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Office of Codes and Standards Resource Book

Section 1: Building Energy Codes and Standards

M. P. Hattrup

January 1995

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
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Office of Codes and Standards

CODES AND STANDARDS RESOURCE BOOK

The U.S. Department of Energy's (DOE's) Office of Codes and Standards has developed this Resource Book to provide:

- a discussion of DOE involvement in building codes and standards
- a current and accurate set of descriptions of residential, commercial, and Federal building codes and standards
- information on State contacts, State code status, State building construction unit volume, and State needs
- a list of stakeholders in the building energy codes and standards arena.

The Resource Book is considered an evolving document and will be updated occasionally. Users are requested to submit additional data (e.g., more current, widely accepted, and/or documented data) and suggested changes to the address listed below. Please provide sources for all data provided.

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1.0 DOE Involvement

The Building Energy Standards Program (BESP) has been in existence since the 1970s. The genesis of the BESP mandate is a collection of Federal legislation aimed at improving the efficiency of new buildings through mandatory State adoption of building energy codes. The most recent pieces of legislation include the Energy Policy Act of 1992 (EPAct) and the Climate Change Action Plan (CCAP).

The BESP consists of a collaboration between the U.S. Department of Energy (DOE), using the Pacific Northwest Laboratory (PNL) as its technical support; the Association of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE); national model code organizations; State governments; and others. This collaboration has resulted in the development, adoption, and implementation of model energy codes for buildings. These codes represent the results of engineering and economic analyses that were introduced by DOE into a process that involved the private sector, the environmental community, and States. The result of this process is a standard for new residential and commercial buildings that is widely accepted.

The BESP is now beginning to focus on providing technical support for the complex process of implementing and enforcing building codes at the State and local levels. Through the efforts of this program, occupants of new buildings will save an estimated $1.2 billion in avoided energy costs by the year 2000. The cumulative year 2000 Federal investment will be less than $100 million, a 10 to 1 return on the investment. Because this program addresses both new buildings and additions or alterations to existing buildings, the program will affect the overall building stock over many years. The savings will be even larger in the post 2000 time period when the cumulative building stock will produce added savings that are likely to be especially important in the context of the post-2000 climate change carbon mitigation strategies.

1.1 Implementation Plan

1.1.1 DOE's Overall Implementation Plan *(The PNL contact is Diana Shankle)*

Under Section 101 of EPAct, States are required to update their commercial building codes to meet or exceed Standard 90.1-89 and to consider whether to update their residential codes to meet or exceed the 1992 Model Energy Code (MEC). State actions must be certified to DOE. DOE is required to provide technical assistance and exemplary program funding to States in upgrading and certifying their building codes.

The DOE will actively assist States in upgrading and implementing energy-related provisions of their building codes through the following activities:

- Provide information to promote the benefits of efficient building energy use to building owners and new home buyers.

- Establish training programs for code officials, builders, and architects.

- Promote model code legislation.
- Offer testimony before State legislative and administrative bodies.
- Provide grants to States for co-funded training and other implementation activities.
- Provide grants to States for exemplary programs and the transfer of these programs to other States.

Until codes are actually adopted, used in design and construction, and enforced, energy savings will not be realized. Action #10 from the 1993 CCAP addresses these implementation issues. Along with adoption, actual buildings must comply with the adopted codes and standards. Knowledge of actual compliance exists in a few States (e.g., California, Florida, New York, Washington, and Oregon) and indicates that full compliance with the adopted codes and standards will not be achieved without significant effort. Other anecdotal information supports these findings and indicates that significant room for improvement exists relative to current compliance with energy codes.

Figure 1.1 illustrates the strategy DOE is using to implement building energy codes. The figure should be viewed as a pyramid with the top of the pyramid being the core implementation materials developed in consultation with national-level user group representatives.

