state code development.	NYSERDA has funded an Advanced Energy Codes and Standards Initiative that includes studies of potential code changes and pilots to support stretch code efforts and efforts to reach new markets	
State Code Adoption		1. Program works closely with the CEC to set agenda for consideration of code proposals. 2. Program supports the hearing process with testimony, stakeholder outreach, proposed code language, and research reports			
Local Code Development		Develop support for reach codes in local jurisdictions through providing cost effectiveness analyses, testimony, technical expertise, and addressing industry concerns	National Grid, NSTAR, Western Massachusetts Electric Company, Cape Light Compact, and NEEP were actively involved in the development and advocacy of local adoption of the stretch code.		
Local Code Adoption	Help local jurisdictions adopt energy code by providing information on building energy use trends, new construction programs, and expert testimony.	Encourage the adoption of reach codes through testimony, technical expertise, addressing industry concerns.			
State/Code Enforcement		IOUs support local jurisdictions through training of code officials, builders, and contractors			Efficiency Vermont supports municipalities where no code enforcement officials exist, as well as by conducting training on building energy codes.
State/Local Code Compliance	Assist local building departments with compliance and enforcement tracking	Support local jurisdictions through training of industry professionals		1. Deliver training to building dept., builders, and other stakeholders. 2. Provide plan review services. 3. Provide education and certification program for inspectors.	Efficiency Vermont and BED delivers trainings to building department staff, builders, and other stakeholders

Support State Code Development and Adoption

- ***Participate in national model code processes.*** PAs have worked with national organizations on model codes, which then influence state codes. Organizations PAs have worked with include the ICC, ASHRAE, DOE, and others. [**AZ**, **CA**][e]
- ***Interact with building industry on code development.*** PAs have worked with builder associations and builders to assess feasibility of code upgrades and gain cooperation or minimize opposition of industry. [**CA**]
- ***Provide technical information and assistance to state entities.*** PAs have conducted technical analyses or provided technical assistance to state code adoption entities. Their technical support has included analysis of potential code changes, feasibility assessments, and estimates of costs and energy savings. PAs have assisted with prioritizing code revisions. [AZ, **CA**, MA, NY]
- ***Participate in formal state code adoption process.*** PAs have provided testimony and been an active participant in the code adoption process. Where codes originate legislatively, PAs can participate in the hearings or drafting of legislation. [**CA**]

Assist Local Code Development and Adoption

- ***Assist with local code development.*** PAs can assist with development of model codes and assist with tailoring them to the needs of local jurisdictions. [**CA,** CO]
- ***Advocate for and assist with local adoption.*** PAs can work in the local policy arena to support adoption of codes, including reach codes or stretch codes, or support implementation of state codes that require local approval. They also can assist by developing resolutions, providing documentation to support adoption such as cost-effectiveness studies, and providing evidence to counter opponents of the code. [**AZ, CA,** CO, **MA**]

Support State and Local Code Enforcement and Compliance

- ***Assess compliance with the existing code.*** It is important to determine what the current code compliance level is for at least two reasons: (1) establishing a baseline for energy savings from new building efficiency programs; and (2) identifying opportunities for increasing compliance and code savings. Many PAs and others have recently conducted code compliance studies. PAs also can conduct regularly scheduled compliance studies to monitor changes in code compliance. [**CA, CT, GA, NY, MA, NEEA, RI, VT**]
- ***Conduct training of code officials and industry.*** PAs and others have delivered training programs to code officials and the building industry to increase their understanding of the codes, leading to improved enforcement and compliance. The building industry comprises builders, developers, designers and architects, material and equipment suppliers, and others. [**AZ, CA,** CO, **CT, MA, NY, RI, VT**]

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[e] PAs in states or regions shown in bold have conducted significant activities in these areas. Others have carried out more limited activities.

- ***Provide technical assistance, materials, and equipment to code officials and industry.*** PAs have provided various technical assistance (including hot lines) and materials to help code officials enforce energy codes. They also have provided equipment, in some cases, such as blower doors. In some cases, similar equipment and services are made available to the building industry to enhance compliance
[**IA, GA,** MA, **VT**]

- ***Support third-party enforcement or specialized inspection.*** In some cases, PAs have funded third parties to provide code enforcement assistance to building officials. HERS raters are one example. **[IA, GA,** MD**,** WA]

3.2. Enabling Activities

This section includes enabling activities that would be implemented in the context of the energy-efficiency program environment and establish conditions conducive to program administrators supporting building codes. These activities are illustrated in Figure 3. As in the preceding section, the activity is described briefly and states that have performed this activity are listed in parentheses at the end of each description.

Establish Policies that Require or Incentivize Utilities and Program Administrators to Increase Energy Efficiency.

- Advocate for establishment of state energy savings goals, efficiency targets, or regulatory frameworks that encourage utilities and program administrators to improve energy efficiency. PAs can work with the legislature or state agencies and bodies to set statewide energy savings goals and/or energy savings targets for the PAs to meet. Mechanisms such as Energy Efficiency Resource Standards (EERS) or strategic plans can be used to establish goals. Also, incentives or regulatory processes (such as utility revenue decoupling, which eliminates the revenue penalty due to customers becoming more efficient) can be used to encourage utilities and PAs to promote energy efficiency. These efforts can take years to implement and considerable effort, but more than half the states now have policies in place such as an EERS.
[AZ, CA, CO, CT, IA, IL, MA, MD, MN, NH, NY, OH, OR, RI, WA, VT]

Establish Policy to Recognize Savings From Building Energy Codes.

- ***Advocate for regulatory recognition of savings from code program.*** PAs can work in the state policy arena to support recognition of savings from code programs. Typically, it can take a number of years to achieve policy changes, but this may decrease as more states establish this model. [**AZ**, **CA, MA**]

Define Methods to Quantify Savings From Energy Code Programs.

- ***Establish methods to quantify savings from statewide code adoption.*** The California protocol defines methods for evaluating savings from adoption of unique building codes. [**CA**]

- ***Establish methods to quantify savings from local code adoption.*** Several states allow local jurisdictions to adopt building codes that exceed the statewide standard by 15% or more. PAs have been active in their support of such stretch or reach codes. Efforts to

quantify the resulting savings are in progress in at least three states.
[**AZ, CA, MA**]

Define Methods for Crediting Savings to Specific PAs and Utilities.

- ***Support development of an attribution framework.*** PAs have recognized the need for this critical step that allows savings to be assigned to specific utilities. To date, California is the only state in which the attribution method has been applied to distribute savings between the IOUs that sponsor the statewide program.
  [AZ, **CA**, MA]

Develop Method for Quantifying Compliance Savings

- ***Support development of methods for quantifying savings from changes in compliance***: Although compliance is factored into savings as measured by the California Protocol, methods for determining savings from changes in compliance are not well defined. PAs in several areas are working to define better methods.
  [CA, **MA, RI**]

3.3. Additional Activities and Strategies

There is a wide variety of other types of activities or strategies that PAs might want to consider supporting code development, adoption, compliance, and enforcement at the state and local level. Some of these approaches have been tried on a limited basis; others are on the books, but have been rarely implemented; and others have been proposed, but never tried. The following list presents this wider range of activities for consideration:

- ***Integrate code adoption and compliance efforts into energy-efficiency resource planning***: Codes and their energy savings are integrated into some integrated resource planning and energy-efficiency potential study efforts, but not in all cases and not consistently. Codes are often assumed to be the baseline for estimating acquisition program savings, without knowing the compliance level or looking at opportunities for increasing code stringency or compliance levels. Energy-efficiency portfolios can benefit by viewing code activities from an integrated perspective with emerging technology and incentive programs.

- ***Advocate for legislation that requires state to adopt latest national model codes automatically.*** By getting on the model code cycle, states can be guaranteed to have frequent code updates. PAs can work with others to advocate for legislation setting such requirements. In states where such updates are not automatic, utilities that successfully influence a change in policy could establish a claim to the savings that result from each successive update.

- ***Advocate for legislation that allows local governments to adopt codes exceeding state code.*** Legislation allowing local adoption of stretch or reach codes permits local governments code flexibility; by requiring the local code to exceed the state code, PAs can work to achieve more savings in the jurisdictions they serve.

- ***Implement a variable rate schedule based on a building's code compliance rating.*** PAs could design a rate structure that rewards more efficient buildings with a lower utility rate. This approach has been discussed in California and has been suggested by experts. It would require some type of rating system.

- ***Require builders/owners to prove code compliance as a requirement for utility service and for program participation.*** A utility service requirement exists in Iowa for new one- and two-family residential construction and is on the books in Maryland, and possibly other states. This approach integrates the requirement into the process of completing a construction project. Some utilities require buildings participating in new construction programs to demonstrate code compliance. Enforcement can be simplified by establishing a requirement that a professional architect or engineer certify that the building comply with the code (Wisconsin has such a requirement for the architect).
- ***Provide plan review services, circuit riders,[f] and other innovative approaches to support enforcement.*** PAs can both: (1) educate code officials about the code through demonstrating best practices and (2) relieve their workload by hiring experts to assist code enforcement organizations with plan reviews and building inspections. Circuit riders can provide an effective service by traveling to different jurisdictions to troubleshoot problems or disseminate information about effective enforcement approaches.
- ***Support development of compliance assessment tools and methods.*** California utilities have helped fund enhancement of code compliance software. PAs could enhance compliance by assisting with development of simplified compliance tools and training both code enforcement officials and the building industry on their use.
- ***Initiate or support an energy code collaborative or task force.*** By bringing together key stakeholders into a collaborative process, PAs can provide a forum to support common interests around energy code adoption and compliance. BCAP and organizations in California and Idaho have established such working groups that address everything from very broad code issues to specific compliance problems.

3.4. Criteria for Selecting Activities to Develop Code Support Programs

The decision about which activities PAs should pursue to advance building energy codes depends on the code and energy-efficiency program processes in the state and whether the opportunities exist to develop activities that could be undertaken by the PA. It is essential to define criteria related to the likelihood an activity will be successful and then apply them to select and prioritize specific activities to implement.

Cadmus has identified the following criteria to use for screening and prioritizing activities PAs may consider undertaking to support building energy codes:

- ***Likely energy savings.*** Given that the ultimate goal driving PA interest and potential involvement in building energy codes is to reduce energy consumption, the amount of energy saved by a code advancement activity, if successful, is a primary criterion for assessing activities. This criterion is most relevant to broad activities, such as code

[f] A circuit rider is any professional who travels a regular circuit of locations to provide services.

compliance enhancement or code adoption, for which entities can estimate energy savings. Such broad activities are accomplished through a suite of detailed activities, such as provision of training, technical information, or technical assistance. In general, code advancement activities are preferred that have the largest potential energy savings. Under varying circumstances, different types of savings—electricity, demand, and natural gas—may be more important.

- ***Resource requirements.*** Advancing energy codes requires PAs to invest resources that could be used to pursue other goals. Specific activities to advance energy codes can draw upon a variety of PA resources including funding, staff, and capital equipment. Because of the nature of the entities and processes involved, advancing energy codes may require other types of unique resources such as political capital or regulatory capital (goodwill or resources dedicated to achieving regulatory goals). Overall, code advancement activities that require fewer resources are preferred.
- ***Cost-effectiveness.*** The energy savings or other impacts per dollar spent provide a metric for comparing the cost-effectiveness of different activities to advance codes, as well as comparing code advancement to other energy-efficiency program opportunities. Identifying and calculating a consistent cost-effectiveness metric, however, are challenging given the uncertainties in quantifying both the savings and costs. Overall, more cost-effective activities are preferred. Knowing the cost-effectiveness will help guide decisions about which activities to prioritize. It is important to note that cost-effectiveness provides no indication of the magnitude of impacts, so it is important to consider cost-effectiveness in conjunction with both the magnitude of impacts and costs.
- ***Feasibility.*** The feasibility of conducting code advancement activities will be influenced by what types of obstacles and constraints limit conduct of the activities. Some feasibility issues affect broad activities, such as builder opposition to code adoption, and others affect the accomplishment of detailed activities, such as minimally available construction cost data to use in impact analysis of specific code recommendations. Some obstacles or constraints may be too excessive for a PA to pursue an activity to overcome them with available resources. The fewer and less significant the obstacles and constraints are, the more feasible it will be to conduct specific code advancement activities.
- ***Time requirements.*** Another important criterion affecting the selection of code advancement activities is the amount of calendar time required to conduct the activities and affect the building code and market. In general, time requirements are linked to resource requirements and resource availability. Some activities are dependent on external cycles, such as how often the state legislature meets or how often the state code adoption entity issues new codes. Others may depend on the time required to develop a constituency to support the activities and how the timing of PA energy efficiency portfolio plan development and submission to regulators overlaps with the code development and adoption cycle. If the code adoption cycle is long (for example, six years), it may be more productive to put resources into activities such as assisting building departments with code enforcement than supporting development of new codes.
- ***Risks and uncertainties.*** PAs need to consider uncertainties in domains such as technical requirements, measure performance, political opposition, and others when selecting among possible code support activities. Risks and uncertainties are related to several of

the other criteria listed here. PAs also need to delineate potential risks and uncertainties and assess their potential impacts on outcomes in the evaluation of alternative strategies.

4. METHODS FOR EVALUATING AND ATTRIBUTING SAVINGS FROM CODE DEVELOPMENT AND ADOPTION ACTIVITIES

This chapter and the next chapter examine methods for evaluating energy savings that result from code support activities and approaches to attributing those savings to PAs. This chapter provides a broad overview of evaluation and attribution, including the assessment of savings that result from code development and adoption.

Given the unique principles and challenges in evaluating code compliance and enforcement efforts, the next chapter includes a separate discussion of the methods to quantify and attribute savings from code enforcement and compliance efforts. These techniques are less developed and differ in some fundamental ways from the methods that apply to assessing code development and adoption activities. However, enhancing code enforcement and compliance is important because the number of PAs pursuing these activities is rapidly growing. Consequently, this report briefly touches on these activities in this chapter and explores them in greater depth in the following.

This chapter begins with a generic overview of evaluation and attribution processes or frameworks. The next section includes specific examples from California, Arizona, Massachusetts, and Rhode Island, where entities have applied these frameworks. The chapter concludes with a set of guiding principles and recommended approaches for PAs to consider as if they choose to dedicate resources to code support programs.

4.1. Overview of Code Savings Evaluation and Attribution Approaches

This section includes an investigation and review of potential evaluation mechanisms or frameworks that attribute energy savings to program administrators' building code advocacy, enhancements and, to a lesser degree, compliance support. This is followed by an examination of how entities can potentially calculate and attribute savings to PAs. This section also discusses options, issues, and the pros and cons of each approach.

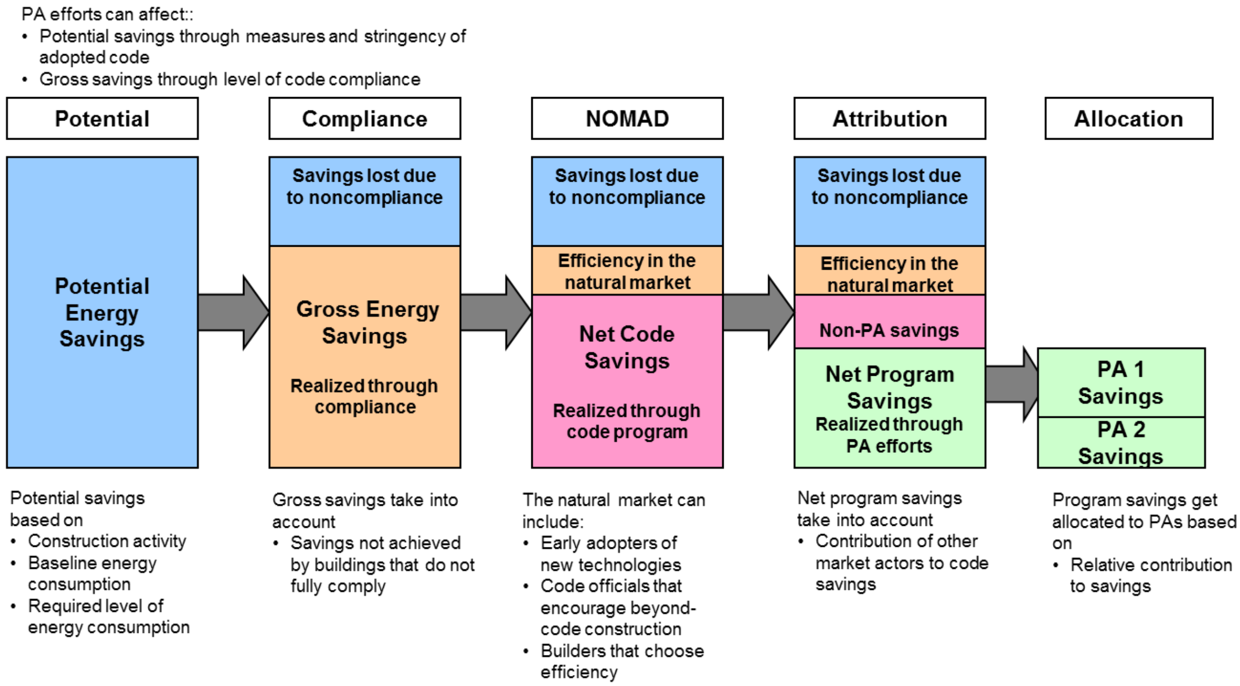
Review of Energy Code Evaluation Frameworks

In theory, it makes good sense for PAs to be credited with energy savings for supporting building energy codes. PAs are in a strong position to support and influence markets: they typically run programs that operate in the new construction arena and they have knowledgeable staff and resources. By providing PAs with an incentive to support energy codes, their focus moves away from concerns about savings erosion due to codes increasing baselines and towards a productive engagement with code officials, builders, developers, contractors, architects, and the market. By receiving credit for energy savings, PA efforts become directed towards positively impacting code adoption and maximizing compliance. This shift of focus is a win-win proposition for all.

While experience is limited with applying an energy code attribution process, entities within California, Arizona, Massachusetts, and Rhode Island have put a good deal of thought and analysis into their current and planned initiatives. From this body of work, the Cadmus team identified the elements of the energy code attribution framework presented here.

Figure 1 (repeated below as Figure 4) provides a general model of energy code program evaluation and attribution. Major elements of the model are discussed in some detail in the following sections.

Figure 4. General Model of Energy Code Evaluation and Attribution to Utilities / PAs



Evaluation of Potential,[g] Gross, and Net Code Savings from Code Development and Adoption Activities

The starting point for attributing savings to PAs for energy code support activities to adopt or modify a code is to determine potential savings. Potential savings are the total amount of energy that could be saved in the market by an energy code/amendment, over a period of time, and assuming that all projects fully comply with the code requirement. Potential savings are based on the number of buildings affected by the code and the energy savings in all the affected buildings if they are constructed to just meet the code requirements. Potential savings include savings from both new buildings and savings from existing buildings that undergo renovations that are subject to the code.

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[g] This report uses terms and definitions that are consistent with the terms used in the energy-efficiency program and program evaluation field. This vocabulary is also consistent with the California Evaluation Protocol and current practice in California. Slightly different definitions have been adopted in the 2013 Energy Efficiency Program Plan for Rhode Island. This excerpt from the plan provides an example: "gross savings are defined as the savings realized from an expected increase in the compliance rate. The potential gross savings are, therefore, the gap between the energy consumption at the baseline compliance rate and consumption at a target maximum rate (i.e. 90%)."

Gross savings are the energy savings that are realized in buildings permitted under the new code requirements. Gross savings are the portion of potential savings that are realized. As shown in Figure 4, gross savings are less than the potential savings if some of the potential is lost due to non-compliance. If PAs undertake programs to reduce the amount of non-compliance, they can affect the quantity of gross savings (discussed in detail in the following chapter). Gross savings are comparable to verified savings in the evaluation of conventional energy-efficiency programs.

However, not all energy savings observed over time in the market after adjusting for non-compliance can be attributed to the adoption of a code. If an underlying upward efficiency trend exists in the market, some of the observed savings would have occurred without the new code. These savings are referred to as savings from naturally occurring market adoption (NOMAD). The net code savings are gross savings adjusted for NOMAD. NOMAD is analogous to freeridership in the case of conventional energy-efficiency programs.

The role of the PAs in influencing the net code savings determines the net program savings. Attribution is the process of determining what portion of the net savings is due to the PAs' efforts. Attribution is discussed in more detail below.

Determining Potential Savings

PAs can develop estimates of the total potential savings from the adoption of a new code or an amendment to an existing code in a number of different ways. The choice of method depends, to a large degree, on the available time and resources, as well as the intended purpose of the estimate. Two general approaches for estimating potential savings include:

- Direct empirical
- Indirect estimation

These approaches are described here as being significantly different in terms of time, resources, and precision. Where the direct approach requires more resources and time to conduct primary research, it also is expected to deliver greater precision and insight. The indirect approach by definition relies on secondary sources and assumptions that allow it to be completed more quickly at a lower cost, but also with less accuracy. In practice, potential studies draw on many sources that represent a combination of direct and indirect methods. They are also qualified by terms such as cost-effective potential or economically feasible potential to differentiate the estimate from a concept such as total technical potential that includes some measures that are not cost-effective.

A direct empirical approach will generally require primary research to measure key variables affected by the new code, such as the level of efficiency that currently exists in the market segment (i.e., new residential construction or commercial building renovations). In addition to the measurement of a market baseline, a potential study needs some estimate of the volume of construction that would be affected by the new code in some time period. Typically, annual estimates are developed although potential studies generally include a number of years in their scope. The final critical factor needed to use the direct empirical approach is the energy savings per unit of new construction. Generally, this is the difference from energy consumption at the market baseline and energy consumption at the new code-required level of efficiency. Usually, potential savings estimates are based on the assumption that all new construction would just comply with the new code. Estimates can rely on other compliance levels, but it is important to document the assumptions.

Indirect approaches as noted above will rely on secondary sources and simplifying assumptions. For example, an estimate could be based on the assumption that the market is currently just complying with the existing code. This makes calculating the per unit energy savings very straightforward since it would simply be the difference between the current code and the proposed level of efficiency. Since this approach does not account for what the actual current practice is, the results will likely be less accurate than more rigorous estimation methods involving primary research.

Determining Gross Savings

There are a range of methods to assess gross savings, the effect of code compliance (or non-compliance), and changes in compliance. For simplicity, the report discusses three different approaches briefly in this chapter:

- Direct empirical
- Indirect estimation
- Expert judgment

The next chapter discusses this topic in more detail.

A direct empirical approach involves measurement of quantities or variables directly related to energy usage and code compliance. For example, one approach is to document the construction of actual buildings through site visits and use these data in simulation models to estimate energy consumption. This approach then compares the results to the estimated consumption of buildings constructed exactly to the code requirements. Another empirical approach is to measure energy consumption using billing data or metered data, but this presents difficulties due to variations in occupant usage. To determine gross savings, this approach measures the energy usage of a sample of buildings built under a new code to the measured usage of a baseline sample of buildings constructed prior to the code. While more expensive[h] than the other approaches, a compliance study using data collected on actual buildings provides the most accurate estimates of the actual changes in the market.

An indirect approach could be based on compiling information on buildings or typical building practices and using that information to inform an estimate of code compliance and gross savings. This approach could include collecting various types of information ranging from detailed data on building construction practices (COMcheck files or similar information is often available from the permitting process) to survey data from builders or code officials about how often building measures typically fail to comply. This type of approach does not provide an estimate of gross energy savings and may or may not estimate compliance directly, thus a methodology is needed to indirectly calculate these values, if desired.

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[h] A typical residential baseline/code compliance study of 100 newly constructed single-family homes can cost $200,000 or more. A typical commercial building baseline/code compliance assessment of about100 buildings can cost between $300,000 and $600,000.

The third approach is to rely on expert judgment. Building energy experts, utility new construction program staff, designers, architects, and code officials would all be potential candidates to provide expert knowledge to assess code compliance levels and gross energy savings. Developing an expert panel strategy (the Delphi approach)[i] to tap the insight and experience of market actors will likely produce realistic estimates of code compliance and achieved energy savings. One type of strategy used for similar situations is a Delphi panel that would, in this case, consist of experts knowledgeable about buildings and energy use.

If sufficient resources are available, the most accurate approach to estimate compliance and energy impacts associated with different compliance levels is to rely on empirical data. An indirect approach is less accurate, while the expert judgment approach will likely be the least accurate. Nevertheless, there may be situations when it is not feasible to conduct a sufficiently comprehensive empirical study (for example, if the program is new and there are too few buildings to analyze or if inadequate funding is available) and an expert judgment approach is the most feasible alternative.

A possible hybrid approach is to use deemed savings initially based on expert judgment, followed by savings derived from an empirical study to true up the savings. Over time, the continuation of this approach will likely lead to smaller differences between deemed and trued up values. Additionally, this approach will help the PA allocate its energy-efficiency investments more appropriately and reduce the risk of the energy-efficiency portfolio not meeting target goals.

Determining Net Savings: Natural Market Adoption and Attribution

In the general model shown in Figure 4, two adjustments are made to gross savings to produce the net savings credited to PAs. The first adjustment, naturally occurring market adoption (NOMAD) is directly analogous to freeridership in other energy efficiency programs. Just as some program participants would have installed an energy efficiency measure in the absence of a PA program, some builders adopt more efficient building practices even if these practices are not code. When gross savings are adjusted for NOMAD, the resulting quantity is described as the net energy code savings.

Estimation of natural market adoption is challenging for a few reasons. First, it is an estimate of something that didn’t happen (sometimes called a counterfactual). The estimate represents the share of the market (or prevalence of a particular building practice) in the case that a code governing that practice was not adopted. However, the code was adopted so no one knows for certain what the natural market would have been. Estimation of NOMAD is also challenging because it requires very specific research on building practices which can add significant expense to the process. Research to estimate NOMAD has been completed in California where experts are used in an online Delphi process to establish a consensus among a small group with knowledge of the market. This research is described briefly in Section 4.2. It is also possible to gain some insight into NOMAD through compliance research since compliance with the new

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i Note that a Delphi approach not only relies on a panel of experts, but also incorporates a systematic iterative process of reviewing estimates and the reasoning behind the estimates, with the opportunity for the experts to revise their estimates. In most cases, this process leads to development of consensus with a basis of reasoning supporting the resulting estimate.

code *before it went into effect* provides some evidence of the prevalence of a building practice. It is possible to neglect the NOMAD estimate—that is, to assume that the natural market was zero—but it is best to be aware of the concept and to consider estimating it when practical. Note that net code savings are the same as gross savings when NOMAD is assumed to be zero.

The second adjustment is for attribution of the code change to the PA program. In many cases, there are several stakeholders involved in the adoption of a new energy code. Attribution then is an estimate of the extent to which the PA program was responsible for the change. When net energy code savings are adjusted for attribution, the resulting quantity is described as the net program savings.

Assuming the PAs actively influenced savings related to energy codes and are to receive credit for their efforts, the credit should be determined through an appropriate attribution process. It is important to note that, unlike energy consumption, there is no meter for measuring attribution so all ways of determining attribution are dependent on judgment and employ varying degrees of rigor.[3] Thus, the decisions that need to be made in applying an attribution estimation approach are dependent on the timing of the estimation, how the estimate will be used, and who will determine attribution.

The options for determining attribution of savings to PAs can include *ex-ante* deeming, *ex-post* estimation, or a hybrid approach. In all three cases, estimating an attribution factor and applying it to the net code savings will result in the savings attributable to PA activities.

Using a deeming approach, regulators and PAs could negotiate attribution factors at the start of a program for each initiative the PAs plan to undertake. If the PA successfully fulfilled their plans, they would be able to claim savings calculated as the product of the predetermined attribution factor times the net code savings. Additionally, if the PA did not fulfill its plan completely, attribution factors could be tied directly to the degree of success a PA had. For example, if a PA only completed a fraction of the originally planned activities, an agreed upon formula might be used to lower the attribution factor commensurate with which performance metrics a PA satisfied. A deemed attribution approach would provide both the PAs and the regulators with an understanding up front of what the expectations for performance would be and, therefore, what the risks and rewards would be. All parties would know that, if the PAs performed, the negotiated share of the net code savings could be claimed.

An important drawback to such a deeming approach is uncertainty in the implied, prospective correspondence between performance metrics and the amount of influence the PA had on net savings.

Although it is challenging to estimate energy savings attribution objectively and reliably for PAs' previous activities, stakeholders such as regulators and PAs can design and implement protocols for conducting such *ex post* estimations with rigor. For example, a determination of attribution could be made retroactively based on things like market participant surveys, the public record of the code adoption process, and evidence in documentation provided by the PAs. Program designers can enlist objective experts to make the assessment and define the approach in advance.