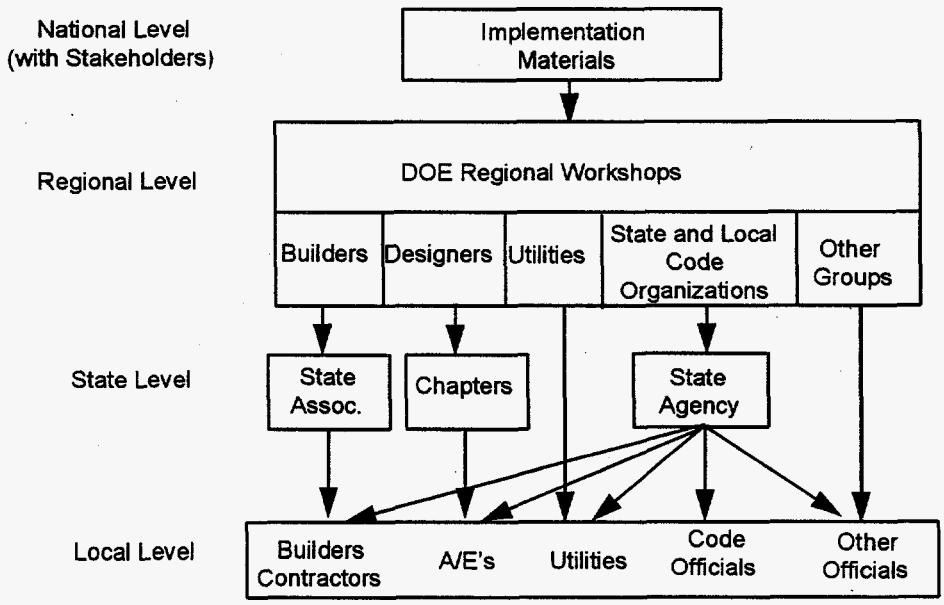

Figure 1.1. Updating and Implementing of Energy Efficiency Provisions in Building Codes

To establish an infrastructure from which training programs on upgraded energy codes can be launched and to tailor, customize, and disseminate the training materials to the appropriate stakeholders, DOE will work at the regional level through its 10 Regional Support Offices. At regional workshops held in FY 1994, invited State representatives learned more about requirements in the EPAct relative to upgrading State building energy efficiency codes and conversely provided DOE with information on their needs. DOE worked with national institutions to identify the key State personnel in the various regions and facilitated the actual workshops. Attendees included representatives from State Energy Offices and agencies responsible for building codes, Public Utility Commissions, national and regional model code organizations, and associations of State and local governments.

Delivery of the materials will take place at the State and local level by regional, State, and local stakeholders. DOE will work through its Regional Support Offices to establish co-funded training and information programs.

1.2 Program History

1.2.1 Building Energy Standards Program (BESP) History *(The PNL contact is Dave Conover)*

This section contains the summary from *A History of the Building Energy Standards Program* by D. L. Shankle, J. A. Merrick, and T. L. Gilbride (PNL-9386). This report describes commercial and residential building energy standards efforts in the United States. The report also discusses the recent history of U.S. code development and DOE's contributions through the 1980s and early 1990s up to the passage of EPAct. DOE's standards development efforts are concentrated in the BESP, which PNL conducts for the DOE.

DOE has worked with ASHRAE, and other building codes and standards organizations to develop, evaluate, and promulgate energy standards in all sectors of the building industry.

Commercial Standards Contributions

DOE's BESP has contributed to the following commercial standards development efforts:

- Revision of Standard 90A-80 through ASHRAE Special Project 41.
- Development of ASHRAE/IES Standard 90.1-89 through ASHRAE SPC 90R activities. Note that Standard 90.1-89 took into account beneficial solar gains, interaction of building envelope components, and seasonal and part-load efficiencies; it also allowed builders options in demonstrating compliance with the standards.
- Development of DOE's Interim Commercial Standard.

- Development of ENVSTD and LTGSTD software programs to help non-Federal designers calculate compliance with the complex envelope and lighting requirements of the commercial buildings standard.

- Revision of ASHRAE/IES Standard 90.1-89, which will be released for public review in 1996.

Voluntary Residential Standard Contributions

DOE's BESP contributed to the following Voluntary Residential Standard development efforts:

- Revision of the Voluntary Residential Standard through ASHRAE Special Project 53.

- Various technical, economic, and environmental assessments of the Voluntary Residential Standard.

- Development of ARES software, which helps code developers generate standard requirements based on local parameters such as climate, economic variables, energy prices, and construction cost.

- Development of ACRES software, which builders can use to demonstrate compliance with one of the Voluntary Residential Standards paths.

Federal Residential Standards Contributions

DOE's BESP contributed to the following Federal residential standards development efforts:

- Demonstration and evaluation of DOE's Interim Federal Residential Standard.

- Development of COSTSAFR software, which Federal housing administrators can use to generate cost-effective compliance criteria for Federal housing projects.

- Development of CAPS software, which building designers can use to evaluate different combinations of conservation measures for compliance with the Federal standard.

Manufactured Home Standards Contributions

DOE's BESP revised and evaluated HUD's Manufactured Home Construction and Safety Standards.

Technology Transfer Activities

DOE's BESP has conducted numerous technology transfer activities to implement DOE's objectives of furthering energy standards development and use nationwide. In addition to participating with standards and code organizations in code development and revisions as noted above, BESP has:

- Interacted with construction industry professional and trade groups through membership in organizations, given presentations at national and international meetings, and published in construction and code trade journals.

- Operated a 24-hour, toll-free code hotline (1-800-270-2633).

- Produced an informative quarterly newsletter.

- Monitored the status of energy codes nationwide to track code adoption, implementation, and enforcement.

- Conducted assessments of State- and local-level training needs.

- Provided technical assistance to States for code adoption and implementation of other requirements of the EPAct.

- Conducted five regional workshops with State Code Officials.

1.3 Program Drivers

1.3.1 Climate Change Action Plan *(The PNL contact is Jeff Johnson)*

Table 1.1. Key Elements to Implementing the Climate Change Action Plan

	New Code Action	Improve Technology Performance	State Adoption	Increased Compliance
1995			x	
2000			x	x
2005	x	x	x	x
2010		x	x	x
2020	x			

1995 The primary DOE action is to increase State adoption of energy codes.

2000 The primary DOE action is to increase compliance through implementation of State adopted codes.

2005 The primary DOE actions are impacting the construction industry with operations and maintenance (O&M) training on new buildings as contractors learn how to work with the technologies and improve their performance. Industry support also allows DOE to promulgate a code change in this time frame.

2010 Adoption of the new code is enhanced by increased State implementation efforts and industry acceptance of the technologies.

2020 New codes are introduced into existing State adoption and implementation infrastructures including voluntary programs, utility supported programs, and regional energy planning programs.

1.3.2 EPAct State Code Certification Guidance and Timeline *(The DOE contact is Stephen P. Walder, Office of Energy Efficiency and Renewable Energy)*

This section discusses the timeline States are to follow when certifying their building energy codes. Pursuant to Section 304 of the Energy Conservation and Production Act, the DOE announced guidance and procedures for use by States in their review of the energy-related provisions of their residential building codes in light of the relevant version of the Council of American Building Officials (CABO) MEC, and of their commercial building codes in light of the ASHRAE/IES Standard 90.1-89. The guidance and procedures cover Certifications, Statements of Reasons, and Requests for Extensions of deadlines from States pursuant to Section 304.

In addition, DOE has determined that the 93 MEC would achieve greater energy efficiency in residential buildings than the 92 MEC. Consequently, States should review their residential building codes during the next 2 years and certify to DOE by July 15, 1996 whether or not they should upgrade their codes to meet or exceed the 93 MEC.

Dates: Certifications or Statements of Reasons with regard to the 92 MEC were due October 24, 1994. Certifications or Statements of Reasons with regard to the 93 MEC are due 2 years from the publication of the notice. Certifications with regard to Standard 90.1-89 were due October 24, 1994.

Addresses: Certifications, Statements of Reasons, and Requests for Extensions of Deadlines for Certification Statements by States should be directed to the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Codes and Standards, Mail Station EE-43, 1000 Independence Avenue, Washington, D.C. 20585. Envelopes or packages should be labeled, "State Certification of Building Codes Regarding Energy Efficiency."

Supplementary Information

- The EPAct applies to all State building codes, which by definition includes the codes of units of general purpose local government.

- The term "State" is defined to include the District of Columbia, the Commonwealth of Puerto Rico, any territory and possession of the United States, as well as the 50 States.

2.0 Energy Efficiency Standards for New Buildings and Additions and Remodels

2.1 Voluntary Sector Building Standards and Model Codes

2.1.1 Predominant Energy Standards and Committees for Commercial and Residential Buildings *(The Pacific Northwest Laboratory (PNL) contact is Dave Conover)*