As in the case of energy savings, analysts can use a hybrid approach to determine attribution. Such an approach would use deemed attribution in the initial phases of the PA's program. In subsequent phases, analysts could apply a more rigorous, evidence-based attribution approach as entities gain a better understanding of what role the PA plays and develop a suitable attribution method.

Quantifying Effects of Code Advocacy and Enhancements

Assessing the energy impacts of efforts dedicated to code advocacy and enhancements can lend themselves well to a hybrid approach combining deeming with *ex-post* application of savings credit once the proposed outcomes have been achieved. After a code or code enhancement is adopted, this approach can estimate the potential savings (assuming full compliance) with reasonable accuracy. For example, if the PAs worked to add a new requirement to the code, they would likely have reliable analyses on the market size, baseline practices, and how much savings potential exists from the code amendment. In this case, the PA could deem savings numbers in advance. In this hybrid circumstance, while the savings values or algorithms for calculating them could be agreed to in advance, the actual savings credit would still be dependent on the actual code change being implemented. In other words, a PA could not claim savings unless, and until, the legislative body adopts the new amendment or new code.

This approach provides PAs with an understanding of the savings credit possible and avoids some retroactive risk since it does not require additional analysis to estimate savings. However, the PAs would still be at risk in that savings could not be claimed unless their efforts were ultimately successful. Given the relatively large magnitude of savings possible from these activities as compared to the costs and effort PAs would have to invest, this limited risk seems reasonable and provides adequate protection to ratepayers.

Developing an Appropriate Evaluation Timeframe

It is important to design a realistic evaluation period into any new code program. This is likely to be approximately a three-year cycle. Based on Cadmus' experience and available information, anything shorter than about three years would be undesirable. The results would not justify the cost and EM&V resources required and, if focused on changes in code compliance, would probably not produce statistically significant estimates.

4.2. Examples of Applied Evaluation and Attribution Frameworks

This section briefly describes the evaluation and attribution methods that are in use or have been defined in the states where PA-led energy code programs exist. Specifically, descriptions are given for California, Arizona, Massachusetts, and Rhode Island. In addition, the status of the evaluation and attribution methods is discussed for each state.

California

Starting in the late 1990s, California utilities began having a significant role in researching, proposing, and promoting efficiency standards through what has become the statewide utility C&S program. Like other statewide programs, each of the four IOUs[j] has a C&S program. These

[j] The four California IOUs are: Pacific Gas and Electric, Southern California Edison, Southern California Gas, and San Diego Gas and Electric.

individual programs provide a place within each utility for funding the program activities and claiming savings in the IOU portfolio.

Development of new codes (or enhancements) and advocacy for adoption of those new codes have been the primary program activities over the last10 years. Funding of third-party research into specific code changes has supported development. The resulting research reports have generally been named Codes and Standards Enhancement reports and are commonly referred to as CASE reports. The IOUs have been active participants in the CEC process for proposing and approving changes to the California appliance and building standards. This process has come to rely on these CASE reports to a large extent.

Efforts have been made to estimate savings from the C&S program and establish a regulatory process to account for them. In 2006, California adopted an evaluation protocol that included a methodology for evaluating C&S programs. That methodology was fully implemented for the first time during the evaluation of the 2006-2008 energy efficiency program cycle. The protocol and the prior evaluation have established a basis for evaluating and verifying savings from the program that will be used in the regulatory process. The process defined in the California Evaluation Protocol for estimating and attributing savings to the California IOUs (who are also the PAs) is shown in Figure 1.

Although the 2006-2008 evaluation established methods for measuring and attributing savings from the statewide C&S program to the IOUs that support it, development of the processes around the C&S program continue in several areas:

- ***Credit for savings achieved.*** The CPUC gave the IOUs credit for 50% of the evaluated savings from the initial 2006-2008 program years. The 2010-2012 evaluation will be the first time that 100% of the evaluated savings are counted towards IOU portfolio objectives.
- ***Savings from C&S activities other than advocacy.*** All savings from the 2006-2008 program were the direct result of IOU advocacy of new or enhanced codes. In the current evaluation, the IOU claims include savings from beyond code programs in a number of jurisdictions. The IOUs have also been working to improve compliance for a number of years and there is considerable interest in methods that would allow savings to be associated with compliance improvement efforts.

Additional detail on evaluation practices and related issues in California is provided here.

- ***Potential Energy Savings.*** Total potential from the statewide building energy code includes savings from individual code changes that the program supported with CASE reports and additional savings found through building simulations. The simulations include implementation of all new building code provisions and not just the subset supported by CASE reports.
- ***Gross Energy Savings.*** As described above, gross savings depend on the level of code compliance in buildings permitted under the new codes. The 2006-2008 evaluation introduced the use of whole building compliance rate analysis because Title 24 allows compliance to be achieved through a building performance path. This approach provides a more accurate analysis of gross savings because it links directly to an analysis of energy

use and savings. This method also requires that a large and representative sample of buildings be audited to accurately estimate compliance.

- ***Net Code Savings.*** The adjustment of gross savings to net depends on estimation of the NOMAD for each regulated measure or practice. This adjustment is made to limit credit for new codes to just those instances where the new code made a difference. If part of the market is already using the more efficient measure, then gross savings is reduced to account for the existence of a natural market change prior to the new code.

  In California, NOMAD estimates are found through the use of a Delphi process in which groups of experts provide their estimates and supporting comments to an online application. Once a first round of inputs is received, the comments and estimate of each expert are made available to all of the other experts. Each expert is then asked if they would like to revise their estimate. This process has proven to be effective to find a consensus estimate from a pool of experts.

- ***Net Program Energy Savings.*** The savings for which the *program* is responsible is that portion of the net code savings that can be attributed to the California IOUs. The method employed in California was developed over several pilot evaluations and the 2006-2008 process. This task consists of three steps that are done in preparation for the final scoring step. These first three steps collect information from a number of primary and secondary sources. The final step, attribution scoring is primary research that depends on the work done in the first three steps as well as the personal knowledge of the expert panel. The steps are to:

  1. Review and confirm attribution guidelines used for Title 24 in the prior evaluation
  2. Collect data about contributions of IOUs and other stakeholders to codes development
  3. Analyze IOU and other stakeholder contributions
  4. Score C & S Program attribution. This step is completed by an independent panel of experts

In the Cadmus Attribution Methodology, the C&S Program receives credit for contributions to standards development by addressing the three factors discussed below. These factors were identified as the fundamental requirements that must be met for the CEC to adopt a new standard. Program attribution will be determined by assessing the degree to which it contributed to satisfying each requirement.

- ***Factor (1): Development of Compliance Determination Methods***
  End users must be able to determine that they are in compliance with the standards. Similarly, code officials (in the case of building standards) or the CEC or manufacturers (for appliance standards) must have tools or methods that allow them to verify compliance with the standards. In some cases, determining compliance entails having a reliable test method. In other cases, it involves having an analysis tool that produces results indicating whether compliance is achieved.

- ***Factor (2): Development of Technical and Cost Information***
  Significant scientific, engineering, and economic research must be completed before regulators can adopt a standard. In addition, the standard must be defined in careful technical language. Since implementation of the C&S Program began, much of this research and development has been summarized in Codes and Standards Enhancement (CASE) reports for standards in which utilities played a significant role.

- ***Factor (3): Feasibility of Meeting the Standard***
  An implicit requirement for adopting a new standard is that compliance with the standard be practical and feasible. Supporters of the standard must address stakeholder concerns and demonstrate through market research that stakeholders can comply with the standard.

After collecting information from the data sources described above, the evaluator will estimate the factor weights based on resource allocation between the three factor areas.

The *factor scores* are determined for each standard by a panel of senior staff familiar with the adoption of energy-efficiency standards in California. The panel is briefed about the objective of the panel, the attribution methodology, and available data sources. The spreadsheets, as well as all primary source materials, are made available to all members of the panel. The panel then attempts to reach consensus about the contribution of the C&S Program in each factor area. If the panel cannot achieve consensus, then each panelists will decide upon a score, the lowest and highest scores will be dropped, and the remaining factor score will be averaged.

The evaluator will use the factor weights and scores to calculate a weighted average overall attribution score for each code and net utility savings:

- ***Net Utility Energy Savings.*** Allocation of savings to the individual utilities is based on utility sales, making this a relatively trivial step in the California process.

Arizona

In Decision 71819, August 10, 2010, the Arizona Corporation Commission (ACC) adopted Electric Energy Efficiency Standards for Arizona requiring the regulated electric utilities to achieve cumulative energy savings equivalent to 22% of sales for 2019. The order specifically stated: “An affected utility may count toward meeting the standard up to one third of the energy savings resulting from energy efficiency building codes that are quantified and reported through a measurement and evaluation study undertaken by the affected uti1ity.” The regulated utilities, Tucson Electric Power (TEP) and Arizona Public Service (APS), have proposed programs. APS’ program is approved and provides code support. To date, APS has claimed no savings from its program. TEP’s program is not yet approved.

Both utilities intend to follow through on conducting EM&V when they get to a point of claiming energy savings. However, little information is available on what type of EM&V activities the utilities are planning or how savings attribution will be determined.

The largest public utility in Arizona, Salt River Project (SRP), is not regulated by the ACC, but has decided to implement a program advocating for local adoption of building codes and providing materials and training to support the code. SRP intends to claim up to 50% of the savings from adopted codes they have supported in their service area. They conducted a baseline study using billing data for residential and commercial buildings constructed just prior to implementation of the new code. They used the results of that study, along with savings estimated with simulation models by PNNL, to develop deemed savings for a range of building types built under the new codes. SRP will repeat the billing analysis with actual buildings built to the new code to true up the savings estimates.

SRP has developed a draft methodology for estimating attribution to its code adoption and support efforts. The methodology takes into account a range of possible activities for which SRP can credit. The utility has not made the method public yet.

Massachusetts/Rhode Island

Massachusetts PAs have historically had metrics with incentives rewarded for achievement. One metric for the 2009 Massachusetts New Homes with ENERGY STAR® Program was to research California's mechanisms for claiming savings from code development, support, implementation, and enforcement activities and design a similar mechanism for claiming savings for codes and standards activities in Massachusetts. Since 2009, the PAs in Massachusetts have been moving a codes and standards (C&S) initiative forward.

The PAs initially hired a contractor to report on the history of the California C&S Programs and the algorithms and calculations they used to claim savings for the IOUs for code and standard upgrades. The contractor will also outline suggestions on how these findings may be applied in Massachusetts. Subsequently, National Grid hired a program manager to focus on this effort, and in 2011 the PAs issued an RFP and then hired a contractor to help them develop the C&S program for the Commonwealth. Since National Grid is leading this effort for all of the PAs in Massachusetts, and they also happen to be the only gas and electric utility in Rhode Island, National Grid plans to take what is developed for Massachusetts and then apply it in Rhode Island. As of this writing, Massachusetts PAs and regulators have not agreed on an attribution framework to be used in 2013. Instead, energy code programs are continuing as pilot programs that may help to support approval of such programs as resource programs in the future. In Rhode Island, the building energy code program is included in the Energy Efficiency Program Plan for 2013.[4]

Informing the Massachusetts and Rhode Island 2013 planning process is the work that the PA's contractor has undertaken since being hired in the spring of 2012. Massachusetts and Rhode Island developed a few studies, met with the regulators and others, conducted analyses and have helped the PAs to develop proposals for a C&S initiative, with the major areas outlined below.[k]

- ***Code Compliance Enhancement***
  Objective: The Compliance Enhancement Initiative is intended to increase the ability and desire of the design community (architects and engineers), the construction community (contractors and construction managers), and the enforcement community (municipal code officials) to comply with and/or document compliance with the locally mandated building energy code. This would either be the version of the IECC adopted statewide, or

[k] Appliance standards advocacy was also included in the proposal but is not shown here

the M Massachusetts Stretch Code. The scope of PA efforts will support the codes, generally including both new construction and retrofits/renovations in existing buildings.

- ***Stretch Code Support***
  Objective: The Stretch Code Initiative will support the Massachusetts Department of Energy Resources' (DOER's) development of a stretch code that exceeds statewide minimum requirements and is adopted by local governments. A coordinated development approach by the PAs will provide technical support for the DOER's development of the stretch code to avoid wasted energy and costs from duplicated efforts. Stretch codes are intended to exceed statewide code in terms of energy savings, and are voluntarily adopted by municipalities as part of becoming "Green Communities," which also confers additional benefits potentially including grant funds. To date, more than 120 towns have adopted stretch codes.

While the savings and attribution details are in negotiation, the framework being proposed includes determining gross savings and then applying negotiated attribution factors for each of the initiatives. Specifically, the PAs are requesting the following:

- Integrating codes and standards as a program path that allows for direct savings claims made in each year of the next three-year plan.
- Deeming gross savings for the next three-year plan based on a rough analysis to date of the potential and targeted performance, with evaluation focused on refining estimates only for future plans, rather than revisiting deemed savings.
- Ensuring that "gross savings" will reflect the total savings and use of an attribution factor to estimate the "net" savings allocated to the PA plans.

While there is general agreement between DOER and the PAs that a C&S Initiative makes sense, there are still some differences in opinion on the approach and framework details.

As noted above, the final 2013 program plan for Massachusetts identified ongoing code program support as a pilot program. Specific plans for measurement and attribution of code-related savings were not included.

For Rhode Island, National Grid proposed a mechanism similar to the one the PAs proposed in Massachusetts. The Rhode Island Energy Efficiency Resource Management Council and its consultants also supported the adoption of a system in Rhode Island similar to DOER's proposal for Massachusetts. As a result, the final Energy Efficiency Program Plan for 2013 includes an implementation plan that includes these four elements:

- **Trainings:** National Grid will identify third-party vendors to deliver combinations of classroom style trainings, location-based training that is geographically dispersed around the state, and accessible Web-based trainings.
- **Technical assistance energy code circuit riders:** These technical resources are to act as consultants on energy codes and energy efficient building design and practice, to interpret and explain code administrative requirements, and to be a go-between between participating market actors and Rhode Island's code officials.

- **Support for third-party inspections:** In 2012, and in collaboration with NEEP, National Grid assisted the Rhode Island Code Commission in incorporating legislative provision for optional/voluntary third-party inspections of the building energy code, both for residential and commercial buildings.
- **Documentation tools:** To address the confusion regarding code compliance due to the lack of standardization of acceptable levels of documentation at the time of building permitting, National Grid will develop and support consistent documentation tools such as builder manuals, software tools, checklists, and code check protocols for adoption by jurisdictions as a means of enhancing compliance.

The expectation is that project savings for this code cycle will be realized in the following three years (2014 to 2016), as projects seek building permits under the current code. The projected savings for 2013 reflect the following: small percentage of buildings that fall under the new code, development of infrastructure to get the community ready for the new code and training and education to the enforcement and building community. Actual savings for 2014-2016 will be finalized in subsequent years.

For 2013, attribution to the PA (National Grid) is pre-determined to be 40%. Each of the PA activities is weighted and if 100% of all activities are met, the 40% attribution rate is applicable. If less than 100% of activities are met in 2013, there will be an incremental reduction in the pre-determined 40% attribution rate.

4.3. Recommended Approaches to Estimating Savings Attributable to PA Code Advocacy and Enhancement Programs

This section outlines a range of general approaches for estimating the savings that are attributable to code savings programs. In developing these recommended approaches we have kept the following principles in mind:

- The range of approaches should be adaptable to varying conditions, such as the level of new construction activity and the level of program effort.
- Approaches for code savings attribution should be as rigorous and defensible as evaluation approaches used to estimate the energy savings attributable to any other type of energy-efficiency program.
- Attribution should involve examining whether the changes expected according to program theory have actually occurred.
- The key metric should be energy savings rather than interim metrics such as construction practices that are expected to lead to savings.

Potential Savings Estimates

The potential energy savings possible from a new code or enhancements to an existing code depend on the number of buildings affected and the savings possible in each building due to complete compliance with the code requirements. The number of buildings affected must be estimated prospectively. Projections of building construction can be estimated based on readily available permit data or commercially available sources of historical and current construction. Code changes usually apply to major retrofits and renovations, as well as new construction, so it is important to estimate this market as well. Statistics on renovations are less readily available, and less reliable, than they are for new construction, however. In general, it is advisable to seek out the best sources of construction data and, if possible, compare alternative sources and use conservative estimates.

Code savings depend on the difference between the energy consumption of a building built to current practice and the same building built to meet the new or enhanced code. If there is an existing code, it is possible to treat the existing code requirements as current practice. However, if a baseline study of recent construction is available, it would be advisable to use its results, rather than the existing code, to define current practice.

The rigor of analyses of potential code savings can vary considerably, depending on factors such as:

- The level of knowledge of baseline construction practices.
- The number of building types considered.
- The complexity and capability of the analysis method (for example, a whole building simulation or simplified engineering analysis).

We recommend that the analysis of potential savings be as rigorous and accurate as the analyses done for savings from other energy-efficiency programs. If simplified calculations are used for other programs, then they would be appropriate for analyzing potential energy code savings. If more complex methods, such as whole building simulation models are used for other programs, they should be here as well. DOE/PNNL regularly estimates the savings of each upgrade of the national model codes so these results can be used if they apply. If the code changes differ from the model codes, it would be appropriate to apply a similar modeling approach based on the requirements of the prior and new codes.

Estimating savings from renovations is likely to require less complex methods. For renovations, only certain code requirements may apply, such as lighting power densities, and only in certain building areas. In this case, it would likely be appropriate to use approaches such as engineering analyses to analyze only the code provisions most commonly implemented.

Gross Savings Estimates

In keeping with the principle that code savings estimates should be as rigorous and defensible as the estimates of energy savings attributed to any other type of energy-efficiency program, we recommend, with some exceptions, that code compliance and gross savings not be deemed. We believe code compliance and estimated gross savings should be based on empirical compliance studies, to the extent practical.

Compliance studies can be relatively costly to conduct, though, and this can be a concern to PAs. However, understanding baseline construction practices is essential to estimate the savings from PAs' new construction programs and address questions about freeriders. In this case, a baseline study can be designed to do double-duty to serve as a standard baseline study and a code compliance study. The cost of such studies might reasonably be shared between code programs and other PA programs—indeed, some PAs (such as those in Massachusetts, New York, Rhode Island, and Vermont) have conducted residential and commercial new construction baseline studies in support of other programs, even in the absence of code savings programs, and the information from them can inform compliance rate estimates.

Under some circumstances, it may be possible to forgo a rigorous compliance study. One example is if there are readily available and relevant data from studies in other states, prior baseline or compliance studies, or other credible evidence about code compliance. Another situation is if the cost of conducting an empirical compliance study is unjustified given the energy savings likely to be attributed to the PA for its code program.

Attribution

While gross savings estimates should be based on actual changes in building practices and they affects energy use, attribution by its nature involves estimating what would have happened in the absence of a program. These results are then compared to what actually did happen in order to estimate net savings. This analysis necessarily involves judgment, or weighing of evidence, to decide which observed changes are: (1) due to NOMAD, (2) due to other programs targeting changes, and (2) due to the PAs' own codes programs. Two of the main differences among attribution approaches are the type and amount of evidence used and the makeup of the deliberative body.

For pilot programs and programs with limited resources and/or limited savings potential, a deemed attribution approach might be advisable. Deemed, however, should not imply simply making numbers up, but it does involve relying on less evidence than would be required with a more complete evaluation approach. The deliberative body for deemed savings estimates would be the regulators working in conjunction with the PAs. This group would specify (negotiate) a set of conditions and the associated percentage of the gross savings that would be attributed to the program if each condition is met. For example, one condition for a code compliance initiative might be training specified numbers of builders, subcontractors, and code officials. The proportion of actual-to-planned numbers of trained individuals in each category could be multiplied by the maximum attribution percentage negotiated for that element, which would then be applied to the gross savings estimate. Given the low risk for PAs with this attribution approach—they will know in advance what they need to do to get a given amount of credit—the negotiated attribution percentages, depending on the jurisdiction, are likely to be on the low side.

A more rigorous approach to evaluation would be called for when the potential savings and/or rewards are greater. For code enhancement efforts in the Northeast, we would recommend that savings attribution be limited to enhancement above the base code—for example, in Massachusetts it would be limited to enhancements above the IECC, whether at a statewide level or at a community level (for stretch or reach codes). The evidence for code enhancement efforts could include the following:

- Documentation of PA efforts to support code changes (e.g., technical and incremental cost studies)

- Documentation of PA efforts that may have prepared the market for code adoption or upgrades, such as development of a HERS rating industry that is essential to the effective implementation of stretch codes in Massachusetts
- Interviews with participants involved in the development of a particular standard to characterize the PAs' role and the roles of other entities
- Review of public documents to characterize the PAs' role and the role roles of other entities
- A summary of changes in compliance and gross savings as estimated through the baseline studies at the beginning and end of the code cycle
- Summaries of baseline studies in other jurisdictions and descriptions of relevant codes and code enhancement efforts

The evidence should be developed by independent evaluators with expertise in new construction and codes and with no vested interest in the outcome of the study.

As mentioned earlier, attribution in the case of codes programs will involve judgment of experts. With more comprehensive approaches, as well as with deemed savings approaches, the regulators are, of course, the ultimate decision-making body. With deemed savings approaches, however, the regulators are more involved in the weighing of (more limited) evidence in their negotiations with PAs. With more comprehensive approaches, they may delegate the more intensive deliberation and weighing of the evidence to an outside group. The group could have different names (e.g., review group, or Delphi panel), but their job would be the same: to weigh available evidence and develop an attribution factor or factors that would be applied to gross savings estimates, subject to regulatory approval. The group should be composed of experts in new construction programs, new construction practices and technologies, codes, or combinations thereof. The effort required of this group would be considerable, and its members should be compensated accordingly.

The review group differs from the group responsible for developing the evidence. The latter is made up of evaluators with some new construction and codes expertise, and their job is to compile the evidence to be examined by the review group. Based on this evidence, it is the responsibility of the review group or Delphi panel to develop one or more attribution factors (e.g., possibly one factor for each technology targeted by the program, according to program theory) that may be applied to gross savings estimates. In the course of developing attribution factors, the review group must also describe the rationales for their recommendations, including any dissenting views. The attribution factors and the reasoning behind them are then presented to the regulators for their final decision.

5. METHODS FOR EVALUATING AND ATTRIBUTING SAVINGS FROM CHANGES IN CODE COMPLIANCE

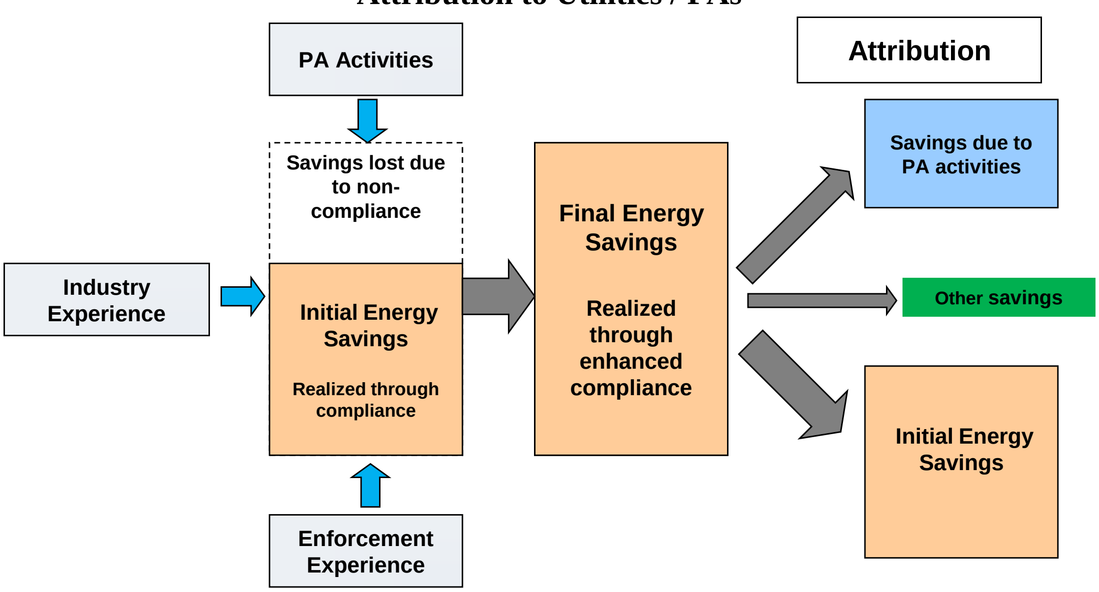
With the exception of California, and a few other states to a lesser degree, the focus of PA efforts to date has been more on activities related to increasing code compliance than on developing and adopting new energy codes. Given the conditions that must be in place for PAs to affect code development and adoption successfully, and the more familiarity PAs are likely to have with activities such as providing training and technical assistance, the focus of PAs on compliance enhancement activities is likely to continue for the near term. Consequently, it is important to examine how code compliance can be determined and how increased compliance might be attributed to PA efforts.

This chapter begins by examining what types of activities PAs can carry out to enhance code compliance and how these efforts fit into the framework presented in chapter 4. It then discusses approaches for measuring code compliance. Next, it describes approaches for assessing attribution to PAs' efforts. The chapter closes with recommendations on how to determine and attribute compliance enhancement to PAs' efforts and then summarizes the status of approaches to assess compliance enhancement and attribution.

5.1. Overview of Evaluation and Attribution Approaches for Compliance Enhancement

Figure 1 in chapter 1 illustrated the overall process from code development to implementation and the components that would be evaluated to determine energy savings that could be attributed to the activities of PAs or utilities. Figure 5 portrays the process directly related to enhancement of code compliance.

Figure 5. General Model of Energy Code Compliance Enhancement Evaluation and Attribution to Utilities / PAs



The figure shows that when a code goes into effect there is likely to be some level of non-compliance that results in less energy savings than anticipated from the code. “Initial savings” are equivalent to “gross savings” as shown in Figure 1—the actual savings achieved after accounting for non-compliance. The term “initial savings” is used here to reflect that they can be increased through efforts focused on compliance enhancement. As industry and code officials gain more experience with the code, compliance is likely to increase. Other parties may also work with the industry and code officials to improve compliance. The PAs or utilities can be involved by carrying out the types of activities described above. The combined effect of all these influences is an increase in code compliance and energy savings. Because several influences could contribute to an observed increase in compliance, an attribution analysis is required to determine the contribution of the PA activities.

The three critical analytical steps in the process are the following:

1. Define and measure code compliance before and after an intervention by PAs.
2. Determine the change in energy savings associated with the change in compliance.
3. Estimate what proportion of the change in compliance and energy savings was due to the PAs’ activities.

5.2. Measuring Code Compliance and Energy Savings

Since building energy codes are regulations, compliance should, in theory, be 100%. However, it is commonly believed that compliance with energy codes is incomplete and varies; numerous compliance studies conducted over the last two or three decades have confirmed that non-compliance occurs. Evidence suggests that non-compliance results from a lack of knowledge or understanding of the code by the industry and code officials, complexity of the code, frequent code upgrades, treatment as a lower priority compared to codes regarded as affecting health and safety, limited resources, and other reasons. These studies also have raised the question of how to define compliance in a meaningful way.

Like other building codes, energy codes delineate a set of conditions that must be met by new buildings and renovations to existing buildings. The codes often have a combination of mandatory and prescriptive requirements, with options for satisfying the code on a performance basis as an alternative to meeting the prescriptive requirements. Energy codes establish minimum efficiency requirements for the materials, operating conditions, and equipment in a building. They also typically specify requirements for documentation that provides the information needed to check compliance; these requirements can include things like providing drawings that indicate the type of insulation installed, posting labels on specific equipment or components, and providing output from energy compliance software.

In the discussion of methods for determining gross savings (see page 43), several approaches are presented for measuring code compliance. Because this document is intended to inform approaches to enhance energy savings from building codes, it addresses code compliance from the perspective of energy impacts. Consequently, this discussion of code compliance measurement is centered on how compliance affects energy savings.

Some approaches provide direct empirical information about energy consumption to inform estimates of energy savings resulting from compliance. Others are primarily aligned with the way enforcement officials assess code compliance. They focus on whether a building satisfies the regulatory requirements delineated by the code—if it satisfies all requirements, the building complies; if it does not satisfy all requirements, it does not comply. These approaches do not provide information on energy use, but could be used indirectly to estimate energy impacts of code compliance. The final approach is to rely on experts who are familiar with buildings and code compliance to estimate the compliance level and effect of compliance on expected energy savings. Each approach is discussed below.

Direct Empirical Approaches

Direct empirical approaches entail the direct estimation of energy use and savings of actual buildings constructed under the relevant energy code. There are two basic direct empirical approaches: (1) modeling and (2) billing data analysis. Both require information on buildings constructed under the code, but they differ in several fundamental ways.