Table 2.1. Predominant Energy Standards and Committees

Standard/Committee	Description
ASHRAE/IES Standard 90-75, "Energy Conservation in New Building Design."	Published in 1975, this document was the first to comprehensively address the design and construction of new buildings from an energy efficiency standpoint.
ANSI/ASHRAE/IES Standard 90A-80 and ASHRAE/IES Standard 90B-75, "Energy Conservation in New Design," and ASHRAE 90C-77, Annual Fuel and Energy Resource Determination."	These documents separate the original Standard 90-75. The documents include revised and more rigorous prescriptive provisions (90A-80), a restatement of a whole building performance alternative contained in Sections 10 and 11 of 90-75 (90B-75), and publication of a methodology to determine the impact of a building design on natural resource use (90C-77).
ANSI/ASHRAE/IES Standard 90Aa-87, addendum to "Energy Conservation In New Building Design."	This addendum provides a minor update and revisions to 90A-80.
ASHRAE/IES Standard 90.1-89 "Energy Efficient Design of New Buildings Except New Low-Rise Residential Buildings."	This document provides a complete revision to the previous ASHRAE standards for buildings, excluding low-rise residential buildings. A new approach is described to address thermal envelope design, and more rigorous systems and equipment requirements are provided.
ASHRAE/IES 90.1b-1992, 90.1d-1992, and 90.1e-1992, addenda to "Energy Efficient Design of New Buildings Except New Low-Rise Residential Buildings."	These addenda provide minor updates and revisions of 90.1-1989. Additional addenda are in the development process.
ASHRAE Energy Code for High-Rise Residential and Commercial Buildings, 1993.	This document contains a code language version of ASHRAE/IES Standard 90.1-89 that is more suitable for adoption and enforcement, yet technically equivalent to the mandatory minimum provisions in the standard.
ASHRAE SSPC 90.1	This standing committee within ASHRAE is charged with updating and maintaining Standard 90.1 that is "in code language suitable for adoption."
ASHRAE Standard 90.2-1993, "Energy Efficient Design of New Low-Rise Residential Buildings."	This document provides a complete revision to the previous Standard 90A-1980 as it applies to low-rise residential buildings.
ASHRAE SSPC 90.2	This standing committee with ASHRAE has the same charge as SSPC 90.1 only for Standard 90.2.

2.1.2 Predominant National Model Codes for Commercial and Residential Buildings *(The PNL contact is Dave Conover)*

Table 2.2. Predominant National Model Codes

Model Code	Description
Model Code for Energy Conservation (MCEC) in New Building Construction 1977	This document was developed in 1977 by the Building Officials and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), Southern Building Code Congress International (SBCCI), and the National Conference of States on Building Codes and Standards (NCSBCS).
Council of American Building Officials (CABO) Model Energy Code (MEC)	The document first developed in 1982 has been maintained by CABO and is revised each year through an annual code change cycle. The technical provisions of the 1994 MEC for low-rise residential buildings are formatted after, and are essentially the same as, the ANSI/ASHRAE/IES Standard 90A-1980, except that the thermal envelope provisions for one- and two-family residential buildings are more stringent and the equipment efficiency provisions are the same as ASHRAE/IES 90.1-89. For high-rise residential and commercial buildings, the 1994 MEC adopts ASHRAE/IES Standard 90.1-89 by reference.
CABO One- and Two- Family Dwelling Code (OTFDC), 1994	The OTFDC adopts by reference the 1993 CABO MEC.
BOCA National Building Code (NBC), BOCA National Mechanical Code (NMC), and BOCA National Plumbing Code (NPC)	The 1993 editions of the NBC, NMC, and NPC contain requirements for energy conservation. Chapter 13 of the NBC addresses the design and construction of the building thermal envelope through reference to ANSI/ASHRAE/IES 90A-80 and 90Aa-87 and the 1993 CABO MEC. Either can be used, although for low-rise residential buildings 90A-80 would be much less rigorous. It is important to note also that the NBC adopts by reference the CABO OTFDC as an alternative to the NBC. Chapter 19 of the NMC contains provisions for mechanical systems and equipment that represent a codified version of requirements from ASHRAE/IES Standard 90.1-89. The NPC contains water conservation requirements for certain plumbing fixtures but does not address water heater efficiency.
BOCA National Energy Conservation Code (NECC), all 1993 editions	All the BOCA NBC, NMC, and NPC 1993 provisions are also compiled and published in one document as the 1993 NECC. With the addition of an administrative chapter by BOCA, the NECC is a stand-alone model code.
ICBO Uniform Building Code (UBC), 1994	The energy provisions are found in Appendix Chapter 13 of the 1994 edition and adopt the 1993 CABO MEC by reference.
SBCCI Standard Building Code, 1994	The energy provisions are found in Chapter 13 of the 1994 edition and adopt the 1993 CABO MEC by reference, but allow compliance with ANSI/ASHRAE/IES Standard 90A-80 as an alternative for low-rise residential buildings.

2.1.3 Definition or Description of Commercial and Residential Buildings *(The PNL contact is Dave Conover)*

The EPAct, CABO MEC, ASHRAE 90.1-89, and State codes each look at residential and commercial buildings differently. The EPAct requires each State to review the provisions of its residential building code and commercial building code regarding energy efficiency. The terms residential and commercial are not defined in EPAct.

A DOE notice on updating State building codes regarding energy efficiency [Docket No. EE-RM-94-210] (Federal Register, July 15, 1994) provides guidance in defining residential and commercial buildings as follows:

> "...high-rise multi-family residential buildings (greater than three stories) and hotel, motel, and other transient residential building types of any height have historically been treated for energy code purposes as commercial buildings. Consistent with the treatment of high-rise multi-family residential buildings and hotels, motels, and other transient residential building types in (ASHRAE/IES) Standard 90.1-89 as if they were commercial buildings, the Department (U.S. DOE) is of the view that the energy efficiency requirements of building codes applicable to such buildings should be reviewed and updated by the States and units of general purpose local government pursuant to the Act as if they were commercial building code requirements. Consequently, residential buildings, for the purposes of certification, would include one- and two-family detached and attached buildings, townhouses, row houses, and low-rise multi-family buildings (not greater than three stories) such as condominiums and garden apartments."

2.2 Commercial Building Standards

2.2.1 Estimated Potential Savings for Commercial Building Energy Codes from the Quality Metric Analysis *(The PNL contact is Jeff Johnson)*

The energy savings potential of implementation of ASHRAE/IES Standard 90.1-89 and subsequent versions is dependent on the level of adoption and enforcement that can be achieved in the United States. Currently, about 16 States have adopted codes that meet or exceed ASHRAE/IES Standard 90.1-89. It is anticipated that in these States, less than half of the buildings actually comply with these requirements. The goals of the CCAP call for $43 million to be spent between 1995 and the year 2000 to assist States with adoption, training, and enforcement. These efforts are anticipated to achieve the adoption of codes in 40 States that meet or exceed ASHRAE/IES Standard 90.1-89. Through adoption and training, compliance is expected in 80% of those buildings. The savings from the commercial code adoption actions are summarized in Table 2.3. The low estimates assume current adoption and compliance levels. The high estimates assume State adoption and compliance levels under CCAP.

Table 2.3. Potential Savings from Commercial Building Codes

Unit Savings	Year: 2000		Year: 2010	
	Low	High	Low	High
Quads (End-use savings)	.026	.031	.145	.219
Dollars (1995 millions)	$453	$490	$3,225	$3,527
Greenhouse Gas Emissions (Mmtc/yr)	.38	.47	2.17	3.31

2.2.2 Scope, Application, and Technologies Addressed in ASHRAE/IES Standard 90.1-89 *(The PNL contact is Mark Halverson)*

ASHRAE/IES Standard 90.1-89 includes energy-efficiency requirements for all commercial buildings and high-rise residential buildings. This standard was also rewritten into code language in 1993, and is known as the Energy Code for Commercial and High-Rise Residential Buildings. The requirements of Standard 90.1-89 and the code version are similar. EPAct identifies ASHRAE/IES Standard 90.1-89 as the relevant standard for State commercial code comparison. ASHRAE/IES Standard 90.1-89 is developed and published by ASHRAE and the Illuminating Society of North America (IES). For commercial buildings, the ASHRAE/IES 90.1-89 has requirements related to electric power distribution, lighting, auxiliary systems, the building envelope, space heating, space cooling, ventilation, water heating, and energy management. Requirements are based on location of the building, activities in the building, construction type of the building, and equipment types in the building. ASHRAE requires that all standards be updated, reaffirmed, or withdrawn every 5 years. Changes may also be made through the addenda or errata process. Any interested party can submit proposed code changes or comments to ASHRAE or IES. The changes are published and subject to a public review period and formal response process. ASHRAE/IES Standard 90.1-89 was developed as a building standard, but the code version was created with the intent that States or local jurisdictions adopt the code. Sixteen States have adopted all or part of Standard 90.1 directly, have modified Standard 90.1, or have made use of the basic body of ASHRAE and IES research that went into Standard 90.1.

2.2.3 Differences between Federal Code 10 CFR 435 and ASHRAE/IES Standard 90.1-89 *(The PNL contact is Mark Halverson)*

The existing Federal commercial building energy standard is found in 10 CFR 435, Subpart A - Voluntary Performance Standards for New Commercial and Multi-Family High Rise Residential Buildings; Mandatory for Federal Buildings. This standard is based on the second public review draft of ASHRAE/IES Standard 90.1-89 and is therefore very similar to the ASHRAE/IES standard. The most significant differences between the Federal standard and the ASHRAE/IES standard are in the lighting requirements, the service water heating requirements, and the ventilation requirements. These differences are summarized in Table 2.4.