Modeling Approach

The modeling approach compares the modeled energy use of an as-built building to modeled use of the same configuration building if it were built to exactly meet the code (reference building). A building energy simulation model is required and the actual characteristics of the building must be documented through site visits to the building. Calibration of the model with metered data can be used to improve the simulation estimates.

Compliance can be calculated as a percent based on the ratio of the modeled energy use of the reference building to the modeled use of the as-built building. Compliance would be less than 100% if the as-built building used more energy than the reference building. Compliance could exceed 100% if the as-built building used less energy than the reference building.

Advantages of this approach include these:

- The energy impacts of the compliance level can be determined directly.
- Estimated compliance and gross savings can be estimated very accurately.
- Since code savings are usually projected based on modeling, this approach provides a consistent metric to use to adjust projected code savings to account for compliance.
- Modeling permits other analyses to be conducted, such as sensitivity analysis, comparison of compliance of plans and buildings as-built, and analysis of savings relative to a prior code.

Disadvantages and challenges of the modeling approach include the following:

- Multiple site visits may be required, which could be difficult and expensive to accomplish.

- The sample size required to provide desired accuracy—typically from about 50 to a few hundred—could make the costs of site visits and analysis prohibitive.[1]
- At least two model runs are required for each sample building—as-built and reference building.
- Results must be extrapolated to the population of buildings.

A number of studies have used the modeling approach to assess code compliance. Examples include a recent study in California, several studies in Northeast states, and ongoing studies in Idaho and Washington. The tools used to measure compliance and energy impacts have varied depending on building type and location.

This method could be used to assess changes in compliance due to compliance enhancement efforts by modeling different buildings built to the code over time. It is essential to establish the baseline compliance level or adjust for any natural changes in code compliance by using an approach such as determining compliance of a control group.

Billing Data Analysis

The billing data analysis approach uses actual energy bills from buildings built under the new code and compares the results to buildings constructed prior to the new code. Consequently, two analyses are required. This approach actually does not estimate compliance, but estimates gross energy savings instead. The compliance rate for the prior code (if one existed) and the new code are reflected in the energy usage of the analyzed buildings.

Advantages of this approach include the following:

- The results are grounded in actual energy consumption data.
- Usually several thousand buildings can be analyzed for a modest level of effort and cost.
- No site visits are required.

Disadvantages and challenges include these:

- There may be obstacles to acquiring the customer billing data needed for the analyses.
- Billing data are likely to be required for multiple fuels.
- Analysis of buildings constructed under the new code must wait, not only until buildings have been constructed, but also until at least three seasons of billing data are available.
- It is not possible to know with certainty under which code new buildings were constructed, as such, some error may be introduced by mischaracterized buildings.

The authors are aware of only one study using this approach and it is still in process for the Salt River Project in Arizona.

[1] A typical residential baseline/code compliance study of 100 newly constructed single family homes can cost between $250,000 and $400,000. A typical commercial building baseline/code compliance assessment of about100 buildings can cost between $300,000 and $600,000.

Effects of compliance enhancement efforts could be determined with this method by analyzing billing data from buildings in an area where such efforts have been implemented with data from buildings in an area where no efforts have been implemented, as long as the same code is in effect in both.

Indirect Estimation Approaches

An indirect approach to estimate energy effects of code compliance could rely on information collected on compliance such as documents filed with building departments, building audits, or surveys of code officials. This information may provide an indication of code compliance, but does not produce energy usage or savings information directly, so a methodology is needed to estimate those values indirectly from the code compliance data collected.

The DOE/PNNL checklist, developed under the American Reinvestment and Recovery Act (ARRA), is an example of a method that provides an approach like this for assessing code compliance.[5] It presents a thorough list of the code requirements and a method for combining them to derive a compliance score. The checklist or tools such as COMcheck and REScheck, available from DOE to assess code compliance, provide comprehensive information on code compliance, but give no information on the energy performance of a building. It is necessary to develop a secondary methodology and use the checklist or other compliance data to produce desired energy impact results.

One process for estimating energy impacts of code compliance indirectly could be determining a relationship between energy use and various building efficiency characteristics by modeling prototype buildings with different levels of insulation and other efficiency measures. It would likely be possible to use the resulting relationship with the available compliance information to estimate energy effects.

Advantages of such indirect approaches include the following:

- Data collection is very similar to what is required to assess code compliance and could use the same processes or tools in some cases.
- If reduced accuracy is acceptable, data collection can rely on relatively inexpensive and easy to implement approaches such as surveys.

Disadvantages and challenges of indirect approaches include these:

- No readily available, broadly applicable tools are available to convert the data into energy impacts.
- Most of the disadvantages and challenges of the direct empirical approach also apply.

In general, the indirect approach can be as complex and resource-intensive as the direct modeling approach described earlier. The accuracy of the results depends on the sample size and the level of detail in the collected data. As an example, the DOE/PNNL checklist requires site visits and detailed data collection efforts comparable to those required to run a simulation model.

If reduced accuracy is acceptable, however, there may be shortcuts that can decrease the level of effort required in an indirect approach. For example, surveys of code officials and builders about typical construction practices can provide useful information that can be compared to code requirements. Instead of modeling a large sample of buildings, prototype buildings could be specified and analyzed using a standard building energy model. Alternatively, simulation models could be used to estimate how energy use varied with building and efficiency characteristics and then data from surveys about building practices or from site visits could be used in a simplified algorithm to estimate compliance energy impacts. Overall, there is more flexibility in varying the level of rigor using an indirect approach than using the more complete direct modeling approach.

We are unaware of any past compliance studies that have used the indirect estimation method as prescribed here to estimate energy impacts of code compliance. Some studies have conducted surveys to estimate typical construction practices as compared to code, but we have not identified any that generated energy impacts from these data.

The indirect estimation method could be applied to estimate the energy savings effects of code compliance enhancement activities. Once a data collection protocol, such as surveying code officials, is established and a method is designed to estimate energy consumption from such data, reported construction characteristics before and after an intervention could be input in the method to estimate changes in energy consumption. The accuracy and validity of the results, of course, depend on the same factors that apply to the empirical methods such as sample size and availability of a control group.

Expert Judgment

The expert judgment approach substitutes the knowledge of experts for some or all of the empirical data and analyses required in the first two approaches. Objective experts would be selected to provide estimates of compliance rates and energy consumption of buildings depending on their level of code compliance. Although it would be challenging to find sufficiently knowledgeable experts, likely candidates could be building energy analysts, utility staff involved in new construction programs, designers and architects, and code officials.

The more information provided to the expert group based on accurate analysis of code compliance and energy impacts, the better would be the results of their assessment. An iterative process, such as the Delphi panel, would facilitate the sharing of knowledge and help improve the group’s findings.

The main advantages of this approach are the following:

- Costs would likely be least of any of the methods.
- It should be relatively easy and quick to implement.

The approach has several disadvantages and challenges, including these:

- The results are likely to be the least accurate of the three approaches.
- It may be challenging to find sufficiently knowledgeable experts to provide quality inputs.
- It may be challenging to find sufficiently objective experts.

- It may be difficult to convince outside parties, such as regulators, that the results are adequately accurate.

To date, this type of approach has not been applied. It is appealing, however, because of its simplicity and low cost.

An expert judgment approach could be extended to assess the code compliance and energy impacts of code compliance enhancement efforts. Reliability of the estimates, however, would depend greatly on the quality and scope of information that could be provided to the experts about the compliance enhancement activities, who was involved, baseline conditions, and other factors.

5.3. Attributing Compliance Enhancement

As described in the opening of this chapter, three analytical steps are required to determine attribution of code compliance changes to the efforts of PAs. These include:

1. Define and measure code compliance before and after an intervention by PAs.
2. Determine the change in energy savings associated with the change in compliance.
3. Estimate what proportion of the change in compliance and energy savings was due to the PAs' activities.

The preceding sections discussed the types of activities PAs can conduct to influence compliance and various methods for measuring compliance and energy savings due to enhanced compliance. As with determining savings due to code changes, methods to quantify and attribute compliance changes and their energy impacts can vary from deeming the values to quantifying them using *ex post* evidence-based estimations. Rationales and concepts similar to those that apply to attribution for development, adoption, and enhancement of codes also apply to attribution for compliance enhancement. All methods of determining attribution are dependent on judgment and have varying degrees of rigor.

Predetermining deemed effects of compliance enhancement efforts would be the simplest approach to implement, but the least accurate. It would likely require experts to make a judgment, in advance, about the overall change in compliance and energy use expected due to PAs' efforts. Providing the experts with supporting data and information would help inform their judgment. An expert panel using a Delphi-type approach could provide the basis for deeming the estimates.

An intermediate approach could be to establish specific targets or outputs that would have to be achieved to earn a deemed attribution value. For example, conducting five training sessions could qualify for 50% attribution of observed energy savings due to enhanced compliance. As with other attribution methods, the appropriate targets and their relationship to attribution would be determined through expert judgment. Using any available empirical data on how various activities affect compliance would help improve the estimates.

The most accurate approach would be to develop a rigorous process of using expert judgment in an evidence-based process to estimate attribution. The following types of evidence might be developed and provided to the experts:

- Program theory or logic, including a description of how PA efforts are expected to lead to increased compliance.
- Documentation on the types and frequency of PA training and participants and training materials.
- Surveys of trainees immediately after sessions to assess what they learned and how they intended to use it.
- Surveys of trainees several months after training to assess how they are using what they learned.
- Amounts and types of technical support provided by the PAs.
- Documentation of compliance efforts by other entities, including training and technical support.

Although designing an evidence-based *ex post* attribution approach would be challenging, protocols for conducting such a process with rigor can be designed and implemented. The California program evaluation has used this approach and it has been accepted by the California Public Utilities Commission.

5.4. Recommended Approaches to Estimating Savings Attributable to PA Code Compliance Enhancement Programs

Determine Appropriate Level of Rigor

The first principle in selecting an approach to estimate energy savings due to code compliance enhancement programs is to define how accurate and rigorous the approach needs to be. As stressed throughout this document, if PAs are to receive credit for energy savings from code enhancement efforts, the decision about the level of rigor applied to evaluating these efforts should be based on the same criteria used to select the rigor level applied to evaluating other energy-efficiency programs. The PA should explain its reasoning about the rigor level to the body that will approve its energy savings and verify that this level will be acceptable.

Because there is little widespread experience with compliance enhancement programs, we recommend that both their implementation and their evaluation be phased in. In the initial stages, only a modest level of rigor would need to be applied in evaluating them and the savings they could be credited with would be discounted to reflect the inherent uncertainty. Over time, the rigor should be increased and the savings credit should increase to reflect this increasing confidence in savings estimates. It is possible that efforts to assess compliance may generate concerns within building departments since the results might reflect negatively on the performance of local officials. One way to address these concerns is to let local officials know what information—such as individual (building) compliance results—will be published and when. Sharing results with building departments prior to broad publication might also help to manage this issue.

The level of rigor selected will determine the recommended steps in the remaining approaches. The following steps should be taken in most cases, though some would be eliminated or conducted at a minimum level if the required rigor is very minimal.

Document PAs' Compliance Enhancement Activities

The activities undertaken by PAs to enhance compliance need to be thoroughly documented. This documentation is important because it provides a portion of the evidence upon which attribution would be based. At a minimum, the PAs should provide tracking information on all activities indicating when they took place and where, whom the activities targeted, and whom received services. Examples of training materials or tools delivered also should be provided.

PAs should develop a program theory that characterizes how the activities are intended to enhance compliance. The theory should capture what activities occurred, what they provided, what outcomes were anticipated, and the mechanism expected to lead to the outcome of enhanced compliance.

Select an Approach to Estimate Compliance and Energy Usage

In a case requiring minimal rigor, the PA could choose to use experts to make judgments about compliance levels and their impact on energy use. In this case, this step would consist of developing criteria for selecting the experts and making the choices.

When more rigor and accuracy are required, the authors recommend designing a compliance estimation process based on documenting actual building characteristics and using energy modeling. Though more expensive than some indirect estimation procedures, a direct estimation approach does not require developing ways to infer compliance and energy impacts. It also provides the benefit of identifying what specific code requirements are problematic and would be good opportunities for focusing enhancement efforts.

There are challenges in conducting a direct empirical approach, including the difficulties of gaining access to buildings for data collection and collecting data on all the essential building components in an efficient way. To manage the costs of a direct empirical approach, sampling can be targeted or stratified. As more compliance studies are conducted using this approach, lessons learned these studies about sampling, data collection, and data analysis can be used to manage the costs of subsequent studies.

Determine the Baseline Compliance Level and Energy Use

In the simple approach using expert judgment, experts can be polled using a Delphi process to estimate the compliance level prior to PAs' compliance enhancement efforts. The experts also would be required to estimate energy usage. This process would benefit significantly from providing the experts with any available data, such as the results of market characterization studies, surveys of builders, utility program data, or billing data that would inform their knowledge of baseline building practices and energy consumption.

Using the more rigorous approach, the authors recommend selecting a sample of recently constructed buildings and conducting site visits to determine construction characteristics. The buildings should be selected in the same jurisdictions where the PAs' activities will be conducted. An appropriate energy simulation model should be selected for estimating the energy consumption of the buildings as built. In some cases, such models analyze the building as built and also as it would be constructed to just meet the code. The difference in estimated energy use for the two configurations indicates how much more or less energy the as-built building consumes compared to what it would consume if minimally code-compliant.

The cost of the baseline modeling can be varied by the number of buildings included in the sample. The sample size also has to take into account the desired precision of the energy estimates.

Determine the Enhanced Compliance Level and Energy Use

In an approach using expert judgment, the same experts would be asked to estimate the compliance level and energy use after the PAs implement their compliance enhancement efforts. Alternatively, they could be asked to estimate the change in compliance and energy use of buildings constructed after the compliance enhancement efforts are completed. In either case, the experts should be informed fully about the type of activities conducted to enhance compliance and provided feedback from recipients of services, such as training and plan review assistance. The authors recommend employing a Delphi panel process that would share feedback on the views of the experts.

Using the more rigorous modeling approach, another sample of buildings would be selected that were constructed after completion of the activities to enhance compliance. They would be modeled as the original sample was to estimate their energy consumption.

Estimate Energy Savings Due to Enhanced Compliance

Using the expert judgment approach, energy savings would be estimated as described above. Ideally, the savings would be normalized. For example, for residential buildings, normalized savings might be for an average home floor area and, for commercial buildings, it might be by building type and unit floor area.

With the modeling approach, energy savings would be determined by comparing the modeling results for buildings constructed after the activities to enhance code compliance to those constructed before. The comparison would need to be done on a normalized basis.

In both cases, the results would be extrapolated to the population of new buildings. A few commercial sources of building data exist, as well as public sources, which could be used to extrapolate to the population of new buildings.

In all cases, the estimated savings could be adjusted for the underlying, naturally occurring trend in code compliance. One way to do this would be to conduct similar analyses in control group areas that were not participants in the compliance enhancement activities. However, doing this analysis could be problematic if activities, such as training, were not localized, making it difficult to find a true control group. It would also add expenses and probably not be necessary if only a few years passed between the initial and final compliance analyses.

Determine Savings Attributable to PAs' Compliance Enhancement Activities

Both general methods would assess attribution of the savings to the PAs' activities using expert judgment. The approach relying on expert judgment throughout the process could use a simplified expert judgment process. One option would be for the experts to estimate in advance what the attribution would be and deem the value. A more stringent approach would assess attribution *ex post* based on which activities the PAs had completed using a scoring type system.

In the more rigorous scenario, an evidentiary approach would be employed. A group of impartial experts would be selected to judge information provided by the PAs documenting their activities and how they theorized the activities affected code compliance changes. The expert group would develop criteria and weights to evaluate the evidence provided and estimate what proportion of the savings could be attributed to the PAs' efforts compared to all other factors.

A final determination might be the allocation of energy savings among different PAs if several implemented activities to enhance code compliance. This would be straightforward if the activities were sufficiently localized and could be assigned based on the territory served by each PA. In cases where the jurisdictions overlapped or individuals operated across territories served by different PAs, the allocation process would be more difficult. The approach would probably be best negotiated among the PAs before the activities were undertaken.

6. RECOMMENDED REGULATORY PATHWAYS

This chapter integrates information presented in the earlier chapters to define the situation in a state in terms of conditions that must be met for PAs to receive credit for savings achieved through building energy code programs. Based on this information, the chapter develops a description of the challenges and opportunities available to PAs depending on the conditions that exist in their state.

In the first part of the chapter, we revisit the strategy matrix introduced in Chapter 2 that characterizes the conditions in each state. For states where PAs are already receiving credit for savings from their code programs, we will summarize the main elements of their program and processes. For states where programs do not currently exist, we will recommend initial steps that PAs can take to develop an energy code program. Our recommendations will focus on challenges and opportunities that states in each common group may face.

The second part of the chapter will introduce a process roadmap based on the paths that have been taken by the more developed programs. The roadmap spans the time from the initial program concept through the stage when the program has been credited with energy savings. It reflects our understanding of how some code program concepts have gained regulatory acceptance and approval. The roadmap also provides a broader context for the near-term steps discussed in the first part of the chapter.

6.1. The Next Steps: Developing PA Code Programs

The strategy matrix presented in Chapter 2, and reintroduced below, allows us to group states together depending on the conditions that they meet (and do not meet) and address the challenges and opportunities for groups of similar states.

Table 3. Strategy Matrix for Developing PA Code Programs

Energy-Efficiency Policy Condition		Does state code exist?		Does local code exist?		Who enforces code?			Row No.
		Yes	No	Yes	No	Local	State	Not enforced	
1. Are there energy-efficiency goals and/or incentives for PAs?	Yes	CA, CT, GA, IL, IA, MD, MA, MN, NH, NY, OH, OR, RI, VT, WA	AZ, CO	AZ, CA, CO, IL, MD, MA, NY	CT, GA, IA, MN, NH, OH, OR, RI, VT, WA	AZ, CA, CO, CT, GA, IL, IA, MD, MA, MN, NH, NY, OH, OR, RI, VT, WA	GA, IA, NH, OH, OR, VT, WA	MN*	1
	No								2
2. Do code savings count towards an energy efficiency goal?	Yes	CA, NY, OR, RI, WA		AZ, CA, NY		AZ, CA, NY, OR, WA	OR, WA		3
	No	CT, GA, IL, IA, MA, MD, MN, NH, OH, VT		CO, IL, MA, MD		CO, CT, GA, IL, IA, MA, MD, MN, NH, OH, RI, VT	GA, IA, NH, OH, VT	MN	4
3. Does a quantification method exist?	Yes	CA, NY, OR, RI, WA		AZ, CA, NY		AZ, CA, NY, OR, WA	OR, WA		5
	No								6
4. Does a method exist to attribute savings to PAs?	Yes	CA, NY, OR, RI, WA		AZ, CA, NY		AZ, CA, NY, OR, WA	OR, WA		7
	No								8
5. Is a change in code compliance counted?	Yes	RI							9
	No	CA, NY, OR, WA		AZ, CA, NY		AZ, CA, NY, OR, WA	OR, WA		10

*Minnesota is identified here as a state where code is not enforced in some rural areas. Cadmus has learned that the situation is very likely the same in other Midwestern states (at least).

For the Six States Where Code Savings Count

We noted that there are 6 states in which code savings count towards an energy efficiency goal: Arizona, California, New York, Oregon, Rhode Island, and Washington. These states are also alike in that methods have been defined to quantify savings from code programs and to attribute code program savings to PAs. Beyond this there are some significant differences discussed below:

- ***California.*** Note that the California IOUs are also the PA for the single statewide code program. This is the only state where savings from PA code programs have been claimed, evaluated, and attributed to the PA/IOUs. It is also the only state where code program savings have directly benefitted the state IOUs in terms of credit towards overall energy savings goals. All building energy code program savings credited to the utilities to date have been the result of the development and adoption of the statewide (Title 24) energy code. IOUs are currently seeking savings credit for local reach codes, but no savings have yet been claimed for program support of code compliance.
- ***Arizona.*** Note that the Arizona utilities are also the PAs for their respective code programs. The structure for code savings to be counted is largely defined, but it has not yet been exercised with actual claimed savings. To date, all savings are expected to result from adoption of an energy code by local jurisdictions. In Arizona, the PA/utility is expected to receive credit towards efficiency goals from code program savings.

- ***Rhode Island.*** The structure for code savings to be counted is defined in the 2013 energy efficiency plan, but it has not yet been exercised with actual claimed savings.

New York, Oregon, and Washington—where code program savings also count - differ from the three states described above. The primary difference is that the state or regional structure has integrated code program savings into energy-efficiency potential studies and resource planning such that code program savings count towards overall efficiency goals. However, the PAs that manage these programs are not IOUs and utilities in these states do not operate code programs or receive any direct credit for code program savings (although IOUs in Washington, Idaho, and Montana do get savings credit for more conventional energy-efficiency programs). It is not clear whether utilities in these states can realize any benefits from changing the current structure. As it stands, code programs appear to be actively working to support the adoption of new codes and compliance to the current code. Evaluations currently in progress are expected to provide additional information on these code programs and their impact in their respective states.

- ***New York.*** NYSERDA is the PA for the Technology and Market Development (T&MD) portfolio. This portfolio includes all code support activities in New York State.[m] To date, code program savings have been the result of the adoption of energy codes rather than changes in compliance. In New York, code savings are claimed and accepted for planning purposes. More rigorous evaluation of code savings is currently in progress.
- ***Oregon and Washington.*** NEEA is the PA for the code program in these states. In addition, Energy Trust of Oregon conducts efficiency programs funded by the IOU system benefits charge. Code program savings are the result of adoption of energy codes rather than changes in compliance. Code savings have been integrated into planning processes based on analysis, but more rigorous evaluation is underway.

Since code programs are more developed in these six states, the challenges and opportunities for them are quite different than for the other states. Another way to describe this is that they have more mature code programs which also places them in a different position on the roadmap described later in this chapter. The challenge for these programs is to continue to find code savings to follow on the codes already adopted.

For the 11 States Where Code Savings Do not Count

For the group of states Colorado, Connecticut, Georgia, Illinois, Iowa, Maryland, Minnesota, New Hampshire, Ohio, Rhode Island, and Vermont, the situation is that a state or local code exists, but code savings do not count towards an energy-efficiency goal. For states in this situation, there is typically not a PA code program in existence. Therefore, the major challenge is the creation of a building energy code program where the other six states already have code programs.

A first step that PAs, utilities, and code program advocates have used to get started is identified in the list of additional activities and strategies in Chapter 3. Specifically, it is to initiate or support an energy code collaborative (or task force). Such a body can be helpful in building the case for an energy code program. Regardless of whether a well-defined or named group begins to

[m] Both NYSERDA and IOUs implement programs to support the New York EEPS portfolio.

meet, the initial and essential activity is to connect stakeholders in the key organizations including PAs/utilities, regulators, advocates, and other stakeholders (if they exist or are known).

One way that a stakeholder group helps to build the case is through a local situation analysis. The environment in each state is different and discussion of possible aspects of a code program needs to incorporate these local factors. For example, in Illinois the law requires automatic updating of the building code for each new version of the IECC code. This reduces the opportunity for a code program to obtain savings from adoption or enhancement of the statewide code. Since Illinois law does allow for more stringent local codes, though, there may be an opportunity to advocate for the adoption of a stretch (or reach) code by local jurisdictions. The situation is much different in a state like Colorado where there is not a mandatory statewide code. In this situation, key stakeholders, including regulators and regional efficiency advocates are in the best position to assess the potential for an effort to adopt a statewide code. This type of situation assessment is a core activity at the beginning of a code initiative and must be refreshed at intervals if the effort is to pursue the best opportunities and correctly assess the challenges for a specific state.

Once the situation has been assessed and stakeholders support an energy code program in concept, the emphasis shifts to program design. We suggest that the program design include at least one code program action since these are the primary sources of code savings and also some aspect of the enabling activity that advocates for recognition of savings from code programs.

There are a number of possible actions to consider in terms of the code support activities identified in Chapter 3. The program design depends on the results of the analysis that must be completed on each proposed activity. We have provided a starting point by including a summary of the recent IMT Assessment of Energy Savings Achievable from Improving Compliance with US Building Energy Codes in Appendix A.

In terms of program design, we offer the following steps as a guideline for PAs to follow:

Identify one or more Code Program Actions to pursue since these are the source(s) (eventually) for savings from code programs. These are the three major categories that have been used to date:

- State code development and adoption
- Local code development and adoption
- State and local code enforcement and compliance

Identify one or more Enabling Activities since these are on the critical path to eventually receiving credit for any savings achieved.

- Advocate for regulatory recognition of savings from code program
- Establish methods to quantify savings from statewide code adoption
- Establish methods to quantify savings from local code adoption
- Develop methods for quantifying savings from changes in compliance
- Support development of an attribution framework

Consider the Additional Activities and Strategies discussed in Chapter 3, Review of Code Support Activities, since these can help to build support for the program with little additional cost. For example, PAs can pursue efforts to integrate code adoption and compliance into energy-efficiency resource-planning.

Analyze program activities using the criteria provided in Chapter 3 (and any additional criteria that are required by the PA's organization). Compared to most other types of energy-efficiency programs, energy code programs require a much longer time period to begin producing savings. Also, there are significant risks and uncertainties in terms of the amount of the savings and whether such savings will ever be counted. For all of these reasons, code programs will usually fail short-term cost effectiveness tests. The criteria to consider include these:

- Potential energy savings
- Resource requirements
- Cost-effectiveness
- Feasibility
- Time requirements
- Risks and uncertainties

Additional Opportunities

Absence of a mandatory statewide code. As shown in Table 3, two states in the study group do not currently have a mandatory[n] statewide energy code. (Also, as noted in Chapter 2 and Appendix B, ten states total do not have statewide energy codes.) In these states, there is clearly an opportunity to advocate for the adoption of a required statewide code. At the same time, we expect that it would be very challenging to succeed in having these states adopt a statewide code since both Arizona and Colorado have longstanding traditions as home rule states. In both states, local jurisdictions have adopted building codes and a strategy to advocate local code adoption targeted at the most populous cities might be more likely to succeed and to subsequently produce savings.

As with any opportunity, a logical first step is to assess the potential benefit of the action. In Colorado for example, approximately 90% of new construction is located in areas that have adopted the 2009 IECC. In this case, the adoption of a statewide code may have little or no impact on a major IOU such as Xcel Energy.

Gaps in code enforcement. For Minnesota, Table 3 (Row 1) indicates that the energy code is enforced locally and that there are parts of the state (estimated at 20%) where code is not enforced (based on information received through the Advisory Committee). Cadmus has learned that there are areas in other states where the energy code is not enforced, but this was the only specific case identified by our research for the 17 states. In such instances, Cadmus identifies an opportunity to extend enforcement and possibly to generate savings through a resulting change in compliance. Clearly, more research is needed to determine the savings potential of an enhanced enforcement approach and the expected cost needs to be weighed against the projected benefit.

[n] Arizona has adopted a voluntary statewide code based on IECC for residential construction and ASHRAE for commercial construction.

6.2. Process Roadmap and Recommended Future Steps for Policy Stakeholders

In the conceptual roadmap for the process of developing a building energy code program, the authors identify three stages for programs as they progress from an informal concept into a fully functioning program.

- Initial Stage
- Intermediate Stage
- Final Stage

Table 4 summarizes the process roadmap. It includes a brief description of each stage, the role of the PA, the role of the regulator, and some of the barriers that energy code programs typically encounter. Using the findings from the strategy matrix and other research, the authors placed each of the 17 states into one of the three roadmap stages.

Table 4. Process Roadmap for PA Energy Code Program Development

	Initial Stage	Intermediate Stage	Final Stage
State Status	**CO, GA, IL, IA, MD, MN, NH, OH, VT**	**AZ, CT, MA, RI**	**CA, NY, OR, WA**
Description	Situation analysis in progress Code program not yet staffed, funded Stakeholders not connected	Code program established and funded Enabling issues are being addressed Savings not yet claimed Evaluation and attribution processes not exercised	Code program produces savings (claimed) Evaluation process validates savings Attribution process assigns savings to PAs
PA Role	Initiate code collaborative / task force Develop code program proposal State / local code adoption Compliance enhancement Plan to address enabling issues Define resources and timeline	Continue collaborative / workshops Engage with stakeholders Administer program Drive code adoption / compliance Propose solutions for EM&V, attribution	Plan for ongoing program operation Claim program savings Support evaluation Provide evidence for attribution Continue to plan for future code actions
Regulator Role	Participate in code collaborative Support program funding Work to address enabling issues	Continue to work with stakeholders Support longer-term funding needed Consider proposals on enabling issues	Recognize program savings Support future funding Expect code savings in portfolio
Barriers	Potential studies do not include savings from building energy codes Regulatory processes do not recognize savings from code programs Multiyear timeline of code programs fails single year cost-effectiveness tests Evaluation methods are not defined for energy savings from code		

Description. The description lists a few characteristics that are meant to convey the general situation for programs in each of the three stages. In the initial stage, the code program does not exist and, perhaps most importantly, stakeholders, and key advocates are not yet supporting the program. The nine states identified in the first part of the chapter that do not have a code program in place are placed in this stage. And the process previously suggested for designing a program applies directly to PAs in the initial stage.

The intermediate stage is characterized by states where PAs have found support for a code program including some resources to allow the program to be staffed and carry out its activities. Programs in the intermediate stage are still at risk in terms of securing additional funding since they have not yet produced savings. It is also possible that some of the enabling issues have not been addressed. Arizona, Connecticut, Massachusetts, and Rhode Island are all placed in the intermediate stage. In these states, the PAs are actively working to resolve the remaining issues but savings have not yet been claimed and the processes have not been exercised—that is evaluated savings have not been credited to the PAs.

In the final stage, the mature program has been successful in claiming savings and receiving credit through the full evaluation and attribution process. Consistent with the discussion above, California, New York, Oregon, and Washington are placed in the final stage since PAs have received credit for savings in each of these states.

PA and Regulator Roles. These two rows list a few of the key activities that the PAs and regulators are expected to be doing during each stage. We expect that the PAs take an active role in creating interest in the concept, designing the program, securing resources, and making the program successful. On the other hand, regulators are not expected to drive the process but to provide feedback on the proposed changes.

Barriers. There are many barriers and issues that have the potential to slow the development of a code program or to prevent a program from receiving savings credit. A few of these are identified in this row of the chart and others have been discussed throughout this report. Among the most challenging of these is the difference between the timeline for most energy-efficiency programs in which program operation produces savings within one or two years and the timeline for a code program where an effort like the one in California operated for several years with the IOUs receiving no credit for savings.

6.3. Historical Perspectives and Conclusion

In our experience with the code programs in California, Arizona, Massachusetts, Oregon, and Washington, there has been a common ingredient that appears to be critical to the development of the programs. This is referred to briefly in the roadmap as the code collaborative or task force. In most cases, a group of stakeholders has shared a common interest in the development of a code program throughout the stages described in the roadmap. It has also often been the case that this group meets outside of the mainstream processes for other energy-efficiency programs for much of the early part of the program history. This may change in the future as awareness of code programs grows in the coming years.

In California, activity to develop a code program goes back at least until the early part of the last decade. The utilities recognized the need for an evaluation protocol that would allow for code savings to be quantified and evaluated. They worked with the CPUC to have this protocol approved and in this we see the cooperation between the PAs and the regulators. Other stakeholders were also involved at numerous points in the history of the California program including a number of consulting firms, the Natural Resources Defense Council, and other energy-efficiency advocates.

In the other states a similar history can be discerned. In the Southwest, SWEEP worked with the Arizona regulators and utilities to help advance the code concept in that state. In the Northwest, the NPCC worked closely with NEEA, BPA, and many of the utilities in the region to integrate savings from energy code into the regional regulatory and planning processes. In New York, Massachusetts, and Rhode Island, NEEP has been an advocate as utilities and regulators have worked closely together to establish code programs and overcome issues.

Based on this history, the authors recommend that PAs begin the development of code programs by identifying stakeholders in their state and region and verifying if an energy code collaborative has been set up either by BCAP or a regional alliance, and to explore their interest in developing this concept into a functioning program.

A second activity that has emerged as a tactic for the introduction of code programs is the adoption of a local code. In states where there is no statewide code such as Arizona and Colorado, this is the only way that code savings have become possible to date. When a statewide code is in force, adoption of a more stringent local code as in California and Massachusetts has the benefit of introducing the higher efficiency code without requiring statewide approval. This effectively creates a pilot or test environment that can ease statewide adoption at some point in the future.

As code programs have matured in states like California and the others shown above, the authors observe that savings from the adoption of new codes become more difficult since the base code has become more stringent due to the program's effect over time. In this situation, Cadmus recommends that the code program continue to look for opportunities and again, the adoption of local codes is one approach to avoiding statewide resistance. Other tactics that may be complementary include advanced home initiatives or Zero Net Energy programs. Although these are not code programs, they also may enable demonstration of advanced concepts that could become code at a later date.

APPENDIX A. SUMMARY OF IMT ASSESSMENT OF ENERGY SAVINGS ACHIEVABLE FROM IMPROVING COMPLIANCE WITH US BUILDING ENERGY CODES: 2013–2030

This appendix describes the approach, data sources, and key assumptions used in IMT's assessment of the energy savings potential by state from achieving full (100%) compliance with building energy codes.[o] There are many challenges in accurately forecasting the potential savings from energy codes activities, in part due to the high degree of uncertainty in compliance rates, future construction levels, code adoption, energy demand and prices. This exercise should be considered a first step in understanding the potential gains from investments in improved compliance with existing building energy codes across the United States.

Although the potential savings from existing buildings are likely significant, this analysis was restricted to code compliance in new residential and commercial construction given the uncertainty of data for retrofits and renovations. All values are presented in 2011 dollars.

1.1 New Construction

New residential construction forecasts by state were derived using US Census Bureau data on new single-family and multifamily housing permits from 1990-2011. Single family permit levels are projected to rise 20% and 30% in 2012 and 2013, respectively, and a conservative 10% each year thereafter, reflecting a recovery of new housing construction from current recessionary levels. Multifamily permits are projected to rise 20% in 2012 and 6% each year thereafter. This levels out to a conservative 1.5 million single family starts and 480,000 multifamily starts in 2022.

New commercial construction forecasts by state were derived from US EIA Annual Energy Outlook 2012-2035 forecasts for US commercial construction. The CoStar database was used to distribute square footage by state based on historic construction levels. Forecasts for years 2013-2015 were diminished to reflect near-term recessionary conditions.

Residential and commercial construction forecasts exclude the estimated state market share of ENERGY STAR, LEED, or other voluntary beyond-code programs, as these buildings are assumed to meet or exceed the minimum code requirements. In states without a mandatory statewide code—AL, AK, AZ, CO, KS, ME, MS, ND, SD, and WY—we estimate the share of new construction subject to the energy code based on jurisdictional adoption status and 2011 US Census Bureau residential permit figures by county and/or city.

1.2 Baseline Compliance

After a thorough literature review of statewide compliance evaluation studies, we found that only fourteen states have completed residential code compliance evaluation at any point over the last decade; only 10 states completed commercial code compliance evaluations during this period. There are significant questions surrounding the accuracy and statistical significance of the results in many of these reports. Almost all noted self-selection, sampling biases, and other methodological limitations, suggesting the findings may overstate true non-compliance levels. Given the overall uncertainty surrounding energy

[o] For a full discussion of the methodology and complete results, see Stellberg, Sarah. 2013. *Assessment of Energy Efficiency Achievable from Improved Compliance with U.S. Building Energy Codes: 2013 – 2030*. Available at www.imt.org

code compliance rates in most states, we opted to run the model for a range of baseline compliance rates. The endpoints were set as follows:

- High savings scenario: low (25%) baseline compliance.
- Low savings scenario: high (75%) baseline compliance.

Compliance is defined at the whole-building level – for example, a rate of 75% signifies that ¾ of all buildings were in full compliance with the code. The degree of non-compliance was captured using an "energy loss factor", which represents the average energy losses per home due to non-compliance. We assume a default energy loss factor of 15% for each state (i.e. a non-compliant building uses 15% more energy than an identical building constructed to code.) This loss factor is consistent with the average non-compliance impacts found in baseline compliance evaluations.

1.3 Energy Consumption

Residential

Baseline energy use intensities for the residential sector were derived primarily from the PNNL publication series, *Energy and Cost Savings for New Single– and Multifamily Homes: 2012 IECC as Compared to the 2009 IECC.*[p] These reports provide an estimate of the consumption intensity for space heating, water heating, cooling, and lighting under each state's current code, the 2009 IECC, and the 2012 IECC.

In states where a PNNL analyses was unavailable—CA, FL, IL, MD, NC, OR, and WA—baseline consumption was constructed using data from the 2009 Residential Energy Consumption Survey (RECS).[q] For each climate zone and fuel type, we derive an estimate of average space heating, water heating, and space cooling consumption for new homes.[r] To capture the mix of natural gas and electric space and water heated homes, we assign weights to each consumption intensity based on the distribution of homes by principal water or space heating fuel in each Census Region or state,[s] as reported in RECS. The RECS database does not track a separate consumption estimate for lighting. For simplifying purposes, we assume an average annual consumption of 2,000 Btu per household for lighting.

Average multifamily consumption was estimated by multiplying single family figures by the average ratio of multifamily to single family energy consumption for code-covered uses.

Commercial

Baseline energy use intensities for the commercial sector (Btu/ft2) were derived primarily from the EIA's 2003 Commercial Buildings Energy Consumption Survey (CBECS). We derive an estimate of the average annual consumption for each end use—heating, cooling, water heating, lighting, and ventilation—by fuel type, vintage, and climate zone.

Natural gas and electric consumption for space and water heating reflect the annual usage in an exclusively natural-gas heated building or an exclusively electric-heated building, respectively. To capture the mix of natural gas and electric space and water heated buildings, we assign weights ($Share_{fuel,enduse}$) to each consumption intensity based on the distribution of structures by principal water or space heating fuel in each Census Region or state,[t] according to EIA's 2003 Commercial Building Energy

[p] Available at: http://www.energycodes.gov/development/residential/iecc_analysis.
[q] As of June, 2012, EIA has published only the 2009 RECS Household Characteristics and Summary tables. The 2009 RECS detailed Consumption and Expenditures tables remain unpublished.
[r] New homes in this case refer to the most recent age category reported in RECS, 2000-2009.
[s] For the 16 states for which detailed data is available
[t] For the 16 states for which detailed data is available.

Consumption Survey. For example, $Share_{NG,WH}$ represents the percent of buildings in that state using Natural Gas as the principal water heating fuel.

Given these inputs, we use the following equations to create a weighted average energy profile for the "typical" home or commercial building in each state:

$$Consumption_{NG,Total} = (Share_{NG,SH}*Consumption_{NG,SH}) + (Share_{NG,WH}*Consumption_{NG,WH}) \quad (1)$$
$$Consumption_{E,Total} = (Share_{E,SH}*Consumption_{E,SH}) + (Share_{E,WH}*Consumption_{E,WH}) + Consumption_{E,SC} + Consumption_{E,L} \; (Share_{E,V}*Consumption_{E,V}) \quad (2)$$

where:

$Consumption_{fuel,enduse}$ = average annual consumption per household for the indicated fuel and end use,
$Share_{fuel,enduse}$ = share of households using principally the indicated fuel for the indicated end use, and
$Consumption_{Fuel,Total}$ =weighted average annual consumption of the indicated fuel for a code compliant home.

NG = Natural Gas
E = Electricity

SH = Space Heating
WH = Water Heating
L = Lighting
V = Ventilation

1.4 Evaluation of Potential Savings

The total potential energy savings is calculated for each fuel type by multiplying the non-compliance energy impact by baseline energy consumption, and scaling by the number of new non-compliant single and multifamily units. The final calculation process used is shown in **Figure 6**. To estimate the net lifetime savings of the compliance effects in a particular year, we multiply the single year savings estimates by an expected 25 year savings lifetime. We assume constant real electricity and natural gas prices at 2011 levels, as published in the Energy Information Administration (EIA) State Energy Data (SEDS) database. We conservatively exclude the impact of rising fuel costs as a result of tightening environmental standards or other political, regulatory or market influences.

Figure 6. Breakdown of Calculations

$$\left(\text{Non-Compliance Energy Impact}\right) = \left(\text{New Construction (units or ft}^2\text{)} - \text{Beyond code market share (units or ft}^2\text{)}\right) \times \left(\text{Non-compliance Rate (\%)}\right) \times \left(\text{Code Compliant Energy Consumption, Natural Gas (Btu), Electricity (kWh)}\right) \times \left(\text{Non-compliance Energy Impact (\%)}\right)$$

	Low Savings Case 75% baseline compliance				High Savings Case 25% baseline compliance			
	Dollars	Total Energy (MMBtu)	Electricity (MWh)	Natural Gas (MMBtu)	Dollars	Total Energy (MMBtu)	Electricity (MWh)	Natural Gas (MMBtu)
Arizona								
1st Year Impacts	$901,690	36,885	7,458	11,437	$2,705,069	110,656	22,375	34,310
10th Year Impacts	$18,912,482	778,205	163,390	220,697	$56,737,446	2,334,616	490,169	662,092
California								
1st Year Impacts	$5,083,859	189,056	30,242	85,867	$15,251,576	567,169	90,726	257,600
10th Year Impacts	$113,059,731	3,985,803	702,652	1,588,257	$339,179,194	11,957,409	2,107,955	4,764,770
Colorado								
1st Year Impacts	$1,125,542	72,566	7,537	46,848	$3,376,625	217,699	22,612	140,544
10th Year Impacts	$23,230,432	1,419,569	169,142	842,433	$69,691,296	4,258,708	507,426	2,527,300
Connecticut								
1st Year Impacts	$645,490	26,005	2,649	16,966	$1,936,469	78,014	7,947	50,898
10th Year Impacts	$13,241,884	506,963	59,891	302,606	$39,725,653	1,520,890	179,674	907,817
Georgia								
1st Year Impacts	$2,810,029	102,148	24,185	19,626	$8,430,088	306,445	72,555	58,878
10th Year Impacts	$54,773,143	2,011,016	481,451	368,235	$164,319,428	6,033,047	1,444,354	1,104,706
Illinois								
1st Year Impacts	$1,374,176	88,243	9,570	55,588	$4,122,529	264,728	28,711	166,763
10th Year Impacts	$28,958,305	1,784,648	221,855	1,027,647	$86,874,914	5,353,943	665,565	3,082,940
Iowa								
1st Year Impacts	$533,118	32,629	3,779	19,733	$1,599,353	97,886	11,338	59,200
10th Year Impacts	$9,856,217	597,383	76,010	338,026	$29,568,650	1,792,148	228,030	1,014,078
Maryland								
1st Year Impacts	$1,237,435	41,989	9,181	10,661	$3,712,305	125,967	27,544	31,982
10th Year Impacts	$25,656,630	869,842	196,907	197,966	$76,969,889	2,609,526	590,722	593,899
Massachusetts								
1st Year Impacts	$1,357,097	58,761	5,681	39,378	$4,071,291	176,284	17,042	118,133
10th Year Impacts	$27,461,981	1,118,282	126,449	686,819	$82,385,943	3,354,847	379,348	2,060,456

	Low Savings Case 75% baseline compliance				High Savings Case 25% baseline compliance			
	Dollars	Total Energy (MMBtu)	Electricity (MWh)	Natural Gas (MMBtu)	Dollars	Total Energy (MMBtu)	Electricity (MWh)	Natural Gas (MMBtu)
Minnesota								
1st Year Impacts	$1,114,979	70,252	7,653	44,138	$3,344,938	210,757	22,960	132,415
10th Year Impacts	$21,417,213	1,323,902	158,499	783,080	$64,251,638	3,971,706	475,498	2,349,241
New Hampshire								
1st Year Impacts	$347,665	16,360	1,238	12,135	$1,042,995	49,080	3,715	36,404
10th Year Impacts	$6,486,029	291,424	25,620	204,005	$19,458,086	874,272	76,860	612,016
New York								
1st Year Impacts	$3,413,084	135,760	13,238	90,591	$10,239,253	407,281	39,714	271,773
10th Year Impacts	$63,777,826	2,425,192	271,620	1,498,385	$191,333,478	7,275,576	814,861	4,495,156
Ohio								
1st Year Impacts	$1,517,269	85,212	9,954	51,248	$4,551,806	255,637	29,862	153,743
10th Year Impacts	$32,246,315	1,756,340	230,219	970,801	$96,738,944	5,269,019	690,656	2,912,402
Oregon								
1st Year Impacts	$585,563	28,416	5,187	10,717	$1,756,688	85,247	15,561	32,151
10th Year Impacts	$11,093,425	540,263	102,462	190,648	$33,280,276	1,620,790	307,387	571,943
Rhode Island								
1st Year Impacts	$161,585	6,829	784	4,156	$484,754	20,488	2,351	12,468
10th Year Impacts	$3,492,941	142,086	18,520	78,892	$10,478,824	426,258	55,561	236,676
Vermont								
1st Year Impacts	$160,840	7,485	395	6,137	$482,519	22,456	1,186	18,410
10th Year Impacts	$2,559,821	117,617	6,772	94,511	$7,679,464	352,851	20,315	283,534
Washington								
1st Year Impacts	$1,211,898	64,757	11,855	24,305	$2,126,081	112,866	22,237	36,989
10th Year Impacts	$23,255,414	1,238,605	235,336	435,605	$47,002,930	2,488,325	505,034	765,079

APPENDIX B. OVERVIEW OF CODES AND EFFICIENCY PROGRAMS

TableB-1. Overview of Building Code Policy

State	Development and Adoption	Compliance and Enforcement	Stakeholders
Arizona	• Home rule state • State adopted IECC code as guideline • Codes adopted by local gov'ts. Adoption processes vary. • Code adopted is usually IECC with variations	• Local enforcement, usually with plan review, site inspection, or voluntary demonstration of compliance. • Compliance identified as concern by Governor's office. • State funds available for education of officials and contractors. • Use of REScheck and COMcheck has increased recently.	• Governor's office of energy policy (GEOP) • Arizona Building Officials (AZBO) • Local code officials • Regional Home Builders Associations • Public utilities and IOUs • Southwest Energy Efficiency Project (SWEEP)
California	• California-specific code (Title 24) with locally developed codes • State code adopted by California Energy Commission • Local jurisdictions can adopt more stringent "Reach Codes" • CEC has to approve local codes if they are to be enforced	• Enforcement by local jurisdictions through plan review and site inspections by code official • Must show compliance to receive building permit • Compliance for new buildings and major renovations demonstrated with CA specific software • Compliance is permitted through both prescriptive and performance approaches.	• California Energy Commission (CEC) • CA Building Standards Commission (BSC) • California Building Officials (CALBO) • Local code officials • IOUs / Utilities • California Building Industry Association (CBIA) • CA Assoc. of Building Energy Consultants
Colorado	• Home rule state • Voluntary adoption encouraged by state energy office and Dept. of Local Affairs which provide training and assistance. • Codes adopted by local governments. Adoption processes vary. • Code adopted is usually IECC with variations • Statute requires that code (if adopted) meet or exceed IECC 2003	• Enforcement by local jurisdiction, typically through plan review and site inspections • Most jurisdictions require, at minimum, ICC building inspector and/or plans examiner certification	• Colorado Energy Codes Support Partnership • Colorado Governor's Energy Office (GEO) • Department of Local Affairs (DOLA) • Association of Code Enforcement Officials • Colorado Association of Home Builders • Southwest Energy Efficiency Project (SWEEP)
Connecticut	• Codes adopted at state level at least every four years • Energy code considered every three years following latest IECC publication • Amendments to IECC adopted by the state building inspector and Codes and Standard Committee • Amendments open to public comment	• Enforcement at municipal level by local building inspectors • Compliance determined through plan review or building modeling by a licensed registered professional	• Codes and Standards Committee • Office of the State Building Inspector • Connecticut Building Officials Association • Assoc. of Housing Code Enforcement Officials • Home Builders & Remodelers Association • Eastern Connecticut State University • Connecticut Dept. of Construction Services • NEEP
Georgia	• Code changes managed by state administrative procedure process and includes publication, public comment, and hearings • Amendments updated annually • Task force reviews every three years following IECC updates • Codes adopted by Department of Community Affairs (DCA)	• Local enforcement by building inspectors through spot checks • In some jurisdictions, builders demonstrate compliance during plan review and local inspection • Even if not enforced locally, builders required to comply with state code • Some jurisdictions allow registered professional statement that design conforms to code • An Energy Code Compliance Certificate must be completed by a builder or design professional, posted on the building's electrical panel, and submitted to the state Office of Buildings.	• Department of Community Affairs (DCA) • Georgia State Codes Advisory Committee • Southeast Energy Efficiency Alliance (SEEA) • State Building Administration Board • Southface Energy Institute • Home Builders Association • Georgia State Energy Office

State	Development and Adoption	Compliance and Enforcement	Stakeholders
Illinois	• Statewide code automatically updated for each new IECC • State code agency can amend the IECC • Amendments go through state process of publication, comment, and hearings • Local jurisdictions allowed to adopt more stringent codes for commercial buildings	• Enforcement by local jurisdiction • Dept. of Commerce and Economic Opportunity provides training to officials and practitioners • Illinois Energy Office administers training programs to provide technical assistance to local jurisdictions and builders funded through public service charge • Compliance requirements vary; some jurisdictions require site inspections	• Dept. of Commerce and Opportunity (DCEO) • Capital Development Board (CDB) • Local / Regional code official organizations • Chicago's Department of Buildings • Home Builders Association of Illinois • Midwest Energy Efficiency Alliance (MEEA) • American Institute of Architects (Illinois Chapter) • Illinois Chapter of ASHRAE
Iowa	• Statewide code based on IECC • Reviewed by Dept. of Public Safety every three years following IECC • Adoption of latest IECC is not required • Requested amendments requested through state process of publication, comments, and hearings	• Enforcement of the energy code is mandatory statewide while other codes are subject to home rule • Residential builders document energy code compliance to local utility • For commercial builders, compliance is enforced through plan reviews and inspections by State Building Code bureau	• Iowa Department of Public Safety • Iowa Building Code Commissioner • Iowa Building Code Bureau • Iowa Association of Building Officials • Iowa Office of Energy Independence • MEEA
Maryland	• Statewide code--MD Building Performance Standards (MBPS)--updated every three years following IECC • Code is adopted by Dept. of Housing and Comm. Development (DHCD) • Commercial code is the ASHRAE 90.1 Standard • Process includes publication, comments, and hearings • Local jurisdictions allowed to adopt more stringent codes	• Enforcement by local jurisdictions through plan review and site inspection • Compliance demonstrated using REScheck and COMcheck software	• Dept. of Housing and Comm. Development. (DHCD) • Maryland Building Officials Association • Home Builders Association of Maryland • NEEP • Maryland Energy Administration • Institute for Market Transformation • Building Codes Assistance Project • American Institute of Architects (AIA) • Associated General Contractors of America
Massachusetts	• Statewide code adopted by the Board of Building Regulations and Standards (BBRS) • State required to revise within one year of IECC publication • Amendments considered in May / Nov. public hearings • State Office of Energy and Environmental Affairs and Dept. of Energy Resources develop "Stretch Codes" • Communities that adopt stretch codes become eligible for additional state funding • Advocacy groups and PAs have been involved in code development	• Enforcement by local jurisdictions through plan review and site inspection • Compliance addressed in three ways: 1) registered architects and engineers are charged by state law and regulations with abiding by design criteria of code 2) construction community is charged with abiding by code and 3) the building officials review plans and complete inspections prior to issuing compliance certificate • Compliance follows both prescriptive and performance approaches.	• Board of Building Regulations and Standards (BBRS) • Energy Efficiency Advisory Council (EEAC) • Office of Energy and Environmental Affairs • Department of Energy Resources (DOER) • Federation of Building Officials • Building Commissioners and Inspectors Association • Program Administrators • NEEP • Home Builders Association of Massachusetts • Boston Society of Architects

State	Development and Adoption	Compliance and Enforcement	Stakeholders
Minnesota	• Statewide code adopted by Minnesota Dept. of Labor and Industry • Proposed rules are published and hearings are held if requested • Update process is required to take no longer than 18 months	• Enforcement by local jurisdictions, typically through plan review and site inspection • Enforcement occurs for about 80% of population. Remaining 20% have no enforced energy code.	• Dept. of Labor and Industry, Building Codes and Standards Division • Commerce Dept., Division of Energy Resources • Association of Minnesota Building Officials • Builders Association of Minnesota • ASHRAE Minnesota chapter • Fresh Energy • Minnesota Mechanical Contractors Association • AIA Minnesota chapter
New Hampshire	• Codes are adopted by the New Hampshire Building Code Review Board and must be ratified by the state legislature required within two years of adoption • Sustainable Energy Division of the Public Utilities Commission manages the statewide energy code program and sets efficiency standards for certain appliances	• Enforcement by local jurisdictions • In municipalities or unincorporated areas without code officials, the PUC is responsible for conducting plan reviews and the Department of Safety (DOS) is responsible for carrying out site inspections. • The PUC sets administrative rules for the State Building Code • REScheck and COMcheck can be used as long as plans are provided • Compliance determined in two ways 1) certificate of compliance by licensed architect or engineer or 2) certificate of compliance through PUC or local building official	• NH Building Energy Code Collaborative • Office of Energy and Planning (OEP) • Dept. of Safety (DOS) Building Code Review Board • Public Utilities Commission (PUC) • New Hampshire Building Officials Association (NHBOA) • Home Builders and Remodelers Association • NEEP
New York	• Statewide code adopted by Fire Prevention and Building Code Council which meets at least four times a year • Secretary of State can amend the code • Amendments process includes publication, comments, and hearings • State legislation requires that amendments and changes must be able to meet a 10-year payback on savings • Local jurisdictions allowed to adopt more stringent energy codes through separate legislation	• Enforcement by local jurisdictions • New York State Division of Code Enforcement and Administration has the responsibility to administer, and provide technical support in the form of technical assistance, interpretations and variances • Compliance is determined through the building permit process that includes plan review and inspection • Compliance follows both prescriptive and performance approaches.	• Architects (NYS American Institute of Architects) • New York State Builders Association • Building Codes Assistance Project (BCAP) • Code Enforcement Officials • NEEP • Engineers • NYSERDA
Ohio	• Statewide code adopted by the Board of Building Standards (BBS) • BBS develops proposed changes to the building code which are then submitted to the legislature's Joint Committee on Agency Rule Review (JCARR) • Residential code changes are reviewed by the Residential Codes Advisory Committee before being considered by the BBS • If JCARR agrees then there is a public comment period	• Enforcement by local jurisdictions • Building departments certified by the Board of Building Standards enforce the provisions of the Ohio Building Code for their jurisdiction. • Code enforcement includes plan review and site inspection • If there is no certified building dept. within a jurisdiction, Ohio Dept. of Commerce reviews and approves plans for commercial construction	• Board of Building Standards (BBS) • Residential Codes Advisory Committee • Joint Committee on Agency Rule Review (JCARR) • Ohio Building Officials Association (OBOA) • Code Enforcement Officials Association (OCEO • Home Builders Association • Midwest Energy Efficiency Alliance (MEEA)

State	Development and Adoption	Compliance and Enforcement	Stakeholders
Oregon*	• Statewide code adopted by the Oregon Building Codes Division (BCD) • Current residential code is state developed • New commercial codes is based on 2009 IECC • Code changes typically take place every three years in coordination with updates to the IECC model code	• Enforcement by local jurisdictions or the BCD • Code enforcement includes plan review and site inspection • Compliance for commercial buildings can be documented using the COMcheck prescriptive, Trade-Off, or Whole Building Approach	• Building Code Division (BCD) • Building Codes Structures Board (BCSB) • Oregon Building Officials Association (OBOA) • Oregon Homebuilders Association (OHBA) • Energy Trust of Oregon • NEEA
Rhode Island	• Statewide code developed by the Building Code Commission (BCC) and approved by the state legislature • Rulemaking process includes publication, comments, and hearings	• Enforcement by local jurisdictions • State building commissioner enforces code for all state-owned buildings • BCC has organized mandatory workshops for building code officials to increase compliance across the state	• Dept. of Administration Building Code Commission • RI Building Code Officials Association • National Grid • NEEP
Vermont	• Energy code development shared between Department of Public Safety (DPS)/Division of Fire Safety for commercial buildings and DPS for residential buildings. Every three years, DPS updates residential (RBES) and commercial (CBES) building energy codes following latest IECC and ASHRAE Standard 90.1 model codes. • The rules must then be approved by the Legislative Committee on Administrative Rules (LCAR) • Rulemaking process includes public notification, public hearing, testimony, and comments	• Residential (RBES) compliance is verified through builder self-certification. • For commercial buildings, the Vermont Department of Public Safety (DPS) Division of Fire Safety verifies builder self-certification. Focus is on fire protection. • Efficiency Vermont (EVT) and Burlington Electric Department (BED) have robust non-resource acquisition budgets that are allocated to code education and development support.** BED and EVT have supported municipalities where there are no code enforcement officials. This includes training and outreach on building energy codes to town clerks, zoning administrators, etc. • Department of Public Service provides interpretation and advice on code compliance. • Compliance can be demonstrated using REScheck, COMcheck, prescriptive tables, or analysis to determine HERS index.	• Department of Public Service • Efficiency Vermont, Burlington Electric Department, Vermont Gas Systems (EE program administrators) • Home Builders and Remodelers Assn. of Vermont • NEEP • Vermont Department of Public Safety • Building Safety Association of Vermont (BSA-VT) • Associated Industries of Vermont • Vermont Businesses for Social Responsibility • Mortgage Lenders • Vermont Green Building Network
Washington[9]	• Washington-specific statewide code developed by the State Building Code Council (SBCC) on a three year schedule following the latest IECC • After review by a Technical Advisory Group (TAG), the SBCC then approves new codes • Current residential code is state developed • State in process of switching to IECC	• Residential compliance is determined by plan review and inspection by the local building official. • For commercial buildings, local jurisdictions can enforce the code or require the builder to hire a certified special inspector • Energy plan reviewers and special inspectors are certified through a program regulated by the Washington Association of Building Officials (WABO). • Compliance follows prescriptive and performance approaches.	• State Building Code Council (SBCC) • Technical Advisory Group (TAG) • Washington Association of Building Officials • Building Industry Association of Washington • Northwest Energy Efficiency Council • NEEA

* The Northwest Energy Efficiency Alliance (NEEA) is a strong regional advocate for more stringent building energy codes, and supports code compliance programs. For the states in the region, NEEA estimates savings from code programs and allocates these savings to utilities in the region. These savings are used by the utilities towards their EE targets or state-defined requirements.
**Non-Resource Acquisition Description and Budget Proposals in EEU-2010-06 (Demand Resource Plan), 2011. http://psb.vermont.gov/sites/psb/files/projects/EEU/drp/2-3-11RevisedVEICDRPNRADescriptionProposal.pdf

TableB-2. Overview of Energy Efficiency Programs

State	Framework, Requirements, and Program Approval	Program Funding	Potential Study	Reporting, EM&V, Cost Effectiveness
Arizona	• Energy Efficiency Resource Standard (EERS) requires cumulative electricity savings of 22% by 2020 (1.25% -2.5% annually)) and 6% cumulative natural gas savings by 2020 (0.6% annually). • For investor-owned utilities (IOUs) and coops, Arizona Corporation Commission (ACC) must approve energy efficiency programs • Major IOUs are Tucson Electric Power (TEP) and Arizona Public Service (APS) • Salt River Project (SRP) a quasi-public utility is not regulated by the ACC but plans to achieve 20% savings through energy efficiency and renewables by 2020	• Programs funded through a system benefits charge • 2011 program budgets were $139.9M for electric and $4.8M for gas	• 2002 SWEEP, ACEEE, and Tellus completed a potential study for AZ, CO, NV,NM, UT, and WY. Estimated potential savings 14% for residential, 20% for commercial, and 19% for industrial (as a percent of retail sales) • 2008 APS published an update potential study	• Annual report due to ACC on Demand Side Management (DSM) programs • Programs required to be cost effective as measured by Total Resource Cost (TRC) test • SRP evaluates programs annually and measures cost effectiveness by TRC
California	• The CPUC established a goal of 1% savings per year for electricity through 2020. (A goal was also established for gas savings but it is not known at present.) • The California Public Utilities Commission (CPUC) must approve IOU energy efficiency programs • IOUs are Pacific Gas and Electric, San Diego Gas and Electric, Southern California Edison, and Southern California Gas	• Programs funded through resource procurement budgets, rate cases, and a Public Goods Charge • 2011 program budgets were $1.53B for electric and $268M for gas • The three-year 2010-2012 statewide C&S budget is $30.4M about 1% of IOU total program spending	• Based on the 2006 Itron potential study, the California Energy Commission (CEC) adopted a target of 100% of economic potential • In March 2012, an updated study was published by the CPUC. This study included codes as a resource, with savings from the C&S activities projected through 2024.and representing approximately 6,674 GWh of potential through that period.	• IOUs are required to provide detailed quarterly and annual reports to the CPUC. A recent ruling allows IOUs to report gross (as opposed to net) savings for purposes of goal attainment • Impact evaluations are contracted by the CPUC while process evaluation are contracted by the IOUs • Cost effectiveness is measured using the TRC test and the Program Administrator Cost (PAC) test • The CPUC and IOUs are working to develop methods for measuring cost effectiveness of code programs
Colorado	• 2007 legislation required the Colorado Public Utility Commission (Colorado PUC) to establish savings goals for gas and electric utilities (thereby creating an EERS) and to give IOUs a financial incentive for implementing cost effective energy efficiency programs • Programs must be approved by the Colorado Public Utilities Commission (PUC) • Major IOU is Xcel Energy also known as the Public Service Company (PSCo) of Colorado	• Programs funded by a cost adjustment mechanism rate rider • 2011 program budgets were $77.5M for electric and $19M for gas	• In 2010, a system wide electric potential study was completed by Nexant and The Cadmus Group. • In 2010 KEMA delivered the Colorado DSM Market Potential Assessment to Xcel Energy	• The PUC must submit a report to the Colorado legislature on progress made by the IOUs in meeting their energy efficiency goals • PSCo conducts evaluations of a subset of programs each year • The TRC is the primary test of cost effectiveness
Connecticut	• In June 2011, legislature established Department of Energy and Environmental Protection (DEEP). The bill requires DEEP to develop a state energy plan and establishes new programs to promote clean energy and energy efficiency. • The Energy Efficiency Board reviews program plans. DEEP must formally approve programs and the Public Utilities Regulatory Authority disburses program funds. Utilities propose goals and program strategies in this process. • Major IOUs include, Connecticut Power, Dominion Power, United Illuminating	• Programs funded by a system benefits charge and through the ISO-New England Forward Capacity Market • 2011 program budgets were $144M total for electric and gas	• 2003 GDS and Quantum potential study estimates savings of 24% for residential, 25% for commercial, and 20% for industrial (as a percent of retail sales) • 2010 KEMA potential study estimated overall potential savings of 25% of electricity sales. Savings from building codes were included in the total achievable potential for the state.	• DEEP is required to maintain an independent program evaluation process to review program performance and cost effectiveness • Connecticut is only state in the region that requires cost effectiveness to be measured using both the TRC and Utility Cost Test (UCT)

State	Framework, Requirements, and Program Approval	Program Funding	Potential Study	Reporting, EM&V, Cost Effectiveness
Georgia	• The Georgia Public Service Commission (GPSC) regulates Georgia Power but not the other electric utilities • Gas utilities are not required to offer energy efficiency programs • Electric energy efficiency programs at regulated utilities must be approved by the GPSC • Georgia Power, cooperative utilities, and the Tennessee Valley Authority offer energy efficiency programs	• Regulated programs funded through a DSM rider that applies to residential customers only • 2011electric program budgets were $31.7M	• 2005 ICF Consulting potential study estimated that energy equivalent to 9% of retail sales could be achieved by 2010	• No specific reporting requirements are identified • A utility may recover costs and an additional sum for GPSC-approved DSM programs
Illinois	• Electric savings goal is 1% in 2012 and 2% in 2015 and thereafter. Gas savings are set at 8.5% cumulative by 2020 • July 2007 legislation created requirement for large-scale utility energy efficiency programs in Illinois • The Illinois Commerce Commission must approve each electric utility's three-year program plans beginning in 2010 • Major IOUs involved in EE in Illinois include Ameren Illinois, Mid-American, and ConEd.	• Utilities must include a proposed cost-recovery tariff mechanism with their three-year program plans	• 1998 ACEEE potential study estimated total achievable consumption savings at 43% as a percent of sales • 2003 MEEA residential study showed potential savings of 67% of sales	• Utilities must provide quarterly reports on implementation and expenditures, an annual independent review, and a full evaluation of the three year results • Evaluation resources not to exceed 3% of portfolio resources • Cost effectiveness is measured by the TRC test. Programs must represent a diverse cross section of opportunities for customers of all rate classes
Iowa	• In 2008, legislature established an EERS that required utilities to submit plans to achieve 1.5% annual electricity and gas savings • Iowa Code mandates that rate-regulated IOUs must offer energy efficiency program through cost effective programs • The Iowa Utility Board (IUB) must approve energy efficiency programs. The IUB periodically reports results for each utility to the General Assembly.	• Programs funded by tariff riders	• 2012 Cadmus and Nexant updated the potentials assessment for energy efficiency and demand response resources	• Utilities are required to file annual reports with the IUB • Cost effectiveness is measured by the TRC test. Programs must represent a diverse cross section of opportunities for customers of all rate classes
Maryland	• The legislature adopted the EmPOWER 2008 Maryland Energy Efficiency Act creating an EERS with the goal of reducing per capita energy use 15% by 2015. • Programs and cost recovery proposals must be approved by the Maryland Public Service Commission (MPSC)	• Funding mechanism varies by utility with most plans using a DSM rider to recover costs. • Utilities have budgeted $210M for electric programs in 2012	• 2008 ACEEE potential study estimated savings of 15% of forecasted electricity consumption by 2015 were possible. Codes were included in ACEEE analysis since Maryland already is on a pre-determined schedule for adoption of energy codes. The codes represented between 3 and 6% of overall savings through 2015.	• Utilities must provide annual updates to the MPSC on implementation and progress towards targets • Maryland uses the Evaluator model with the Evaluator assisting the MPSC and the a separate EM&V contractor conducting evaluations • Cost effectiveness is measured by the TRC test
Massachusetts	• Massachusetts has defined savings goals of 2,625 GWh and 57 million therms during 2010-2012. • Utilities develop budgets and program plans • Programs are reviewed by the Energy and Efficiency Advisory Council (EEAC) and must be approved by the Department of Public Utilities (DPU)	• Programs funded by a system benefits charge, proceeds from the Forward Capacity Market, and other sources • 2012 program budgets were $490M for electric and $132M for gas	• In 2011, a detailed potential study was conducted of all available cost effective energy efficiency. Consumption savings were estimated at 31% for residential and 21% for commercial as a percent of sales.	• The statewide evaluation plan includes a suite of plans to measure program impact, assess program processes, and characterize markets across residential and nonresidential segments • Cost effectiveness is primarily measured by the TRC test

State	Framework, Requirements, and Program Approval	Program Funding	Potential Study	Reporting, EM&V, Cost Effectiveness
Minnesota	• In 2007, the legislature established an EERS with savings goal of 1.5% of retail sales per year for electric and gas utilities • Programs must be approved by the Division of Energy Resources (DER)• Utilities file Conservation Improvement Plans (CIPs) with the Division of Energy Resources (DER) every three years	• Programs funded by a Conservation Cost Recovery Charge set by the MPUC with periodic adjustments	• 2010 Navigant potential study estimated energy savings at 29.8% of forecasted electric sales • 2009 Navigant study estimated energy savings of 14%-24% of forecasted gas sales	• Utilities report savings achieved annually in status report to the Division of Energy Resources • Cost effectiveness is measured from four perspectives: societal, utility, participant, and ratepayer. The DER relies most heavily on the societal cost test
New Hampshire	• State utilities develop and offer energy efficiency programs under a statewide program • Electric and gas programs must be approved by the Public Utility Commission (PUC)	• Programs funded by a systems benefit charge • 2012 program budgets were $21M for electric and $1.2M for gas.	• 2009 potential study evaluated savings potential for electric, gas, propane, and fuel oil savings at the state level and for each electric and gas utility.	• Utilities must provide multi-year analyses that include energy savings, market transformation, and policy goals • Independent evaluation is not required • Cost effectiveness is primarily measured by TRC test
New York	• In 2008 the NYPSC established an Energy Efficiency Portfolio Standard (EEPS) with three year targets and a goal of reducing electric and gas energy consumption 15% by 2015 and 2020, respectively • Programs are administered by NYSERDA and must be approved by the New York Public Service Commission (NYPSC)	• Programs funded by a system benefits charge • Statewide 2011 energy-efficiency spending was $1.22 billion. • In 2012, NYSERDA has budgeted $582M for energy efficiency and R&D • The Advanced Codes and Standards initiative was awarded $16.7M through 2016 with an average annual budget of $3.3M	• 2008 Optimal potential study found that energy efficiency programs could save 14% of projected electricity use above and beyond savings from expected updates in codes and standards. • 2006 Optimal potential study found savings of 18% of projected gas use	• NYSERDA is responsible for monthly, semiannual, and annual reports on progress and outcomes of efficiency programs • Cost effectiveness is primarily measured by the TRC test
Ohio	• The Ohio Department of Development, Office of Energy administers incentive programs through the Advanced Energy Fund to support investments in renewable energy and energy efficiency projects in the industrial, commercial, and residential sectors. • The Public Utilities Commission of Ohio provides oversight for the utility programs	• Programs funded through the Energy Loan Fund that utilizes funds through the Advanced Energy Fund along with federal funds from the State Energy Program • Until 2010, a tariff rider also funded energy programs	• Utilities are required to assess potential energy savings prior to proposing efficiency and demand reduction programs • Specific studies are unknown to the report authors at this time.	• An annual portfolio status report to PUCO is required and must include assessment of program performance and an independent evaluator report • Programs required to be cost effective as measured by Total Resource Cost (TRC) test
Oregon	• The Energy Trust of Oregon (ETO) was set up under direction of the OPUC to implement efficiency programs with public purpose charge funds. • ETO's first long-range strategic plan, laid out energy savings goals between 2010 and 2014 of 256 average megawatts (2,242.6 GWh) of electricity and 22.5 million annual therms of natural gas • ETO provides oversight and must approve all energy programs	• Programs funded by public purpose charge (3% of the total revenues) • Total of all ratepayer funded electric program budgets was $109.1M for 2011. • Total natural gas efficiency budgets were $27.8M for 2011	• 2003 ACEEE potential study estimated consumption savings as percentage of sales was 28% for the residential sector, 32% for the commercial sector, and 35% for the industrial sector • In 2006 another study was completed for ETO	• Oregon uses the Societal Cost Test as the primary cost-effectiveness test. Oregon also uses the Utility Cost Test as a secondary test.

State	Framework, Requirements, and Program Approval	Program Funding	Potential Study	Reporting, EM&V, Cost Effectiveness
Rhode Island	• In 2006, the legislature created the Energy Efficiency and Resources Management Council (EERMC) and a public benefits charge to support energy-efficiency programs. The act also set three-year savings targets • The EEMRC reviews proposed energy efficiency plans • The major IOU in the state, Narragansett Electric (a National Grid company), offers a comprehensive slate of programs that parallel National Grid's offerings in Massachusetts	• For 2012, National Grid budgeted $61M for electric programs and an additional $14M for gas programs.	• 2010 KEMA potential study estimated economic potential as a percentage of forecast energy use was 28% for residential, 28% for commercial, and 14% for industrial (24% overall). The base case forecast and technology penetrations include effects from autonomous efficiency improvements that would result from natural market shifts, existing and expected codes and standards.	• Utilities are required to provide status reports to the PUC on programs. The M&E component should address savings verification, issues of ongoing program design, and methods to claim savings from market effects. • The PUC's Standards for Energy Efficiency and Conservation Procurement require use of the Total Resource Cost (TRC) test.
Vermont	• Vermont has a statewide "energy efficiency utility" (EEU) after 1999 legislation authorized the Public Service Board (PSB) to collect a charge on all electric utility customers' bills to support programs. It offers programs throughout the state with the exception of Burlington Electric Department's Service Territory, which delivers programs under similar regulatory parameters. • Electric EE Budgets are approved by the PSB following development of potential study and consideration of factors identified in 30 V.S.A. §209(d) and (e). Goals are negotiated with the EEU appointees – currently BED and Vermont Energy Investment Corp. (VEIC). Gas EE budgets are currently developed within Vermont Gas Systems (VGS) Integrated Resource Plans • Annual plans must be approved by PSB. • VEIC and BED have received 12 year appointments as EEUs.	• Energy efficiency programs are funded through a separately stated energy efficiency System Benefit Charge (SBC) for electric and is within rates for gas. • In 2012, EVT has budgeted $41M for electric programs, while Vermont Gas has budgeted an additional $2.1M for natural gas programs.	• In 2011 a potential study was conducted by DPS, estimating savings to be 25.4% overall by 2031. The study assumed the code was updated every three years consistent with Vermont statutes.	• EVT and BED Savings Claim verification is conducted annually by the PSD. Market studies and specific program process and impact evaluations are conducted periodically. In addition, the PSB appoints an independent auditor every three years of reported energy and capacity savings and cost-effectiveness of programs delivered by any PSB-appointed entity. PSB must report to the general assembly annually • Vermont uses the Societal Cost Test as the primary screening test as well as the ratepayer test for whole three-year portfolio screening.
Washington	• Law requires savings targets based on the Northwest Power Plan, which estimates potential of about 1.5% savings annually through 2030 • 17 WA publicly- and investor-owned utilities are subject to this law • Programs must be approved by the WA Utilities and Transportation Commission (WUTC).	• IOUs recover the costs through tariff riders. Most publicly-owned utilities also provide program funding • 2011 program budgets were $150.8M for electric and $29.7M for gas	• Every two years since January 2010, each utility must project its cumulative 10-year conservation potential. • Methods used must be consistent with those used by the Northwest Power and Conservation Council (NPCC) in its most recent regional power plan	• Each utility is required to submit an annual report to the department of Community, Trade, and Economic Development • Utilities must use the NPCC's regional technical forum "planning, tracking and reporting system," or an alternative approved reporting system. • A modified TRC is the main cost effectiveness test

Arizona

Codes Overview

Development and Adoption. Arizona has broad home rule requirements, so authority for adopting and enforcing building energy codes resides with local governments, not the state. In the past, the Department of Commerce Energy Office developed a draft building energy-efficiency code and the legislative recommendations necessary to implement a code, but the code was strictly voluntary.[6]

Currently, local governments may choose to adopt and amend building codes for their jurisdictions and about one-third have adopted an energy code. Adoption processes for codes vary from jurisdiction to jurisdiction.

Compliance and Enforcement. Enforcement for energy codes takes place at the local level, usually in the form of plan review, site inspection, or voluntary demonstration of compliance to the agency charged with administering building codes in that jurisdiction. ARRA requires that States achieve 90% compliance for building codes by 2017. As a result, compliance in Arizona has been identified as an area of concern by the Governor’s office and as a response they have made funding available to provide local governments with educational support for building officials and contractors. As building codes become more stringent many communities have begun to use REScheck and COMcheck software to demonstrate compliance.

Role of Program Administrators. In 2010, the ACC authorized the IOUs to receive credit for up to one-third of the energy saved through adoption of local energy codes. The IOUs have to provide evidence of their effect on adoption. The IOUs have been engaged in a number of code support efforts.[7] The SRP Board also implemented a similar approach and will allow the utility to claim up to 50% of the energy savings from codes for which adoption was influenced by the utility.

Stakeholders: Key stakeholders in the energy code arena in Arizona include:

- Governor's office of energy policy(GEOP)
- Arizona Building Officials (AZBO)
- Local code officials
- Regional Home Builders Associations
- Public utilities and IOUs
- Southwest Energy Efficiency Project (SWEEP)

Energy-Efficiency Program Overview

Framework and Requirements. Energy-efficiency programs are submitted to and approval is required from the Arizona Corporation Commission (ACC). In December 2009, the ACC ordered that all investor-owned utilities and rural electric cooperatives achieve 1.25% annual savings, ramping up to 2% beginning in 2014. This energy-efficiency resource standard (EERS) will ultimately result in 22% cumulative savings.

- Salt River Project, a public utility, recently released plans to ramp up its energy-efficiency programs. It seeks to achieve 20% of its expected retail sales through the implementation of energy efficiency and renewable resources by FY 2020.
- Two of the major gas and electric IOUs in Arizona, Arizona Public Service Company (APS) and Tucson Electric Power Company (TEP), operate a variety of demand-side management and energy-efficiency programs, applicable to a range of customers.[8]

Funding. Energy-efficiency programs in Arizona are funded through a systems benefits charge, collected through a non-bypassable surcharge on electricity bills, or through an adjustor mechanism, depending on the utility. A non-bypassable charge is a charge applied to all customer bills in a given region whether they receive service from a local utility or from a competitive supplier. In 2011, electric program budgets totaled $139.9 million, and natural gas program budgets were $4.8 million. Arizona utilities spent $44.6 million on electric energy efficiency in 2008 and $56.7 million in 2009.[9]

Potential Study. In 2002, SWEEP, the American Council for an Energy Efficient Economy (ACEEE), and Tellus completed a potential study for Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming; the estimated consumption savings as percentage of sales was 14% for the residential sector, 20% for the commercial sector, and 19% for the industrial sector.[10] In June 2008, APS published an updated potential study.

Implementation Plan. Under the Arizona Administrative Code, electric and gas utilities must file energy conservation plans that must include customer education and assistance programs to help the public reduce energy consumption and to increase participation in energy conservation programs sponsored by governmental agencies. Currently, investor-owned utilities administer energy-efficiency programs in Arizona.[11]

Program Approval. The Arizona Corporation Commission (ACC) approves program funding and spending. Utilities may apply for ACC approval of a DSM program or DSM measure by submitting a program proposal, which must include the following: description, objectives, target market, marketing plan, expected participation, expected savings, environmental benefits, program costs, benefit-cost ratio, EM&V plan, schedule, and other information.[12]

Reporting, EM&V, and Cost-effectiveness. Annually in March, each IOU will submit to the ACC a DSM progress report providing information for each utility's Commission-approved DSM programs and will include: (1) an analysis of the affected utility's progress towards meeting the annual energy-efficiency standard; (2) a list of the affected utility's current Commission-approved DSM programs and DSM measures, organized by customer segment; (3) a description of the findings from any research projects completed during the previous year; (4) the following information for each DSM program or measure: brief description; goals, objectives, and savings targets; level of customer participation during the previous year; costs incurred; description of evaluation activities; savings realized; environmental savings realized; incremental and net benefits; performance-incentive calculations for the previous year; problems encountered during previous year and solutions; description of modifications proposed for the following year; whether the affected utility proposes to terminate the DSM program or measure.

- Regarding EM&V, each IOU must monitor and evaluate each DSM program and measure to (1) ensure compliance with the cost-effectiveness requirements; (2) determine participation rates, energy savings, and demand reductions; (3) assess the implementation process for the DSM program or DSM measure; (4) obtain information on whether to continue, modify, or terminate a DSM program or DSM measure; and (5) determine the persistence and reliability of the affected utility's DSM.
- Arizona’s large quasi-public utility, Salt River Project (SRP), evaluates programs each year and assesses cost-effectiveness analysis is done annually to determine the total resource cost (TRC) for each program and for the program portfolio.[13]

California

Codes Overview

Development and Adoption. Since the late 1970s, the California Energy Commission (CEC) has had the responsibility to develop and adopt building energy codes (Title 24). Legislation establishes the process and criteria that must be met. The CEC adopts updates to the Building Energy Efficiency Standards for both residential and nonresidential buildings to coincide with the triennial publication of the state and model building codes, which must be approved by the Building Standards Commission (BSC). Public and industry input is sought by the CEC throughout the rulemaking process. California’s codes are mandatory statewide, but local jurisdictions can adopt more stringent energy codes and enforce them if the CEC reviews and approves them.[14]

Compliance and Enforcement. Enforcement of the Title 24 energy code falls to either the municipal or county government that is responsible for administering the code in that jurisdiction. An enforcement agency cannot issue a building permit for any construction unless it determines, in writing, that the building design complies with all energy-efficiency requirements on the building permit application date. After construction is complete a field inspection is required by the enforcement agency prior to the issuance of a certificate of occupancy.[15]

Role of Program Administrators. Starting in the late 1990s, California utilities began playing a significant role in researching, proposing, and promoting efficiency standards through what has become the statewide utility Codes and Standards (C&S) Program. Like other “statewide” programs, each of the IOUs has a C&S program. These individual programs provide a home within each company for funding of the program activities and also for savings claims in the IOU portfolio. One of the major program activities is funding third-party research into specific code changes. The resulting research reports have generally been named Codes and Standards Enhancement Initiatives and are commonly referred to as “CASE” reports. The CEC process for proposing and approving changes to the California appliance and building standards has come to rely on these CASE reports to a large extent. IOUs have extended their efforts to include training and education to support codes. The IOUs are looking to their C&S efforts to contribute about 20% of their total energy-efficiency portfolio savings. Additionally, California’s 2008 Long-Term Energy Efficiency Strategic Plan included $3.82M for improving compliance with existing codes. Activities to support compliance included the development of a statewide compliance plan, the support of local enforcement, and the development of models that require proof of code compliance as a condition of receiving rebates or financing.[16]

Stakeholders. Key stakeholders in California include:

- CEC
- BSC
- California Building Officials (CALBO)
- Local code officials
- IOUs
- California Building Industry Association (CBIA) and local home builder associations
- California Association of Building Energy Consultants (CABEC)

Energy-efficiency Program Overview

Framework and Requirements. Investor-owned utilities administer energy-efficiency programs with oversight by the California Public Utilities Commission (CPUC). The CPUC establishes key policies and guidelines, sets program goals, and approves spending levels. Investor-owned utilities, third-party contractors, and local governments implement the programs. A share of public benefits funding is designated to go to non-utility organizations to offer programs that supplement and complement those of the IOUs and public utilities. The CPUC has established savings goals of 1% of electricity per year through 2020 and natural gas savings goals.[17]

Funding. California utilities fund some of their energy efficiency programs and initiatives through resource procurement budgets and then recover costs through rate cases brought before the CPUC. The utilities also collect a Public Goods Charge (PGC) on customer utility bills to fund utility energy-efficiency programs. The Public Goods Charge is a public benefits fund established in Assembly Bill 1890 in 1996. For the 2006-2008 program cycle, California's IOUs had budgeted $2 billion and reported spending $316 million in 2006, $670 million in 2007, and $932 million in 2008. In 2009, California utilities spent $756 million on electric efficiency programs in 2009. The Consortium for Energy Efficiency (CEE) reports 2011 electric utility energy-efficiency program budgets totaled $1.536 billion and natural gas program budgets totaled $268 million.[18]

Potential Study. AB 2021 required the CEC to set a statewide energy-efficiency target encompassing the service territories of all of California's IOUs and Publicly Owned Utilities (POUs).[19] The CEC adopted a target of 100% of economic potential as projected by the 2006 Itron Energy Efficiency Potential Study in the 2007 Integrated Energy Policy Report (IEPR). An updated potential study sponsored by the CPUC was published in March 2012. This study included codes as a resource with savings from the C&S activities projected through 2024.and representing approximately 6,674 GWh of potential through that period.[20]

Implementation Plan. The IOUs are required to prepare and submit to the CPUC program implementation plans (PIPs) describing each of the programs proposed in their portfolio and demonstrating how their proposed portfolio will aggressively increase overall capacity utilization and lower peak loads through the deployment of low load factor/high critical peak saving measures.[21]

Program Approval. On September 24, 2009 the California Public Utilities Commission (CPUC) approved the 2010-12 portfolios and budgets for the IOU's, which established the current set of programs. California is in the process of reviewing and approving IOU plans for the 2013-2014 period.[22]

Reporting, EM&V, and Cost-effectiveness. California IOUs are required to provide detailed quarterly and annual reporting to the CPUC on all programs. A recent ruling allowed that the IOUs may, for the purposes of goal attainment, report gross, as opposed to net, savings achieved over the program cycle.

- Regarding EM&V, impact evaluations are conducted by contractors under the auspices of the CPUC. Program process evaluations are conducted separately, using under contracts with the IOUs.
- The CPUC has committed to streamline EM&V efforts with the goal of increasing their usefulness while lessening contentiousness. In particular, they commit to holding the savings assumptions used in planning the portfolio constant over the course of the program cycle for the purpose of tracking reported savings against goals, contingent on compliance and consistency in utility-submitted data.
- Cost-effectiveness is measured primarily using two different tests: (1) the Total Resource Cost whereby the value of the energy savings is greater than the total cost of installed measures and all program costs; and (2) Program Administrator Cost whereby the value of energy savings outweighs the cost of utility financial incentives to customers and all other program costs.
- The CPUC has initiated workshops to investigate expanding the scope of the cost-effectiveness tests to include factors such spillover and non-energy benefits.[23]

Colorado

Codes Overview

Development and Adoption. Colorado is a home rule state with a quasi-statewide energy code based at the 2003 IECC. House Bill 1146 was passed in legislative year 2007 requiring all municipalities who had adopted any type of building code to adopt the 2003 IECC. By end of the year 2012 DOLA has stated 90% of new construction occurs in municipalities who have adopted at least the 2009 IECC. Each jurisdiction has its own set of requirements and rules regarding the development and subsequent adoption of energy codes. Voluntary adoption of energy codes is encouraged by the state energy office and the department of local affairs in the form of training and technical assistance to support code implementation.[24]

Compliance and Enforcement. Colorado statute requires counties that have enacted building codes to adopt and enforce a building energy code that meets or exceeds the 2003 IECC. Local governments with adopted energy codes have enforcement agencies responsible for ensuring compliance. These agencies typically enforce the code through plan reviews and physical site inspection.[25]

Role of Program Administrators. Currently, Xcel Energy (d/b/a as PSCo) is the only utility in the state that is engaged in building codes via their Building Energy Code Support pilot program. The pilot will determine if the proposed DOE Building Energy Codes Program (BECP) protocol process of measuring and verifying compliance is viable and cost-effective and help identify critical components of a successful program.[26]

Stakeholders: Stakeholders in the Colorado energy code process include:

- Colorado Energy Codes Support Partnership (ECSP)
- Colorado Energy Office (CEO)
- Department of Local Affairs (DOLA)
- Colorado ICC Chapter
- Colorado Association of Home Builders, Metro Denver Home Builders Association
- SWEEP

Energy Efficiency Program Overview

Framework and Requirements. In 2007, a House Bill required the Colorado Public Utilities Commission (Colorado PUC) to establish energy savings goals for gas and electric utilities (thereby creating an EERS) and to give IOUs a financial incentive for implementing cost-effective efficiency programs.[27]

Funding. Xcel Energy/PSCo's programs are funded by a demand-side management Cost Adjustment Mechanism rate rider. According to SWEEP, Xcel Energy/PSCo plans to increase its investment in DSM programs from $63 million in 2009 to $80 million in 2020. CEE reports 2010 electric utility efficiency program budgets of $77.5 million. CEE reported that Colorado utilities budgeted $19 million for 2011 natural gas programs.[28]

Potential Study. Nexant, Inc. and The Cadmus Group, Inc. conducted a system-wide electric energy-efficiency potential study in 2010.[29]

Implementation Plan. Consistent with existing practice, PSCo shall set forth in this plan the various programs the Company will implement each year with an associated annual budget. Specifically, the plan shall describe how each DSM program or activity is expected to operate, which customers are eligible to participate, how customers receive the services, who provides those services, and how the program will be evaluated and monitored. The plan shall also establish a budget for each program and shall demonstrate how that program is cost-effective either on a stand-alone basis (for most direct impact programs) or on an entire-portfolio basis (for many indirect impact programs). The Company's DSM plan shall also set forth the technical assumptions that support both the analysis of program cost-effectiveness and the calculations of achieved savings and projected net economic benefits. The plan shall further describe ongoing measurement and verification protocols for the DSM programs as well as parameters for comprehensive evaluations for select programs.[30]

Program Approval. Utilities must submit a set of technical assumptions as part of their respective plan filings, which are approved by the PUC.[31]

Reporting, EM&V, and Cost-effectiveness. By April 30 of each year, the PUC must submit a report to the Business, Labor, and Technology committee of the Senate, or its successor committee, and the Business Affairs and Labor committee of the House of Representatives, or its successor committee, on the progress made by IOUs in meeting their natural gas and electricity demand-side management goals. The report will include any recommended statutory changes the PUC deems necessary to further the intent of sections 40-3.2-103 and 40-3.2-104 of the Colorado Revised Statutes.[32]

- Regarding EM&V, the utilities submit a set of technical assumptions as part of their respective plan filings which are approved by the PUC. Utilities are required to participate in ongoing measurement and verification of programs. PSCo conducts comprehensive program evaluations of three or four specific programs each year.[33]
- The Total Resource Cost test is the primary cost-effectiveness test for Colorado.[34]

Connecticut

Codes Overview

Development and Adoption. Starting in 1989, energy codes have been adopted at the state level, with continuous updates being made at a minimum of every four years. Codes are updated and approved, with implementation dates driven by the Federal requirement to report energy code consideration within three years following the publication of the latest IECC. Amendments to the code adopted by the state building inspector and Codes and Standards Committee, is the building code for all towns, cities, and boroughs in the state. Any amendment to the code is open to the public for comment.[35]

Compliance and Enforcement. Enforcement of the energy code resides with local code officials. The Connecticut Office of the State Building Inspector ensures compliance for state owned buildings. Compliance is primarily determined through plan review or building modeling requiring the signature and seal of a licensed registered professional. Variances and interpretations of the code are granted through the department of public safety.[36]

Role of Program Administrators. Program administrators in Connecticut have been undertaking code training although there haven't yet been any savings claims.

Stakeholders: Key stakeholders in the energy code process in Connecticut include:

- Codes and Standards Committee
- Connecticut Office of the State Building Inspector
- Connecticut Building Officials Association
- Connecticut Association of Housing Code Enforcement Officials, Inc.
- Home Builders & Remodelers Association of Connecticut
- Connecticut Department of Construction Services
- NEEP

Energy Efficiency Program Overview

Framework and Requirements. In June 2011, the Connecticut legislature passed significant legislation that consolidates the development and implementation of Connecticut's environmental and energy policy within a new, expanded Department of Energy and Environmental Protection (DEEP). The new Department will include the Department of Public Utility Control, now known as the Public Utility Regulatory Authority, the old DEP, and the Connecticut Siting Council (for administrative purposes). The bill requires the new DEEP to develop a comprehensive State Energy Plan and establishes a variety of new programs to promote clean energy and energy efficiency.[37]

Funding. Connecticut's electric energy-efficiency programs are supported by a monthly system benefits charge (approximately 0.3 cents/kWh for "conservation and load management") on customers' electric bills. This charge is listed as a separate line item with several other public benefits fees. Connecticut Energy Efficiency Fund (CEEF) electricity programs are also funded through the ISO-New England Forward Capacity Market (FCM). Demand savings resulting from CEEF programs were enrolled into the FCM as other demand resources (ODR) capacity. This produced $15.3 million in revenues for program funding in 2010. CEEF will also be supplemented with funds from Class III Renewable Energy Credits (REC) for energy efficiency and the Regional Greenhouse Gas Initiative (RGGI). Connecticut's total electric and gas energy efficiency program budget for 2011 was $144,386,157.[38]

Potential Study. GDS Associates and Quantum Consulting completed a potential study for Connecticut in 2003; the estimated consumption savings as percentage of sales was 24% for the residential sector, 25% for the commercial sector, 20% for the industrial sector, and an estimated summer peak demand savings of 24% of total capacity. Another potential study completed in 2010 by KEMA showed an overall potential savings that were economically achievable of about 25% of electricity sales.[39]

Implementation Plan. This category is intended to summarize the expected contents for implementation plans. Additional research is needed on this topic for Connecticut.[40]

Program Approval. Connecticut utilities must submit biennial assessments of energy and capacity requirements projected three, five, and ten years into the future. They also must submit plans to "eliminate growth in electric demand" and to achieve other demand-side and environmental objectives. The Connecticut Energy Advisory Board (CEAB) reviews and analyzes the plans before they are submitted to the Department of Public Utility Control (DPUC). The DPUC separately reviews the annual Conservation and Load Management (CLM) Plan, which is developed by the utilities with oversight by the Energy Conservation Management Board (ECMB), an entity appointed by the DPUC.[41]

Reporting, EM&V, and Cost-effectiveness. Reports, analyses and other documents and information which may form the basis for Board discussions and decisions, including program modifications and new program proposals with budgets and target goals, will be circulated to all Board members whenever reasonably feasible at the Board meeting preceding the meeting at which the discussion will occur or a vote will be taken, but no later than three days prior to the meeting.

- Regarding EM&V, the Department of Energy and Environmental Protection shall adopt an independent, comprehensive program evaluation, measurement and verification process to ensure the ECMB's programs are administered appropriately and efficiently comply with statutory requirements; programs and measures are cost-effective; evaluation reports are accurate and issued in a timely manner; evaluation results are appropriately and accurately taken into account in program development and implementation; and information necessary to meet any third-party evaluation requirements is provided. EM&V shall be conducted on an ongoing basis, with emphasis on impact and process evaluations.

- Programs shall be screened through cost-effectiveness testing that compares the value and payback period of program benefits to program costs. Connecticut is the only state in the region that uses both the Total Resource and Utility cost tests. Program cost-effectiveness shall be reviewed annually and shall incorporate the results of the evaluation process. If a program is determined to fail the cost-effectiveness test as part of the review process, it shall either be modified to meet the test or shall be terminated.[42]

Georgia

Codes Overview

Development and Adoption. All code changes are managed by the state's administrative procedures process of publication, public comment, and hearings. Supplements and amendments are updated annually. Georgia also convenes task forces of various stakeholders to review its energy code every three years and each update to the IECC standard; this is not required by law so some code change cycles may be longer. Building codes in Georgia are adopted by the Department of Community Affairs (DCA). If approved, the amendment or update is adopted by the Board of Community Affairs for inclusion into the code. DCA is also responsible for the final rulemaking.[43]

Compliance and Enforcement. The statewide energy code is mandatory regardless of whether or not it is adopted or enforced by a local jurisdiction. Even if the code is not enforced by a jurisdiction the builder is still required to comply with all statewide codes. Local enforcement is typically done by a building inspector with spot checks of envelope air leakage and duct tightness to verify compliance with the energy code. Builders can demonstrate compliance during plan review and local inspection and in some jurisdictions a registered design professional's seal on a letter stating that the design conforms to code may be allowed.[44]

Role of Program Administrators. Currently Georgia Power, an investor owned utility, supports Duct and Envelope Tightness Verifier training across the state with a focus on rural areas where energy code enforcement is lacking. Georgia Power coordinates these efforts with The Georgia Environmental Finance Authority (GEFA); the State Energy Office; Southface, an energy and sustainability non-profit organization based in the Southeast; and the Georgia Department of Community Affairs (DCA). The Georgia Environmental Finance Authority (GEFA) is sponsoring a report on building department best practices for enforcing Georgia's energy code, with the main audience being building departments and local governments.[45]

Stakeholders: Key stakeholders in Georgia include:

- DCA and Board of Community Affairs
- Georgia State Codes Advisory Committee
- Southeast Energy Efficiency Alliance (SEEA)
- State Building Administration Board
- Southface Energy Institute
- Home Builders Association
- Georgia State Energy Office

Energy Efficiency Program Overview

Framework and Requirements. Georgia Power, cooperative utilities, and Tennessee Valley Authority (TVA) offer energy-efficiency programs. The Georgia Public Service Commission (GPSC) regulates Georgia Power, but not the other electric utilities. To date, levels of spending and associated energy-efficiency program activity have been relatively low. GPSC Rule 515-3-4 outlines the commission's role in the review and approval of the companies' Integrated Resource Plans (IRPs). Natural gas utilities are not required to file IRPs or offer energy-efficiency programs.[46]

Funding. Regulated utility energy-efficiency and demand-side management programs are funded through a demand-side management rider that is applied to residential and commercial customers. As of January 2012, the residential DSM rider amount added to the bill was equal to 1.9126% of base revenue. The commercial DSM rider amount was equal to 1.0795% of the base bill calculation.[47]

Potential Study. ICF Consulting conducted an assessment of the energy-efficiency potential in Georgia in 2005. This study projected that energy equivalent to as much as almost 9% of sales could be achieved by 2010.[48]

Implementation Plan. Georgia's Integrated Resource Planning law, O.C.G.A. § 46-3A-2, approved in the early 1990s, requires the regulated electric utilities to file integrated resource plans (IRPs) with the Georgia Public Service Commission (GPSC) every three years. The IRPs must report on the impact of energy efficiency improvements on projected energy demand. Natural gas companies are not required to file IRPs or offer energy efficiency programs.[49]

Program Approval. GPSC Rule 515-3-4 outlines Georgia Public Service Commission's (GPSC) role in the review and approval of the companies' IRPs. A utility's application is approved if it is found by the GPSC to be in the public interest and to comply with the outlined regulations.[50]

Reporting, EM&V, and Cost-effectiveness. No specific reporting requirements were identified, but, by statute (O.C.G.A. § 46-3A-9), a utility may recover costs and an additional sum for commission-approved demand side management programs to encourage development of demand-side and energy-efficiency resources.[51]

- No statutory/regulatory requirements are in place for EM&V.

- Georgia does not specify a primary cost-effectiveness test. Utilities may use TRC, Utility Cost Test (UCT), Participant Cost Test (PCT), Societal Cost Test (SCT), or Ratepayer Impact Measure (RIM) to determine cost-effectiveness.[52]

Illinois

Codes Overview

Development and Adoption. In 2007, with the passage of the Energy Efficient Building Act, commercial energy codes became mandatory in all Illinois jurisdictions. In 2010, residential energy codes became mandatory statewide. Both commercial and residential energy codes are updated when new iterations of the IECC are issued. The state code agency can amend the IECC to account for unique characteristics of Illinois. All amendments, updates and code renewals go through the state's administrative procedures process of publication, public comment, and public hearings. Although codes are adopted at the state level, local jurisdictions are permitted to adopt more stringent energy codes for commercial buildings. For residential energy codes, there is a min-max provision which does not allow local jurisdictions to amend the residential energy codes. The only exceptions to min-max apply to jurisdictions with a residential energy code in place before the adoption of the statewide code or for Chicago.[53]

Compliance and Enforcement. The Illinois Department of Commerce and Economic Opportunity (DCEO), has begun an effort to train officials and practitioners on the energy code to help achieve 90% compliance by 2017 as required by ARRA. The Illinois Energy Office has also funded training programs to provide technical assistance to local jurisdictions and builders funded through the public service charge.[54] Compliance demonstration can be shown in a verity of ways, however, jurisdictions such as Chicago and its suburbs, which have a history of building code enforcement, may require physical on-site inspection as well. The Illinois Department of Commerce and Economic Opportunity is currently running a training program on the 2012 IECC. It is conducting 30-40 trainings statewide. Over the past couple of years, the DCEO has:

- Coordinated with the Building Codes Assistance Project to develop a compliance plan for the state;
- Worked with the Pacific Northwest National Laboratory to do a baseline compliance study on the implementation of the 2009 IECC
- Worked with the Metropolitan Mayors Caucus on a gap analysis of 10 jurisdictions in the Chicago area.[55]

Role of Program Administrators. The Illinois regulatory framework currently does not have a methodology for claiming energy savings from training programs; however, regulators intend to have a plan in place before its next three-year plan in 2014. It is likely that utilities will be able to support compliance and enforcement efforts.[56]

Stakeholders: Key stakeholders include:

- Illinois DCEO
- Illinois Capital Development Board (CDB)
- Local code officials and regional code official organizations
- Chicago's Department of Buildings

- Home Builders Association of Illinois
- Midwest Energy Efficiency Alliance (MEEA)
- American Institute of Architects (Illinois Chapter)
- Illinois Chapter of ASHRAE

Energy Efficiency Program Overview

Framework and Requirements. Illinois passed legislation (SB1592) in July 2007 that created a requirement for large-scale utility energy-efficiency programs in Illinois. State electric utilities reported efficiency program savings of 553,152 MWh in 2009 and 671,477 MWh in 2010, equal to 0.4% and 0.5% of sales, respectively. The state established a goal of 0.2% annual savings in 2008, ramping up to 1% in 2012, and 2% in 2015 and thereafter. Natural gas savings are set at 8.5% cumulative savings by 2020 (0.2% annual savings in 2011, ramping up to 1.5% in 2019).[57]

Funding. In submitting proposed energy-efficiency and demand-response plans and funding levels to meet the savings goals adopted by this Act the utilities shall include a proposed cost-recovery tariff mechanism to fund the proposed energy-efficiency and demand-response measures and to ensure the recovery of the prudently and reasonably incurred costs of Illinois Commerce Commission approved programs. CEE reports 2011 electric utility efficiency program budgets of $123.7 million. CEE reported that Illinois utilities budgeted $51.6 million for 2011 natural gas programs.

Potential Study. ACEEE completed a potential study for Illinois in 1998; the total achievable consumption savings as percentage of sales was 43%. An update of the savings potential in the residential sector was completed by MEEA in 2003 and showed a potential of about 67% of sales.

Implementation Plan. Electric utilities shall be responsible for overseeing the design, development, and filing of energy-efficiency and demand-response plans with the Commerce Commission. Electric utilities shall implement 100% of the demand-response measures in the plans. Electric utilities shall implement 75% of the energy-efficiency measures approved by the Commerce Commission, and may, as part of that implementation, outsource various aspects of program development and implementation. The remaining 25% of those energy-efficiency measures approved by the Commerce Commission shall be implemented by the Department of Commerce and Economic Opportunity, and must be designed in conjunction with the utility and the filing process. The Department may outsource development and implementation of energy-efficiency measures. A minimum of 10% of the entire portfolio of cost-effective energy-efficiency measures shall be procured from units of local government, municipal corporations, school districts, and community college districts. The Department shall coordinate the implementation of these measures.

Program Approval. No later than October 1, 2010, each electric utility shall file an energy-efficiency and demand-response plan with the Commission to meet the energy-efficiency and demand-response standards for 2011 through 2013. Every 3 years thereafter, each electric utility shall file in September, an energy-efficiency and demand-response plan. The Commission shall seek public comment on the utility's plan and shall issue an order approving or disapproving each plan within 5 months after its submission.

Reporting, EM&V, and Cost-effectiveness. Utilities must provide for quarterly status reports tracking implementation of and expenditures for the utility's portfolio of measures and the Department's portfolio of measures, an annual independent review, and a full independent evaluation of the 3-year results of the performance and the cost-effectiveness of the utility's and Department's portfolios of measures and broader net program impacts and, to the extent practical, for adjustment of the measures on a going forward basis as a result of the evaluations. The resources dedicated to evaluation shall not exceed 3% of portfolio resources in any given 3-year period.

- Utilities must provide for an annual independent evaluation of the performance of the cost-effectiveness of the utility's portfolio of measures and the Department's portfolio of measures, as well as a full review of the 3-year results of the broader net program impacts and for adjustments on a going-forward basis as a result of the evaluations. The resources dedicated to evaluation shall not exceed 3% of portfolio resources in any given year.
- Utilities must demonstrate that the overall portfolio of energy-efficiency measures are cost-effective using the total resource cost test and represent a diverse cross section of opportunities for customers of all rate classes to participate in the programs.[58]

Iowa

Codes Overview

Development and Adoption. The state energy code is reviewed on a three-year code cycle corresponding to publication of the IECC. State statute **does not** require the adoption of the latest version of the IECC for both commercial and residential buildings; **however, the Department of Public Safety reviews the code as a matter of policy**. Written requests for changes to the state energy code can be submitted to the state Building Code Bureau. All suggested code revisions are processed through the state administrative rule-making process involving publication, public comments, and public hearings. The Iowa Department of Public Safety adopts the code and the Iowa Building Advisory Council encourages the development of building energy codes.[59]

Compliance and Enforcement. . Iowa requires statewide enforcement of the energy code while all other codes are subject to home rule. This has led to a difficult enforcement situation in Iowa. For residential construction, the owner or builder must submit statement/certification to their local utility attesting to their compliance with the state energy code. For commercial construction compliance is demonstrated by plan reviews and inspections performed by the State Building Code Bureau. Enforcement of energy codes is made optional for local jurisdictions.[60]

Role of Program Administrators. Utilities must receive the owner or builder attestation that their home complies with the code before service can be provided. Utilities are engaged in a quality assurance initiative for the Advanced Builder Option Package (BOP) program where the utility provides QA services for 10% to 20% of homes inspected by HERS raters for the program. The initiative is designed to ensure that HERS raters are uniformly administering ratings on home performance. Utilities also through new construction programs provide incentives for buildings designed to meet the next version of the energy code.[61]

Stakeholders: Key stakeholders in Iowa include:

- Iowa Department of Public Safety
- Iowa Building Code Commissioner
- Iowa Building Code Bureau
- Iowa Association of Building Officials
- Iowa Office of Energy Independence
- MEEA

Energy Efficiency Program Overview

Framework and Requirements. Iowa's utilities administer energy-efficiency programs under a regulated structure with oversight by the Iowa Utilities Board (IUB) and significant input from the Office of Consumer Advocate. Iowa Code 476.6.16 mandates that electric and natural gas utilities that are required to be rate-regulated (IOUs) must offer energy-efficiency programs through cost-effective energy-efficiency plans. The utilities recover program costs of the plans approved by the IUB through adding tariff riders to customer bills. Senate File 2386, signed in 2008, requires the IUB to report periodically to the General Assembly on the plans and results of IOU energy-efficiency programs. Senate Bill 2386 also requires utilities to file energy-efficiency goals, thereby establishing an EERS. In accordance with this mandate, the IUB issued an order in 2008 asking IOUs to submit plans to achieve multiple goals, including a 1.5% annual electricity and natural gas savings goal.[62]

Funding. Regulated IOUs recover costs of programs approved by the Iowa Utilities Board via adding tariff riders to customer bills. This is an automatic rate pass-through, reconciled annually to prevent over-recovery or under-recovery. Recently-filed utility plans indicate an increasing level of funding for energy-efficiency programs. The IUB is authorized to conduct prudence reviews of IOU energy efficiency and may disallow imprudent costs. The CEE reported that electric utilities budgeted $112.9 million for 2011 programs, and natural gas efficiency budgets totaled $41.9 million that year.[63]

Potential Study. Quantec, LLC (now Cadmus), in collaboration with Nexant, Inc., Summit Blue Consulting, A-TEC Energy Corporation, and the Britt/Makela Group, were retained by the Iowa Utility Association to conduct an assessment of technical and economic opportunities for electric and gas energy-efficiency and renewable resources in the service territories of the Association's three investor owned utility members, namely Alliant Energy Corporation (Alliant), Aquila, Inc. (Aquila), and MidAmerican Energy Company (MidAmerican).[64]

In 2012, Cadmus and Nexant updated the potentials assessment for energy efficiency and limited demand response resources.

Implementation Plan. Iowa's IOUs are required to prepare and implement energy-efficiency plans. The Iowa Utilities Board approves the plans. Key features of all the plans and programs approved for IOUs by the IUB include: (1) Plans must be cost-effective; (2) Plans must include programs for all types of customers; (3) Plans must include analysis of the potential for energy efficiency and must include performance standards in terms of energy and capacity savings. Iowa's municipally owned utilities and rural electric cooperatives must also develop energy-efficiency plans and submit both progress and final reports to the IUB. The IUB does not review or approve these plans, but compiles the results to use as part of overall state energy planning.[65]

Program Approval. Rate-regulated gas and electric utilities must assess potential energy and capacity savings available from actual and projected customer usage by applying commercially available technology and improved operating practices to energy-using equipment and buildings. Utilities must submit this assessment to the IUB. Upon receipt of the assessment, the IUB shall consult with the department of natural resources to develop specific capacity and energy savings performance standards for each utility. The utility must then submit an energy-efficiency plan that includes economically achievable programs designed to attain these energy and capacity performance standards. The board shall periodically report the energy-efficiency results including energy savings of each utility to the general assembly.[66]

Reporting, EM&V, and Cost-effectiveness. On January 1 of each even-numbered year, commencing January 1, 2012, gas and electric utilities that are not required to be rate-regulated shall file a report with the IUB identifying their progress in meeting the energy-efficiency goal and any updates or amendments to their energy-efficiency plans and goals.[67]

- In terms of EM&V, each regulated utility shall describe in complete detail how it proposes to monitor and evaluate the implementation of its proposed programs and plan and shall show how it will accumulate and validate the information needed to measure the plan's performance against the standards. The utility shall propose a format for monitoring reports and describe how annual results will be reported to the board on a detailed, accurate and timely basis.[68]
- The societal cost test is the primary cost-effectiveness test for Iowa. Iowa uses the Utility Cost Test, Participant Cost Test, and Ratepayer Impact Measure test as secondary tests.[69]

Maryland

Codes Overview

Development and Adoption. Maryland updates its building code after the International Code Council (ICC) updates its model codes, which happens every three years. The updated code proceeds through the rulemaking authority of the Maryland Department of Housing and Community Development (DHCD) Codes Administration. Public notice, public hearings, and a public comment are required before a new rule updating the codes can be published in the Maryland Register.[70]

Compliance and Enforcement. Local jurisdictions may modify codes to be more stringent than what the state requires. Local governments typically adopt and implement the current Maryland Building Performance Standards (MBPS). The MBPS is mandatory statewide with enforcement taking place at the local level through plan review and site inspections. Compliance is demonstrated via REScheck and COMcheck software.[71]

Role of Program Administrators. No specific role has been identified to date.

Stakeholders: Key stakeholders in Maryland include:

- DHCD Codes Administration
- Maryland Building Officials Association
- Home Builders Association of Maryland
- NEEP
- Institute for Market Transformation
- Building Codes Assistance Project
- American Institute of Architects (AIA)
- Connecticut Society of Professional Engineers
- Associated General Contractors of America

Energy Efficiency Program Overview

Framework and Requirements. In 2008, the legislature enacted the EmPOWER Maryland Energy Efficiency Act of 2008, creating an EERS that sets a statewide goal of reducing per capita energy use by 15% by 2015 with targeted reductions of 5% by 2011 calculated against a 2007 baseline (Order 82344). Utilities must also decrease peak demand by 15% by 2015.[72]

Funding. Funding sources for energy-efficiency and demand side management programs vary by utility, with most of the newly proposed utility plans using a demand-side management rider or surcharge recovery. Carbon dioxide allowance auctions also fund a small percentage of utility and non-utility energy-efficiency programs. Maryland electric utilities have budgeted $210,165,199 for electric efficiency programs in 2012.[73]

Potential Study. ACEEE assessed Maryland's energy-efficiency potential in a 2008 study. The energy-efficiency policies assessed in the report hold the potential to meet 15% of forecasted electricity consumption by 2015. The resource assessment identifies over 22,000 GWh of cost-effective electricity efficiency, more than sufficient to meet the projected 2015 goal of cost-effective savings of 10,500 GWh. Codes were included in ACEEE analysis since Maryland already is on a pre-determined schedule for adoption of energy codes. The codes represented between 3 and 6% of overall savings through 2015.[74]

Implementation Plan. Beginning in July 2008, and every 3 years thereafter, each electric company shall consult with the Maryland Energy Administration (MEA) regarding the design and adequacy of the plan to achieve the savings and demand reduction targets specified, and submit proposals to the Public Service Commission (PSC) for achieving those savings and demand reductions. The plan shall address residential, commercial, and industrial sectors as appropriate, including low–income communities and low– to moderate–income communities. The PSC reviews each electric company's plan to determine if the plan is adequate and cost–effective in achieving the savings and demand reduction targets.[75]

Program Approval. Electricity savings and demand reduction plans and cost recovery proposals are must be approved by the PSC. The initial program cycle ran from 2009 until 2011. The PSC has approved the second round of EmPOWER Maryland plans which run from 2012 through 2014.[76]

Reporting, EM&V, and Cost-effectiveness. Each electric company shall provide annual updates to the MPSC and the Maryland Energy Administration on plan implementation and progress towards achieving the electricity savings and demand reduction targets.[77]

- Maryland uses the Evaluator Model. Under this model, the EM&V Contractor and the EM&V Evaluator have defined roles and responsibilities – with the contractor providing EM&V services to the EmPOWER Maryland Utilities, and the Evaluator assisting the MPSC with overseeing and coordinating with the EmPOWER Maryland Utilities and their Contractors. The Evaluator provides the MPSC an independent, third party to evaluate and verify the results of the EmPOWER Maryland programs as well as providing other deliverables to meet the MPSC's other obligations under the EmPOWER Maryland Act of 2008.[78]
- Maryland uses the Total Resource Cost as the primary cost-effectiveness test. Maryland also uses the Utility Cost Test, Participant Cost Test, Societal Cost Test, and Ratepayer Impact Measure Test as secondary tests.[79]

Massachusetts

Codes Overview

Development and Adoption. As mandated by the Green Communities Act of 2008, the State Board of Building Regulations and Standards (BBRS) is required to revise the building code with updated energy provisions within one year of the publication of the International Energy Conservation Code (IECC). Public hearings to consider changes to the energy code are generally scheduled for the months of May and November. The Board requires code change proposals be filed 60 days in advance of such hearings. The Massachusetts Office of Energy and Environmental Affairs and Department of Energy Resources work to develop the stretch codes as a mechanism for cities and towns to qualify as 'Green Communities' under the Act, and thereby be eligible for additional state funding for qualified clean energy projects. Other environmental and advocacy groups and the PAs have historically been involved in code development, as well.

In 2009, the BBRS adopted the first-of-its-kind Stretch Code, which was designed to be roughly 20% more efficient than the state baseline code at the time. To date, 121 municipalities have voluntarily adopted the stretch code. As their energy efficiency levels match, incentives available through the ratepayer funded new construction programs are allowed to be utilized in homes and buildings built to the stretch code.[80]

Compliance and Enforcement. Enforcement is through the local building inspectors. Only a Building Code Board of Appeals, consisting of specified technical members, may grant a variance to the code. Plan review and construction inspection is performed by the local building official. In some of the more rural western parts of the state, code officials are sometimes shared by multiple smaller towns and this role may even be played by a subcontractor and not a town employee. Compliance paths include both prescriptive and performance approaches. Compliance is determined at the local level by local building inspectors as part of an application review and inspection process. Compliance is addressed in three distinct ways: 1) registered architects and engineers at the design level are charged by state law and regulations with abiding by design criteria of the code; 2) the construction community is equally charged with abiding by the code; and 3) the building officials review the submitted plans and complete inspections prior to issuing the certificate of compliance. Compliance follows both prescriptive and performance approaches. Compliance pathways include the Overall Building (REScheck, COMcheck), the performance based Home Energy Rating (HERS Index), and Annual Energy Cost compliance paths.[81]

Role of Program Administrators. The PAs have worked with the state Department of Energy Resources (DOER) on code compliance in the past. In 2010, the state DOER drove participation in DOE's Code Compliance Evaluation Pilot Study. Following an initial study code compliance completed study in July 2011, the DOER completed a "mini-baseline" (50 homes) study in 2012 and is nearing completion of a more robust (100 homes) residential new construction baseline study and a C&I baseline code compliance study. The PAs supported these studies through funding, data, and technical assistance.

One utility was very actively involved in the development of the original stretch code, as well as in advancing the adoption of a residential furnace efficiency standard in the state, though no savings were allowed to be claimed with regard to either activity.[82]

The PAs are developing plans for codes and standards advancement projects as part of their 2013-2015 program plans, but they have not yet been formally submitted.

Along with those plans will be a proposal for attributing savings from building code and appliance standards programs that will be informed by similar programs in other states, such as California and Arizona. The model uses factors that are designated with determinations made for the amount of PA contribution and the amount of overall energy savings resulting from a particular activity. Potential activities where PAs can be active include compliance and development support for the stretch code, appliance standards advocacy, base energy code advocacy, and training and education to enhance compliance with the codes.[83]

Stakeholders: Key stakeholders in Massachusetts include:

- BBRS
- Energy Efficiency Advisory Council (EEAC)
- Massachusetts Executive Office of Energy and Environmental Affairs
- Massachusetts Department of Energy Resources (DOER)
- Massachusetts Federation of Building Officials
- Massachusetts Building Commissioners and Inspectors Association
- Program Administrators
- Municipalities
- NEEP
- Home Builders Association of Massachusetts

Energy Efficiency Program Overview

Framework and Requirements. Massachusetts' goals are to save approximately 2,625 gigawatt hours (GWh) and 57 million therms of natural gas during the three year period (2010-2012). The electric distribution and natural gas utilities and the Cape Light Compact develop estimated budgets and associated plans for energy-efficiency programs. Each submits annual energy-efficiency program proposals to the EEAC. DOER is represented on the EEAC. The utilities and the CLC also work collaboratively in developing the coordinated three-year plans. The EEAC is responsible for reviewing and providing its recommendations regarding the design of the statewide plans. The plan is then reviewed for cost-effectiveness and approved by the state's utility regulatory authority, the Department of Public Utilities. After the statewide three-year plans are complete, each individual utility designs its own three-year energy-efficiency plan and submits it to the DPU for approval. The initial three-year efficiency plans under the Green Communities Act ran from 2010-2012; plans for the next three-year phase from 2013-2015 are currently under development.[84]

Funding. In 2012, the Massachusetts efficiency program administrators have budgeted $490,005,649 for electric energy efficiency programs, and $132,019,056 for natural gas efficiency programs. The electric energy-efficiency and low-income programs are funded by a monthly charge (system benefits charge) on customers' electric bills (approximately 0.25 cents/kWh). The Green Communities Act provides for additional funding to be allocated to energy-efficiency programs. It specifically expands funding to include (1) proceeds from the Forward Capacity Market, (2) not less than 80% of the proceeds from the Regional Greenhouse Gas Initiative (RGGI) auction , and (3) an adjustment to distribution charges to the extent that it is necessary to procure all cost-effective energy-efficiency and demand resources.[85]

Potential Study. A detailed potential study or set of targeted studies was performed in 2011 and an updated assessment of all available cost-effective energy efficiency was prepared in connection with the three-year plans for 2013 through 2015. RLW Analytics and SFMC completed an earlier potential study for Massachusetts in 2001; the estimated consumption savings as percentage of sales was 31% economic savings for the residential sector and 21% economic savings for the commercial sector. This study included non-utility impacts and low income customers.[86]

Implementation Plan. The plan must include: (1) an assessment of the estimated lifetime cost, reliability and magnitude of all available energy-efficiency and demand reduction resources that are cost-effective or less expensive than supply; (2) the amount of demand resources, including efficiency, conservation, demand response and load management, that are proposed to be acquired under the plan and the basis for this determination; (3) the estimated energy cost savings that the acquisition of such resources will provide to electricity and natural gas consumers, including, but not limited to, reductions in capacity and energy costs and increases in rate stability and affordability for low-income customers; (4) a description of programs (a wide range of program types is allowed); (5) a proposed mechanism that provides performance incentives to the companies based on their success in meeting or exceeding the goals in the plan; (6) the budget that is needed to support the programs; and (7) additional information.[87]

Program Approval. Chapter 169 of the Acts of 2008 (An Act Relative to Green Communities) requires utilities to file their plans every 3 years. The law required the state's regulatory authority, the DPU, to ensure that energy-efficiency programs are delivered in a cost-effective manner. The Act created the EEAC, which works with the program administrators to establish statewide plans for gas and electric utilities for 3 years into the future. In the course of this process, the utilities work with independent consultants hired to advise the EEAC in establishing appropriately ambitious targets to meet the Act's mandate. After these statewide three-year plans have been made, each individual utility designs its 3-year energy-efficiency plan and submits it to the DPU for approval. This process is open to the public.

Reporting, EM&V, and Cost-effectiveness

- The Statewide Evaluation Plan includes the following EM&V studies: (1) measurement and verification; (2) impact evaluation; (3) market evaluation; (4) process evaluation; (5) market characterization or assessment; and (6) evaluation of pilots. Of these studies, one or more, as appropriate, will be used to assess the effectiveness of energy-efficiency measures and/or programs within the following market research areas: (1) residential retrofit and low-income; (2) residential retail products; (3) residential new construction; (4) non-residential large retrofit and new construction; (5) non-residential small retrofit; and (6) special and cross-sector studies.
- A program included in the plan shall be screened through cost-effectiveness testing, which compares the value of program benefits to the program costs to ensure that the program is designed to obtain energy savings and system benefits with value greater than the costs of the program. The Total Resource Cost (TRC) Test is required.[88]

Minnesota

Codes Overview

Development and Adoption. The Minnesota Department of Labor and Industry has authority for adopting rules governing building codes in accordance with the Minnesota Administrative Procedures Act (APA). Once proposed rules are published, a public review hearing will take place if it is requested by 25 or more individuals (Minnesota Statues §14.25). However, the process of updating codes is required to take no longer than 18 months (Minnesota Statues §14.125). After rule changes are approved per APA procedures a Notice of Adoption is published in the state register. The new code becomes effective six months following the date of publication.

Compliance and Enforcement. Presently enforcement occurs for about 80% of the population base; with the remaining 20% of the population having no enforced energy code. Plans and specifications must be submitted to local code officials and field inspections are required before a certificate of occupancy can be issued.[89]

Role of Program Administrators. The Next Generation Energy Act, passed of 2007 (Minnesota Statutes §216B.241), sets annual energy savings goals for natural gas and electric utilities. The Division of Energy Resources in the Department of Commerce is exploring ways to measure building energy code savings, assess compliance, and develop options to enhance compliance rates. These efforts could set the stage for utilities to play a role in supporting increased code compliance or stretch codes through program implementation, and to receive savings credit if the Division of Energy Resources develops a savings attribution model.[90]

Stakeholders: Key stakeholders in Minnesota include, but are not limited to the following:

- Department of Labor and Industry, Building Codes and Standards Division

- Minnesota Commerce Department, Division of Energy Resources
- Association of Minnesota Building Officials
- Builders Association of Minnesota
- ASHRAE Minnesota chapter
- Fresh Energy Minnesota Mechanical Contractors Association
- AIA Minnesota chapter

Energy Efficiency Program Overview

Framework and Requirements. Oversight of the utility Conservation Improvement Program (CIP) in Minnesota falls under the jurisdiction of the Department of Commerce, Division of Energy Resources. The Minnesota Next Generation Energy Act of 2007 (Minnesota Statutes §216B.241) includes provisions setting energy-saving goals for electric and natural gas utilities of 1.5% of retail sales each year, thereby establishing an Energy Efficiency Resource Standard (EERS).[91]

Funding. The Minnesota Legislature does not appropriate state dollars to CIP. Instead, Minnesota statute requires utilities to make investments and expenditures in energy conservation improvements as a percent of gross operating revenues. This includes investor owned utilities (IOUs), cooperative electric associations, and municipal utilities (except for natural gas municipal utilities with annual throughput sales to retail customers under 1 billion cubic feet).

Total electric and natural gas CIP incremental first-year expenditure and savings for all regulated utilities in Minnesota from 2006 through 2010 are shown in Tables B-3 and B-4 below.[92]

Table B-3. Total Electric CIP Expenditures and Savings by Year, 2006-2010

Year	Expenditures	MWh Savings
2006	$82,245,240	411,999
2007	$91,239,426	468,070
2008	$102,010,572	597,288
2009	$144,917,876	669,122
2010	$186,282,527	899,553

Table B-4. Total Natural Gas CIP Expenditures and Savings by Year, 2006-2010

Year	Expenditures	Dth Savings
2006	$16,266,993	2,095,047
2007	$16,406,430	1,917,144
2008	$18,125,110	1,563,496
2009	$22,771,640	1,843,347
2010	$37,963,093	2,612,212

Regulated utilities in Minnesota typically track conservation costs (including any utility Demand Side Management incentives) and recoveries in tracker accounts that are submitted annually for approval by the Minnesota Public Utilities Commission (MPUC). Minnesota utilities usually employ two conservation cost recovery mechanisms: a Conservation Cost Recovery Charge (CCRC), which is set by the MPUC in the context of a rate case proceeding and is included in customers' volumetric base rates; and a Conservation Cost Recovery Adjustment (CCRA), which is an annually adjusted surcharge approved by the MPUC that is designed either to recover conservation costs that are not being recovered in the tracker account via the CCRC, or to return to ratepayers any over-recovery of conservation costs. In addition to these cost recovery mechanisms, Minnesota has a Shared Savings Demand Side Management Financial incentive on CIP achievements and costs for natural gas and electric IOUs. This performance incentive is designed to encourage IOUs to increase investments in cost-effective energy conservation.

Minnesota also allows three types of utility customers to request exemptions from paying for, or participating in, utility conservation programs: large customer facilities, commercial gas customers, and large energy facilities. Eligibility requirements, based on minimum thresholds of energy use, for these three customer types are defined in Minnesota Statutes: for large customer facilities, §216B.241, subd. 1(i); for commercial gas customers §216B.241, subd. 1a(c); for large energy facilities, §216B.2421, subd. 2(l).[93]

Potential Study. Summit Blue Consulting, LLC (now Navigant Consulting) completed an electric efficiency potential study for Minnesota in 2010 with funding from the Department of Commerce. This study estimated cumulative energy savings in 2028 at 17,704,078 MWh or 29.8% of forecast electric sales, based on the available energy efficiency that was economically cost-effective. A similar study but for natural gas was funded by CenterPoint Energy, Integrys, and Xcel Energy (three Minnesota natural gas utilities) and completed in 2009 by Navigant Consulting. The study estimated the cumulative economically cost-effective gas savings potential in 2019 at 48,732,583 DTh, which ranged from 14-24% of forecast natural gas sales.[94]

Implementation Plan. Each electric and natural gas utility in Minnesota develops its own CIP plan, including a comprehensive description of each project making up the program, a description of the expected effect of each project on peak demand and energy consumption, and an estimate of the expected cost effectiveness of each project to the utility, to the project's participants, to the utility's ratepayers, and to society.

Requirements for IOUs are more extensive than for municipal or cooperative utilities. However, CIPs for all three types of utilities are required meet their minimum spending and savings requirements, to devote a portion of funding to projects that serve the needs of low-income customers, including low-income renters, and to serve the full range of customer types within their service territories.

A utility in Minnesota is allowed to include in its CIP plan energy savings from approved electric infrastructure projects or waste heat recovery converted into electricity projects once an energy savings goal of at least 1% has been achieved for energy conservation improvements. For municipal utilities and cooperatives, load-management activities may be used to meet up to 50% of the conservation investment and spending requirements.

In addition to conservation projects designed by utilities, Minnesota statute allow interested persons, including political subdivisions and nonprofit and community organizations, to submit alternative projects for inclusion in a utility's CIP.

In order to help utilities to meet their 1.5% savings goals, Minnesota statute authorizes the Commissioner of the Department of Commerce (Commissioner) to assess utilities up to $3.6 million annually in order to create a fund for applied research and development grants. The purpose of these grants is to identify new technologies or strategies to maximize energy savings, improve the effectiveness of energy conservation programs, or document the carbon dioxide reductions from energy conservation programs.[95]

Program Approval. Each utility in Minnesota has an annual energy-savings goal equivalent to 1.5% of gross annual retail energy sales. However, the Commissioner may modify the savings goal for a specific utility to less than 1.5% but no lower than 1% based on the utility's historical conservation investment experience, customer class makeup, load growth, a conservation potential study, or other factors the Commissioner determines warrants an adjustment.

State statute requires utilities to file their CIP plans with the Division of Energy Resources at least every three years. Current practice is for IOUs to file triennially and for municipal utilities and cooperatives to file annually. The Division of Energy Resources reviews each plan and the associated energy savings calculations. Based on this review the Commissioner either approves the plan as is, or if applicable makes recommendations for appropriate changes to increase the effectiveness of the CIP plan. In general, the process for approving and overseeing CIP activities for IOUs is more extensive and lengthy than for municipal and cooperative utilities.[96]

Reporting, EM&V, and Cost-effectiveness. Utilities report their actual CIP spending and savings achieved on an annual basis in status reports. The Division of Energy Resources reviews each status report and the associated spending and savings calculations. Based on this review the Commissioner either approves the reported expenditures and savings, or requests revisions as appropriate.

IOUs in Minnesota currently file their status reports electronically through the Department of Commerce's eDocket system, while municipal utilities and electric cooperative associations use a cloud-based on-line interface, the Energy Savings Platform™. The goal is to eventually have all utilities in Minnesota use the on-line interface to report the results of their CIP plans.

Based on data provided through utility reporting, the Commissioner produces an annual report, required by the legislature, which details energy savings, expenditures, and estimated carbon dioxide reductions achieved by CIP for the two most recent years for which data are available. The Commissioner reports on program performance both in the aggregate and for each entity filing a CIP plan for approval or review by the Commissioner.

Regarding EM&V, the Division of Energy Resources provides a Technical Reference Manual (TRM) for use by electric and gas utilities in the State. The TRM consists of a set of standardized energy efficiency and conservation measure specifications for calculating and reporting energy savings and cost-effectiveness. Utilities may use these specifications directly in their CIP plans without prior approval by the Division of Energy Resources or propose their own measure specifications, which are subject to review.

In addition, the State requires that all large custom CIP projects follow a formal M&V protocol. Large custom projects are defined as those with estimated annual savings greater than 1,000,000 kWh of electricity or 20,000 MCF of natural gas. The protocol directs utilities to apply one of three options for custom projects: a third-party engineering review; equipment sub-metering; or facility metering. For each qualifying custom project, utilities are required to submit an M&V plan (ideally after baseline data collection and prior to implementation of the measure), as well as an M&V report detailing measured savings and actual expenditures. The Division of Energy Resources audits a sample of custom projects submitted by each utility as part of their status report filing.

State statute directs the Commissioner to measure the cost-effectiveness of conservation programs from four different perspectives—societal, utility, program participant, and ratepayer. However, when reviewing and assessing each utility's overall conservation program and individual projects, the Division of Energy Resources relies heavily on the societal test. With the exception of projects targeted exclusively for low-income households and projects that have an indirect impact on energy savings (such as energy audits and research & development), the department generally requires projects to have societal benefits that outweigh its societal costs.[97]

New Hampshire

Codes Overview

Development and Adoption. The Sustainable Energy Division of the Public Utilities Commission was created in 2008 to assist the Commission in implementing specific state legislative initiatives for renewable energy and energy efficiency and to advance the goals of energy sustainability, affordability, and security. The Division is responsible for managing the statewide energy code program, as well as setting energy efficiency standards for certain appliances.

Building codes in New Hampshire are reviewed every three years in coordination with the issuance of codes from the ICC. The New Hampshire Building Code Review Board is given authority to change standards within the code and hold periods for public comment. The New Hampshire state legislature must agree with the review board's amendments within two years or else the code reverts back to the previously adopted version. Local jurisdictions are allowed to adopt amendments to the code only if those changes are more stringent than the current state code.[98]

An April 2012 report, the New Hampshire Building Energy Code Compliance Roadmap, which was overseen by the state's Office of Energy and Planning (OEP), with funding from the US Department of Energy, recommended the establishment of a "Codes Collaborative," which has recently been formed to help implement recommendations from the Compliance Roadmap. The state's electric and gas utilities are participants in this effort.[99]

Compliance and Enforcement. Enforcement of energy codes is the responsibility of local building officials. These officials determine compliance by receiving a letter of certification from a licensed architect or engineer with a copy forwarded to the New Hampshire PUC or by processing an application for certificate of compliance through the PUC or the local building code official. REScheck and COMcheck can be used for compliance so long as plans are available to supplement documentation. If there is no local code official in a jurisdiction then plans and a certificate of compliance application must be submitted to the PUC.[100]

Role of Program Administrators. The PAs have worked with the OEP on the statewide New Hampshire Building Code Collaborative.

Stakeholders: Key stakeholders include:

- New Hampshire Building Energy Code Collaborative
- New Hampshire Office of Energy and Planning (OEP)
- Department of Safety Building Code Review Board
- New Hampshire Public Utilities Commission
- New Hampshire Building Officials Association
- Home Builders and Remodelers Association of New Hampshire
- US Department of Energy Building Energy Codes Program
- NEEP

Energy Efficiency Program Overview

Framework and Requirements. New Hampshire's regulated electric distribution utilities jointly develop and offer their customers energy-efficiency programs under a statewide brand known as “NHSaves.” Each year, the New Hampshire PUC reviews and approves these “Core Energy Efficiency” program plans and budgets submitted by the utilities. Utilities can earn performance incentives based on successful implementation of their programs and meeting performance goals. Natural gas efficiency programs, while not part of the Core efficiency programs or NHsaves, are coordinated with the electric programs, and separately administered by the natural gas utilities after approval by the New Hampshire PUC.[101]

Funding. The Core energy efficiency programs are funded by a systems benefits charge included in customer rates of 1.8 mills/kWh for energy efficiency programs. In 2012, the New Hampshire electric utilities budgeted $20,968,651 for energy efficiency programs, while the natural gas utilities budgeted an additional $1,195,188. Unlike other Northeast states, New Hampshire’s proceeds from the Regional Greenhouse Gas Initiative have not gone to supplement the ratepayer funded efficiency program budgets, but have been held in a special fund by the Public Utilities Commission that makes competitive bid awards to qualifying recipients, who can range from business associations to cities and towns. That practice will end this year as a result of legislative action which, starting in 2013, will send the first $1 of each carbon ton RGGI auction proceed to the energy efficiency programs, with the remainder being used for direct ratepayer refunds.[102]

Potential Study. A 2009 study evaluated additional opportunities for energy efficiency in New Hampshire. Estimates of technical potential, maximum achievable potential, and maximum achievable cost-effective potential by the year 2018 (a 10-year period) are provided for electricity, natural gas and related propane and fuel oil savings at the state level and for each of the four New Hampshire retail electricity providers and two natural gas distribution companies.[103]

Implementation Plan. The New Hampshire Energy Efficiency Working Group determined that a proposal for a program in a market eligible for ratepayer funding should identify: (1) the reasons for addressing this market; (2) the general approach or approaches that could best address those conditions; (3) the evaluation metrics and exit strategy; (4) budget; (5) program administration; and (6) cost-effectiveness.[104]

Program Approval. The order establishing guidelines for energy-efficiency programs (November 2000), allotted utilities 60 days to agree upon a set of core programs. The focus of the PUC is on the efficacy of the core programs. Individual utilities may file other energy-efficiency programs based on the specific objectives of that utility so long as they conform to the goals and objectives stated in the PUC order. Should any utility anticipate difficulty in meeting the filing requirements, that utility is required to file a request for extension with the PUC within thirty (30) days from the date of the order.[105]

Reporting, EM&V, and Cost-effectiveness. Utilities must submit multi-year analyses that include short- and long-term savings, market transformation, and recognition of energy policy goals.

- Regarding EM&V, no requirement for independent evaluation was identified.[106]
- The Total Resource Cost test is the primary cost-effectiveness test for New Hampshire.[107]

New York

Codes Overview

Development and Adoption. New York's Uniform Fire Prevention and Building Code (Uniform Code) and Energy Conservation Construction Code (Energy Code) fall under the authority of the State Fire Prevention and Building Code Council. The council is a 17-member body that meets a minimum of four times a year to consider revisions to the code. By legislative authority, the Secretary of State can, through regulation, amend the code and issue formal interpretations. Amendments are developed and adopted through a formal rulemaking process that includes a public review period. State legislation requires that amendments and changes must be able to meet a 10-year payback on energy savings. The New York State Division of Code Enforcement and Administration has the responsibility to administer, and provide technical support in the form of technical assistance, interpretations and variances. Local governments may adopt their own energy codes after notifying the Code Council, but can only implement changes that are judged to be more restrictive than the current statewide code.[108]

Compliance and Enforcement. Local governments (cities, towns, villages and counties) are responsible for enforcing the Uniform Code and Energy Code (as outlined in Executive Law Section 381). Communities are allowed to "opt out" or not enforce the Uniform and Energy Codes. In these instances, the Department of State is required to ensure that minimum code requirements are met. Changes to the Uniform Code and Energy Code, such as those enacted in 2010, fall under the statewide mandate that has been in effect since 1979 (Energy Code) and 1984 (Uniform Code). Compliance is determined through the building permit process that includes plan review and inspection by the government entity responsible for the administration and enforcement of the provisions of the Uniform Code and Energy Code applicable within the municipality.[109]

Role of Program Administrators. The Department of State is responsible for overall administration of, and training and certification for, code enforcement officials on the Uniform

Code and Energy Code. Code enforcement officials must complete 126 hours of initial certification training – five of which are specific to the Energy Code – and an additional 24 hours of approved in-service training per calendar year to maintain certification. NYSERDA supplements the work of the Department of State by offering code enforcement officials no-cost energy code training for in-service credit, as well as needs-based energy code support services. Additionally, NYSERDA provides similar training and support to the building design and construction communities. In the last few years, these activities have been funded through the American Recovery and Reinvestment Act of 2009 (ARRA).

Through ARRA, NYSERDA has distributed, in cooperation with the New York State Department of State, $4.4 million for training and support services to improve education on and enforcement of the Energy Code. As part of this initiative, in-person and online training has been delivered statewide to thousands of building, design and code enforcement professionals since early 2010. NYSERDA has also made possible through this funding free plan review assistance and as-needed Energy Code support to municipalities. The primary goals of this initiative are to achieve at least 90% compliance with the Energy Code by 2017, as required by ARRA, and to contribute to achieving the state's aggressive energy savings targets. NYSERDA, in conjunction with the Department of State, will continue providing similar services through 2016 using System Benefits Charge (SBC) funding (see description below).[110]

Stakeholders: Key stakeholders in New York include:

- Architects (NYS American Institute of Architects)
- Builders (New York State Builders Association)
- Building Codes Assistance Project (BCAP)
- Code Enforcement Officials (New York State Building Officials Conference)
- Energy Efficiency Advocates (Building Codes Assistance Project/Alliance to Save Energy and Northeast Energy Efficiency Partnerships)
- Environmental Advocates (Urban Green)
- Engineers
- Large Community (New York City)
- Mid-and small- Communities
- NYSERDA

Energy Efficiency Program Overview

Framework and Requirements. New York has two prevailing policy directives governing its most of its energy efficiency programs. The first established System Benefits Charge (SBC) programs to be administered by the New York State Energy Research and Development Authority (NYSERDA). The second is an Energy Efficiency Portfolio Standard with three-year targets for energy savings with a goal of reducing the state's energy consumption 15% by 2015, and specifies both electric and natural gas consumption.

The System Benefits Charge (SBC) program was established by the New York Public Service Commission (NYPSC) and took effect July 1, 1998 to offer programs that were historically funded through utility rates, but not expected to be adequately addressed by competitive energy markets. In October 2011, the NYSPSC approved the latest extension of the SBC for a five year period from January 1, 2012 through December 31, 2016. In recent years, New York State has adopted a number of landmark energy and environmental policy decisions, including 45 x 15 clean energy strategies (i.e., the adoption of the 15 x 15 energy-efficiency goal and the 30 x 15 renewable energy goal) and the adoption of the 80 x 50 greenhouse gas reduction goal. In response to and in support of these policies, as part of the latest extension, the NYSPSC approved strategically adjusting the SBC program to be a means of testing, developing, and introducing new technologies, strategies and practices that build the statewide market infrastructure to reliably deliver clean energy to New Yorkers. Of note, the strategies identified in the Order include accelerating incorporation of more rigorous energy-use standards in codes. NYSERDA, as program administrator for the SBC, has committed to using an open, stakeholder-driven planning process to develop, implement and administer the latest SBC activities, collectively known as the Technology and Market Development (T&MD) portfolio, and will use competitive solicitations to secure industry experts to deliver the initiatives. NYSERDA will also measure performance of the program from development, through implementation and into post-implementation to evaluate its impact and effectiveness.[111]

Funding. The New York Public Service Commission (NYPSC) in October 2011, in Case 10-M-0457 issued its order continuing the Systems Benefit Charge and Approved an Operating Plan for a Technology and Market Development Portfolio of SBC funded programs through 2016. For the current program year NYSERDA's SBC programs for energy efficiency have been budgeted at $70,984,760.

In June 2008, the NYPSC issued an Order Establishing Energy Efficiency Portfolio Standard (EEPS) and Approving Programs (Case 07-M-0548). This order adopted a goal of a 15% reduction in electricity usage in the state by 2015. The order increased the annual level of electric system benefits charges from $175 million to $334 million as of October 1, 2008. For the current program year, NYSERDA has budgeted an additional $183,125,776 for EEPS energy efficiency programs. In addition to NYSERDA, the state's utilities have budgeted an additional $184,842,518 in 2012 for their energy efficiency programs under the EEPS. The June 2008 order also initiated a charge on customers' natural gas bills to meet EEPS targets. The order set the annual level of yearly natural gas system benefits charges at $13.2 million as of October 1, 2008. Natural gas efficiency program budgets totaled $119.4 million in 2011, for electric efficiency program budgets totaled $1.096 billion as reported by the CEE

In addition, both the Long Island Power Authority (LIPA) and the New York Power Authority (NYPA) run energy efficiency programs under independent authority jurisdiction and program structures. For 2012, LIPA budgeted a total of $82,955,00 for its energy efficiency programs, while NYPA has approved an energy efficiency budget of $200,100,000.[112]

Potential Study. A draft electric energy efficiency potential study, the 2008 Optimal Study, concluded that a 14% reduction in projected levels of electricity use, over and above what can be realized from compliance with expected updates in energy efficiency codes and appliance standards, could be "achievable" by 2015 with well designed, fully funded statewide energy efficiency programs. Achievable potential for cost-effective natural gas efficiency savings is estimated to be approximately 18% of forecasted load for 2016, according to a natural gas energy efficiency potential study, the 2006 Optimal Study.[113]

Implementation Plan. NYSERDA administers the system benefits charge (SBC) programs, collectively known as "New York Energy $mart™." NYSERDA and its contractors implement the programs, which are described as "Technology and Market Development" Programs. In the T&MD portfolio, NYSERDA has included plans for the Advanced Energy Codes and Standards initiative. This project will include training, support services and publications for the building design, construction, and enforcement communities. Additionally, NYSERDA will conduct annual Energy Code compliance assessments and periodic research into Energy Code-related topics, including the building science impacts of various Energy Code provisions.

Also, energy efficiency programs on Long Island are administered separately by LIPA under the brand name of "Efficiency Long Island," while separate programs are administered in New York City by NYPA.[114]

Program Approval. In New York State, the SBC program is under the purview of the NYPSC. The NYPSC's June 2008 Order Establishing Energy Efficiency Portfolio Standard (EEPS) and Approving Programs (Case 07-M-0548) allows the utility companies to administer some of the new, fast-track and expedited programs.[115]

Reporting, EM&V, and Cost-effectiveness. Per Case 10-M-0457, NYSERDA is responsible for delivering monthly financial status reports and semiannual and annual reports on the progress, outputs and outcomes of the T&MD portfolio initiatives. NYSERDA is also responsible for making publicly available the results of all T&MD evaluation studies, including their recommendations and NYSERDA's responses. Moreover, NYSERDA must conduct a "mid-term" review that will include written reports and a presentation – following submission of its 2013 annual report – to describe the full scope of T&MD initiatives to date.[116]

- Regarding EM&V, each proposal must contain a detailed protocol for measurement and verification of results, taking into account guidance provided by the Director of the Office of Energy Efficiency and Environment. With respect to evaluation and reporting, Staff recommends that for expanded NYSERDA programs, existing mechanisms for program evaluation should be used, with the exception that expenditures of up to 5% of funding for the program can be used for measurement and analysis.[117]

- Utilities must provide TRC ratios, which should include any proposed utility incentives.

Ohio

Codes Overview

Development and Adoption. The Board of Building Standards is the primary state agency charged with developing recommendations on the building code. The Board must submit its recommendations to Ohio legislature's Joint Committee on Agency Rule Review (JCARR) and the state's administrative review procedures before any code update can become effective. JCARR reviews the rules to avoid any contradictions with previous legislation and to ensure that rules do not exceed the agency's stated authority. After that process has been completed, a public comment and notice period takes place and if no major changes are made the Board of Building Code Standards will then adopt the rules and file them with the appropriate state agencies.

JCARR then has authority to review the adopted rules under the same criteria used when rules are proposed.[118]

Compliance and Enforcement. Building departments certified by the Board of Building Standards enforce the provisions of the Ohio Building Code for their jurisdiction. To comply with code, plans must be submitted for all buildings within the scope of the code, as adopted by the state and local government. The jurisdiction is required to review and approve the plans and to perform inspections to determine if the work performed conforms to the approved plans. If there is no certified building department within a jurisdiction, the Ohio Department of Commerce Division of Industrial Compliance reviews and approves plans for commercial construction.[119]

Role of Program Administrators. No specific role was identified.

Stakeholders: Key stakeholders include:

- Ohio Board of Building Standards (BBS)
- Joint Committee on Agency Rule Review (JCARR)
- Ohio Building Officials Association
- Ohio Code Enforcement Officials Association
- Ohio Home Builders Association
- Midwest Energy Efficiency Alliance (MEEA)

Energy Efficiency Program Overview

Framework and Requirements. The Advanced Energy Fund, instituted in 1999, supports an Energy Efficiency Revolving Loan Fund that is administered by the state. The Ohio Energy Resources Division oversees the Advanced Energy Fund, which supports energy-efficiency programs throughout the state.[120]

Funding. These mostly commercial and industrial projects are funded by a utility rider, calculated at $0.09/month per utility bill on retail electric service rates until December 31, 2010. The rider has not been renewed. As a result, the Energy Loan Fund is designed to sustain the remaining funds through the Advanced Energy Fund as a revolving loan fund in order to continue delivering benefits and for customers and achieve the results of verified energy and cost savings, improved environmental quality and positive economic impacts. CEE reported that $140.9 million was budgeted for 2011 electric programs and $42.6 million for natural gas programs. CEE reported that $140.9 million was budgeted for 2011 electric programs and $42.6 million for natural gas programs.

The Ohio Department of Development, Office of Energy administers incentive programs through the Advanced Energy Fund to support investments in renewable energy and energy efficiency projects in the industrial, commercial, and residential sectors. To that end, on December 15, 2011, the Office of Energy launched the Energy Loan Fund that utilizes funds through the Advanced Energy Fund along with federal funds from the State Energy Program.

Established under Ohio Revised Code (ORC) section 4928.63, the Advanced Energy Fund was funded under ORC 4928.61 that provided for a rider, calculated at $0.09/month per utility bill on retail electric service rates until December 31, 2010. The rider has not been renewed. As a result, the Energy Loan Fund is designed to sustain the remaining funds through the Advanced Energy Fund as a revolving loan fund in order to continue delivering benefits and for customers and achieve the results of verified energy and cost savings, improved environmental quality and positive economic impacts. Since its inception in 1999, the Advanced Energy Fund has invested nearly $60 million in nearly 700 energy efficiency and renewable energy projects. The results have been an energy savings of more than 173,909 megawatt hours annually – enough to power more than 15,000 homes per year.[121]

Senate Bill 221. Passed in 2008, it calls on utilities to develop electric energy efficiency programs to meet newly proposed energy and peak demand savings targets. Components of SB221 include the following:[122]

Potential Study. Prior to proposing its comprehensive energy-efficiency and peak-demand reduction program portfolio plan, an electric utility must conduct an assessment of potential energy savings and peak-demand reduction from adoption of energy-efficiency and demand-response measures in its territory. An electric utility may collaborate with other electric utilities to co-fund or conduct such an assessment on a broader geographic basis than its certified territory. However, such an assessment must also disaggregate results on the basis of each electric utility's territory. (Note: It appears that studies have been done since program portfolios are in place in Ohio.)[123]

Implementation Plan. When developing programs for inclusion in its program portfolio plan, an electric utility must consider the following criteria: (1) Relative cost-effectiveness. (2) Benefit to all members of a customer class. (3) Potential for broad participation within the targeted customer class. (4) Likely magnitude of aggregate energy savings or peak-demand reduction. (5) Non-energy benefits. (6) Equity among customer classes. (7) Relative advantages or disadvantages of energy-efficiency and peak-demand reduction programs. (8) Potential to integrate the proposed program with similar programs offered by other utilities, if such integration produces the most cost-effective result and is in the public interest. (9) The degree to which a program bundles measures to avoid lost opportunities. (10) The degree to which the program design engages the energy-efficiency supply chain and leverages partners. (11) The degree to which the program successfully addresses market barriers or market failures. (12) The degree to which the program leverages knowledge gained from existing program successes and failures. (13) The degree to which the program promotes market transformation.[124]

Program Approval. The distribution utilities administer their own energy-efficiency programs with oversight from the Public Utilities Commission of Ohio (PUCO) and the PUCO may modify the utilities' proposed programs.[125]

Reporting, EM&V, and Cost-effectiveness. By March 15 of each year, each electric utility must file a portfolio status report addressing the performance of all approved programs in its program portfolio plan over the previous calendar year which includes, at a minimum, the following information: compliance demonstration, program performance assessment, and an independent program evaluator report.

- Regarding EM&V, the utility annual portfolio status report must include an evaluation, measurement, and verification report documenting the energy savings and peak-demand reduction values and the cost-effectiveness of each energy-efficiency and demand-side management program. The report must include documentation of any process evaluations and expenditures, measured and verified savings, and cost-effectiveness of each program. Measurement and verification processes shall confirm measures were actually installed; installation meets reasonable quality standards; and measures are operating correctly and are expected to generate the predicted savings. PUCO staff may publish guidelines for program measurement and verification.[126]
- Ohio uses the Total Resource Cost Test as the primary cost-effectiveness test. Ohio also uses the Utility Cost Test as a secondary test.[127]

Oregon

Codes Overview

Development and Adoption. Changes to the energy conservation requirements are submitted on code change forms to the Oregon Building Codes Division (BCD), with the Residential Structures Board reviewing proposed changes that are applicable to residential code and the Building Codes Structures Board reviewing proposed changes that are applicable to the non-residential provisions of the energy code. Code changes typically take place every three years in coordination with the next iteration of ICC and IECC model codes. The BCD administrator and the applicable board must concur for a code change to move forward to the rulemaking process.[128]

Compliance and Enforcement. The state energy code provisions are mandatory for all heated and/or cooled residential and commercial construction, and set mandatory statewide minimum requirements that cannot be modified by local government without state approval. For all buildings, the city, county or designated enforcement agency is responsible for code enforcement. Compliance can be determined through plan review and site inspection documenting construction characteristics. Compliance can be demonstrated for residential construction either by applying the prescriptive path or by completing a residential thermal performance calculation form for trade-offs of the components of the envelope. Documenting compliance for commercial buildings can be done using the COMcheck prescriptive or Simplified Trade-Off methods, as well as a Whole Building Approach.[129]

Role of Program Administrators.

Stakeholders: Key stakeholders include:

- Building Code Division (BCD)
- Building Codes Structures Board (BCSB)
- Oregon Building Officials Association (OBOA)
- Residential & Manufactured Structures Board (RMSB)
- Homebuilders Association (OHBA)
- Energy Trust of Oregon
- Northwest Energy Efficiency Alliance (NEEA)

Energy Efficiency Program Overview

Framework and Requirements. In 1989, the Oregon Public Utility Commission's (OPUC's) Integrated Resource Planning (IRP) Order No. 89-507 required the IOUs to consider energy-efficiency as a resource when developing resource plans. Oregon's 1999 restructuring law, SB1149, established a public purpose charge to support electric energy-efficiency, renewable energy, and low-income programs. In response to SB1149, the Energy Trust of Oregon (ETO) was set up under the direction of the OPUC to implement efficiency programs with the public purpose charge funds. ETO's first long-range strategic plan, laid out energy savings goals between 2010 and 2014 of 256 average megawatts (2,242.6 GWh) of electricity and 22.5 million annual therms of natural gas. Electric utility savings reported to EIA added to ETO and NEEA program energy savings indicate that 291,658 MWh were saved in 2009.[130]

Funding. Oregon's public purpose charge (3% of the total revenues collected by the utilities from customer electric bills) provides about $60 million per year to support energy-efficiency, renewable energy, and low-income programs in Oregon. This funding supports ETO's electric programs as well as electric low-income programs provided by Oregon Housing and Community Services. In 2007, SB 838 extended the public purpose charge through 2025. The total of all rate-payer funded electric program budgets, according to CEE, was $109.1million for 2011. The ETO also receives funding from natural gas utilities (NW Natural and Cascade Natural Gas) to administer natural gas efficiency programs. Total natural gas efficiency budgets were $27.8 million for 2011.[131]

Potential Study. ACEEE completed a technical potential study for Oregon in 2003; the estimated consumption savings as percentage of sales was 28% for the residential sector, 32% for the commercial sector, and 35% for the industrial sector. Another potential study was completed in 2006 for ETO.[132]

Implementation Plan. (1) Statutory/Regulatory requirements for evaluation: Docket UM 551, Order-590 (not posted on web); (2) Written evaluation rules/requirements: Docket UM 551, Order 94-590.[133] (Need additional information here)

Program Approval. The state's electric energy-efficiency programs are required under SB1149 and overseen by ETO.[134]

Reporting, EM&V, and Cost-effectiveness. (1) Statutory/Regulatory requirements for evaluation: Docket UM 551, Order-590 (not posted on web); (2) Written evaluation rules/requirements: Docket UM 551, Order 94-590.

- Regarding EM&V, (1) Statutory/Regulatory requirements for evaluation: Docket UM 551, Order-590 (not posted on web); (2) Written evaluation rules/requirements: Docket UM 551, Order 94-590. (Need additional information here)
- Oregon uses the Societal Cost Test as the primary cost-effectiveness test. Oregon also uses the Utility Cost Test as a secondary test.[135]

Rhode Island

Codes Overview

Development and Adoption. The codes and standards process takes place every three years in Rhode Island, concurrent with the publication of new editions of the model organization codes. The Rhode Island Building Code Commission (BCC) is charged with developing codes and holding public hearings and comment periods before their updates go to the state legislature for approval.[136]

Compliance and Enforcement. Code officials in each local jurisdiction are charged with enforcing the state building code while the state building commissioner enforces the code for all state-owned buildings. To meet ARRA's requirement of at least 90% compliance, Rhode Island has undertaken significant efforts to ensure that the target is met. The BCC has organized mandatory workshops for building code officials. These workshops are intended to increase compliance across the state.[137]

Role of Program Administrators. Currently, National Grid (Narragansett Electric) in collaboration with NEEP and the BCC have begun to develop plans for a third-party inspector program to standardize enforcement across the state and increase compliance. National Grid has also contributed funding and support to workshops and trainings for building code officials in the state. However, there is presently no methodology in place to provide for the attribution of energy savings to utilities for their efforts.[138]

Stakeholders: Key stakeholders in Rhode Island include:

- Rhode Island Department of Administration Building Code Commission
- Rhode Island Building Code Officials Association
- Rhode Island Builders Association
- National Grid
- NEEP

Energy Efficiency Program Overview

Framework and Requirements. The Comprehensive Energy Conservation, Efficiency and Affordability Act of 2006 increased the role and requirements of energy efficiency, requiring utilities to acquire all cost-effective energy efficiency. The act also established requirements for strategic long-term planning and purchasing of least-cost supply and demand resources and setting three-year energy saving targets. Rhode Island established a public benefits funding mechanism as part of its restructuring legislation to support energy-efficiency programs and renewable energy.[139]

Funding. Substantial increases in Rhode Island's electric efficiency investments from $14 million (2008) to $44 million (2011) place R.I. in the top five states nationally in terms of per capita spending on efficiency programs, For 2012, National Grid budgeted $61,400,000 for electric efficiency programs and an additional $13,700,000 for gas efficiency programs.[140]

Potential Study. KEMA completed a potential study for Rhode Island in 2010 the estimated economic potential as a percentage of forecast energy use was 28% for the residential sector, 28% for the commercial sector, and 14% for the industrial sector (24% overall).[141] [142]

Implementation Plan. Each electricity and natural gas distribution company is required to submit to the Rhode Island Public Utilities Commission on or before September 1, 2008, and triennially on or before September 1, thereafter through September 1, 2017, a plan for system reliability and energy-efficiency and conservation procurement. In developing the plan, the distribution company may seek the advice of the commissioner and the council. The plan shall include measurable goals and target percentages for each energy resource, pursuant to standards established by the commission, including efficiency, distributed generation, demand response, combined heat and power, and renewables.[143]

Program Approval. Energy-efficiency programs are offered by Rhode Island's regulated distribution utilities. The major investor-owned utility operating in the state, Narragansett Electric (a National Grid company) offers a comprehensive slate of programs that parallel National Grid's offerings in Massachusetts. Hearings are held once a year before the Rhode Island PUC to review program plans. The 2006 act also mandated the creation of the Energy Efficiency and Resources Management Council (EERMC), a stakeholder advisory board modeled after Connecticut's that also acts to review and recommend the proposed energy efficiency plans. Program costs are trued up annually each May.[144]

Reporting, EM&V, and Cost-effectiveness. Each electrical and natural gas distribution company must provide a status report on the implementation of least cost procurement to the PUC and other organizations, which may provide the distribution company recommendations with regard to effective implementation of least cost procurement. The report must include targets for each energy resource included in the order approving the plan and the achieved percentage for energy resource. It must include the achieved percentages for efficiency, distributed generation, demand response, combined heat and power, and renewables.[145]

- Utilities must include a Monitoring and Evaluation (M&E) component in its energy-efficiency plan. The M&E component should address savings verification, including analysis of customer usage, issues of ongoing program design and effectiveness, and other issues including those related to market assessment and methods to claim savings from market effects.[146]
- The PUC's Standards for Energy Efficiency and Conservation Procurement require use of the Total Resource Cost (TRC) test.[147]

Vermont

Codes Overview

Development and Adoption. Act 250 was first adopted in 1970 and energy criteria were added in 1973. Act 250 required that certain developments incorporate energy conservation measures that employed the best available technology based on life-cycle cost analysis. The Vermont Department of Public Service reviews and provides comments on Act 250 applications to the nine District Environmental Commissions that issue land use permits. The Vermont Department of Public Service (DPS) is responsible for energy code development in Vermont. It took the lead starting with Vermont's first energy code in 1998 in organizing stakeholder groups and coordinating development of the next version of the code.

The residential building energy standards (RBES) revisions go through a process specified in the State Administrative Procedures Act. The process includes public notification, public hearing, testimony, and comments. At least one year prior to adopting required revisions to the RBES, the DPS must convene an advisory committee to provide recommendations to the commissioner. Energy code responsibilities are shared between the Department of Public Safety/Division of Fire Safety for commercial buildings and DPS for residential buildings. Typically every three years, DPS promulgates updates to the residential and commercial codes to incorporate the most recent versions of the IECC and ASHRAE Standard 90.1. The rules must then be approved by the Vermont Legislative Committee on Administrative Rules (LCAR) with an effective date within three months of final adoption.[148]

Compliance and Enforcement. Builders must self-certify compliance with the residential energy code. The RBES requires that a certification label be signed and permanently affixed in the home. The RBES is not enforced at the state level and does not require inspections by code officials; however, it does not eliminate inspections related to Act 250, spot checks for enforcement of other codes, or inspections required by local codes. For commercial buildings (both new construction and renovations), the Vermont Department of Public Safety, Division of Fire Safety is responsible for the building codes. The primary focus is on fire protection. However, the Department of Public Safety is working with DPS to better enforce the energy provisions of building codes. Where compliance with RBES or CBES is required by an Act 250 permit, it is separately enforceable through Act 250. The Vermont DPS and several utilities have instituted an inspection process for Act 250 commercial building projects. Four different ways to comply with energy codes are available after the basic requirements have been satisfied: 1) a prescriptive list of features, 2) tradeoff variations, 3) VTcheck software, and 4) a home energy rating less than or equal to 82.[149]

Role of Program Administrators. There are currently two studies wrapping up in Vermont to address the question of energy code compliance rates, neither of which is currently complete. The Navigant study is the first to address non-residential code compliance in Vermont. The NMR study on the residential side is the fourth in a series of such studies and is funded by DPS.

The DPS and Efficiency Vermont (EVT) have had a long history of explorations of the concept of claiming energy savings from code support. Neither organization has found it necessary or worthwhile to endeavor to evaluate and assign savings for this activity. EVT is officially regulated by the Vermont Public Service Board, but DPS serves as the day-to-day overseer and clearinghouse for issues before they are raised with the Board. Instead of claiming savings from energy codes, the DPS and EVT proposed, and the Public Service Board adopted "non-resource acquisition" goals, which include activities for which budgets are allocated but no energy savings are measured. Included in this category are a number of activities in support of code compliance (e.g., number of trainings, number of individuals trained, etc.). There has previously been little to no EM&V conducted on these activities beyond keeping count for the purposes of reporting to the DPS and Board. However, Vermont Energy Investment Corporation and Burlington Electric Department are assessed periodically to measure overall performance, and the PSD has specifically allocated funds in the coming years to address these issues.

Efficiency Vermont has played a key role in supporting municipalities where no code enforcement officials exist, as well as by conducting trainings on building energy codes.[150]

Stakeholders: Key stakeholders include:

- Department of Public Service
- Vermont Natural Resources Board
- Efficiency Vermont
- Department of Public Safety
- Home Builders and Remodelers Association of Vermont
- NEEP
- Building Codes Assistance Project

Energy Efficiency Program Overview

Framework and Requirements. Vermont does not have traditional EERS legislation with a set schedule of energy savings percentages for each year. Vermont originated the model of a statewide "energy efficiency utility" (EEU) after 1999 legislation authorized the Vermont Public Service Board (PSB) to collect a volumetric charge on all electric utility customers' bills to support energy efficiency programs. Vermont law requires EEU budgets to be set at a level to realize "all reasonably available, cost-effective energy efficiency." Compensation and specific energy-savings levels are then negotiated with the Efficiency Vermont (EVT) contractor Vermont Energy Investment Corporation (VEIC).[151]

Funding. EVT is funded by a non-bypassable "energy efficiency charge" (EEC) that is included in electric rates. This charge resulted from passage of S. 137 by the Vermont Legislature in 1999. In December 2010 the Public Service Board issued an Order of Appointment setting Efficiency Vermont's term through 2021. VPS has tentatively approved a 2012-2014 budget for EVT that will achieve approximately 2.2% annual savings (VT Public Service Board Docket EEU-2010-06, Order Entered 8/1/2011). In 2012, Efficiency Vermont has budgeted $41,222,700 for energy efficiency programs, while Vermont Gas has budgeted an additional $2,107,965 for natural gas efficiency programs.[152]

Potential Study. GDS Associates, Inc. completed a potential study for Vermont in 2007; the estimated consumption savings as percentage of forecasted 2015 sales was 21.3% for the residential sector, 21.3% for the commercial sector, and 14.5% for the industrial sector.[153]

Implementation Plan. The Vermont PSB oversees EVT which is run by VEIC. Vermont statute (30 VSA Sec. 218c) directs all electric and natural gas utilities to prepare and implement least cost integrated plans — plans "for meeting the public's need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including environmental and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs." The Vermont Energy Act of 2009 directs the Vermont Department of Public Service (DPS) to create a self-managed energy efficiency pilot program for select transmission and industrial utility customers whose individual contributions to the public benefits fund exceeded $1.5 million in 2008.[154]

Program Approval. DPS, any entity appointed by the PSB, all gas and electric utility companies, and the PSB, are encouraged to propose, develop, solicit, and monitor energy-efficiency and conservation programs and measures that result in the conservation and efficient use of energy and meet the applicable agency of natural resources' air quality standards. Such programs and measures, and their implementation, may be approved by the PSB if it determines they will be beneficial to the ratepayers of the companies after PSB notice and hearings. DPS shall investigate the feasibility of enhancing and expanding the efficiency programs of gas utilities and make any appropriate proposals to the PSB.[155]

Reporting, EM&V, and Cost-effectiveness. Savings verification is conducted annually by the Public Service Department. In addition, every three years by an independent auditor of the reported energy and capacity savings and cost-effectiveness of programs delivered by any entity appointed by the PSB. The PSB must report to the general assembly annually concerning the prior year's self-managed energy-efficiency programs. The report shall identify participants, their annual investments, and resulting savings, and actions to exclude entities from the program.[156]

- Utilities must provide for the independent evaluation of programs, but no written evaluation rules and requirements are mentioned. As part of each three year performance period, the PSD proposes a comprehensive evaluation plan and budget.
- Vermont uses the Societal Cost Test as the primary cost-effectiveness test. Vermont also uses the Utility Cost Test and the Participant Cost Test as secondary tests.[157]

Washington

Codes Overview

Development and Adoption. The Washington State Building Code Council (SBCC) reviews and amends the state energy code for residential and commercial buildings, typically on a three year schedule to coincide with next iteration of model codes. When the SBCC accepts a proposed rule change, the change is sent to a Technical Advisory Group (TAG) for review and rulemaking begins. After completing the review, the TAG submits its recommendations back to the SBCC. The SBCC then makes the final determination on acceptance. Once final approval is granted by the SBCC, the rule is filed with the Washington State Code Reviser and then published in the Washington State Register. The final rule becomes effective after the next legislative session.[158]

Compliance and Enforcement. For commercial buildings, the city or county, or its designated enforcement agency, can enforce the code or require the building owner to hire a certified nonresidential energy special inspector to perform the plan review and/or field inspection. Energy plan reviewers and special inspectors are certified through a program regulated by the Washington Association of Building Officials (WABO). Certification requires that individuals complete a comprehensive testing program and have specific credentials. Re-certification is required when changes are made to the code. Technical assistance is offered through the Northwest Energy Efficiency Council (NEEC). For residential buildings, the city or county, or their designated enforcement agencies, regulate enforcement. Residential compliance can be through a prescriptive path or component performance approach. Compliance is determined by plan review and inspection by the local building official. For commercial buildings an on-site inspection is required before a certificate of occupancy for the building can be issued. Technical assistance is offered through the Washington State University (WSU) Extension Energy Program. WSU is also a technical advisor to the SBCC for energy-related items and assists the TAG.[159]

Role of Program Administrators. In the mid 1990's Washington utilities formed the Utility Code Group (UCG), which established training programs to raise understanding and awareness for the enforcement of codes and standards across the state. Developers could choose whether they wanted the city/county inspector to perform the inspections or a special inspector (trained by the UCG) to provide inspection services. Savings were determined via compliance verification and were allocated based on how much funding the utilities provided for the UCG in relation to their revenues. This program has been discontinued.[160]

Washington took part in the Department of Energy's Compliance Pilot Study, which tracked and evaluated the compliance process in the state. Researchers conducted interviews in local jurisdictions to determine current data collection and storage practices and reviewed five residential and five non-residential plan sets. The relevant state building code administrative agencies were contacted to verify the data collection and plan retention requirements that already exist to determine how the current situation can be improved. NEEA is sponsoring a follow-on residential code compliance study to determine the actual compliance rate.[161]

Stakeholders: Stakeholders in the Washington code efforts include:

- State Building Code Council (SBCC)
- Technical Advisory Group (TAG)
- Washington Association of Building Officials (WABO)
- Building Industry Association of Washington
- Northwest Energy Efficiency Council
- NEEA

Energy Efficiency Program Overview

Framework and Requirements. Law requires savings targets to be based on the Northwest Power Plan, which estimates potential savings of about 1.5% savings annually through 2030 for Washington utilities. Each utility with more than 25,000 customers in Washington must “pursue all available conservation that is cost-effective, reliable and feasible.” Seventeen utilities, both publicly owned and investor owned, currently meet the definition of qualifying utility. Utilities are required to use the Northwest Power and Conservation Council’s (NPCC) methodology to determine their achievable cost-effective conservation potential through 2019, and update that potential assessment every two years for the subsequent 10-year period. Utilities also must establish a biennial acquisition target for 2010-2011, and update that target every two years. Biennial and 10-year efficiency goals vary by utility.[162]

Funding. Washington has no public benefits funding to support programs. IOUs recover the costs of energy-efficiency programs through tariff riders. Program costs are reported and adjusted annually in proceedings before the Utilities and Transportation Commission (WUTC). Most publicly-owned utilities in Washington also provide funding for energy-efficiency programs and services. Washington electric utilities budgeted $150.8 million for 2011 programs. Budgets totaled $29.7 million for natural gas programs in 2011.[163]

Potential Study. Every two years since January 2010, each utility must project its cumulative 10-year conservation potential. This projection must be derived from and reasonably consistent with one of two sources: (1) The utility's most recent IRP—When developing this projection, utilities must use methodologies that are consistent with those used by the NPPC in its most recent regional power plan. (2) The utility's proportionate share, developed as a percentage of its retail sales, of the NPPC's current power plan targets for the state of Washington.[164]

Implementation Plan. The NPPC is a regional multistate agency established under the Northwest Power Act. The NPPC prepares and adopts a regional conservation and electric power plan for the Pacific Northwest region every five years. The NPPC's plans include regional targets for conservation.[165] The NPPC adopted its Sixth Northwest Power Plan in February 2010.[166]

Program Approval. The Washington IOUs carry out DSM programs with regulatory oversight by the WUTC. WUTC staff and other interested persons may file written comments regarding a utility's 10-year achievable conservation potential or its biennial conservation target within 30 days of the utility's filing. The WUTC, considering any written or oral comments, may determine that additional scrutiny is warranted of a utility's 10-year achievable conservation potential or biennial conservation target. If the WUTC determines that additional review is needed, it will establish a process to fully consider appropriate revisions. Upon conclusion of the review, the WUTC will determine whether to approve, approve with conditions, or reject the utility's 10-year achievable conservation potential and biennial conservation target.[167]

Reporting, EM&V, and Cost-effectiveness. Starting in June 2012, each utility was required to submit an annual conservation report to the department of Community, Trade, and Economic Development (the department). The report must document the utility's progress in meeting the conservation targets established in RCW 19.285.040 and must include the following:

(1) A summary of the data the utility reports to the "planning, tracking and reporting system." The summary must include total electricity savings by customer sector. Utilities must use the NPCC's regional technical forum "planning, tracking and reporting system," or an alternative `approved reporting system.

(2) If the utility counts towards its biennial target any electricity savings from local, regional, state, or federal market transformation programs, or local, state or federal codes or standards, the utility shall include copies of reports of the annual electricity savings for the utility's service territory as estimated and recorded by entities such as the department, the NPCC, regional market transformation organizations, or the utility;

(3) A brief description of the methodology used to establish the utility's 10-year potential and biennial target to capture cost-effective conservation;

(4) The utility's total expenditures for conservation broken down by sector and, if any, production efficiency and distribution efficiency.[168]

- Regarding EM&V, Avista agreed to spend 3% to 6% of its conservation budget on EM&V activities to determine whether its programs result in actual energy savings. PacifiCorp agreed to spend 4% to 6% of its conservation budget on EM&V activities to determine whether its conservation programs result in actual energy savings.
- The primary cost-effectiveness test is the Total Resource Cost (TRC) test as modified by the NPPC. The NPPC-modified calculation of TRC includes quantifiable non-energy benefits, a risk adder, and a 10% conservation benefit adder that increases the avoided costs by 10%. The NPPC does not include a net-to-gross adjustment. Utilities also must provide calculations of the Program Administrator Cost test (also called the Utility Cost test), Ratepayer Impact Measure test, and Participant Cost test as described in the National Action Plan for Energy Efficiency study "Understanding Cost-effectiveness of Energy Efficiency Programs."[169] [170]

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