Table 2.4. Differences Between 10 CFR 435 and ASHRAE/IES Standard 90.1-89

Requirements	10 CFR 435, Subpart A	ASHRAE/IES Standard 90.1-89
Lighting	Federal standard has more stringent requirements starting in 1993	ASHRAE standard has less stringent lighting requirements equivalent to 1989 Federal requirements
Service Water Heating	Federal standard has less stringent requirements for thermal efficiency and has no standby loss requirements for gas/oil heaters	ASHRAE standard has more stringent requirements for thermal efficiency and has standby loss requirements for gas/oil heaters
Ventilation	Federal standard requires the use of ASHRAE Standard 62-1981	ASHRAE standard requires the use of ASHRAE Standard 62-1989, which requires the use of more outside air

Minor differences between 10 CFR 435 and ASHRAE/IES Standard 90.1-89 include some mandatory requirements in 10 CFR 435 for electric power distribution and energy management that are only recommended in ASHRAE/IES Standard 90.1-89.

The Federal standard is scheduled to be updated in 1995. At this time, much of the text of the codified version of ASHRAE/IES Standard 90.1-89 will be incorporated in the Federal standard.

2.2.4 Unique (or Custom) State Commercial Building Energy Codes *(The PNL contact is Mark Halverson)*

A number of States have developed their own customized commercial building energy codes. California, Florida, New York, Washington, and Minnesota have all developed their own codes that reflect the requirements of ASHRAE/IES Standard 90.1-89 in a form more acceptable to the users in each State. The requirements in these codes are not identical to Standard 90.1-89 requirements and in some cases, individual requirements may differ greatly. However, each State code reflects the general principles and requirements of Standard 90.1-1989. Unique features of each code are discussed below.

California has been very active in the building codes arena for several years, with their commercial building energy code being updated every 3 years. The heating, ventilation, and air conditioning (HVAC) provisions are based on the most current version of the ASHRAE/IES standards, while the envelope and lighting provisions were developed by California. California has been a leader in the development of whole building energy analysis and the certification of software tools that perform that analysis. COMPLY24, software that performs an energy cost budget analysis based on simplified user inputs, helps designers to comply with the code. The current version of the California energy code was released in July 1992.

The ***Florida*** commercial building energy code makes extensive use of computer software for compliance. It has options for both a whole building performance method, based on a Simplified

Energy Analysis Method (ASEAM), and a component performance method for envelope and lighting tradeoffs based on the algorithms developed by the ASHRAE SSPC 90.1. The latest Florida code went into effect January 1, 1994.

The ***New York*** commercial building energy code was substantially rewritten in 1990 to reflect the requirements of ASHRAE/IES Standard 90.1-89. Perhaps the most innovative feature of the New York code is the use of component efficiency requirements for lighting systems rather than overall lighting power density values. The new New York code became effective March 1, 1991.

Washington recently implemented a new commercial building energy code that embodies several unique features. The new code requires more stringent envelope requirements for buildings heated by electrical resistance heating and imposes more stringent lighting requirements than ASHRAE/IES Standard 90.1-89. The code also reflects some skepticism about automatic lighting controls by not allowing increased lighting power if automatic controls are used. The new Washington energy code went into effect April 1, 1994.

Minnesota is unique among States by requiring lighting levels at least as stringent as the 1993 lighting levels found in the Federal standard. Minnesota also requires their State code to be equal to or exceed the most stringent code adopted by any other State. Minnesota's new code went into effect on June 16, 1994.

Two other unique State codes that meet the overall requirements of energy usage in ASHRAE/IES Standard 90.1-89 are included in this list. Oregon currently uses a State-developed version of ANSI/ ASHRAE/IES Standard 90A-80 but incorporates ASHRAE/IES 90.1-89 equipment efficiencies. Rhode Island also uses a State-developed version of ANSI/ASHRAE/IES Standard 90A-80 but incorporates ASHRAE/IES 90.1-89 lighting requirements. The annual energy usage of a building built to these codes is very similar to the annual energy usage of a building built to ASHRAE/IES Standard 90.1-89.

Other unique State codes that do not meet or exceed the requirements of ASHRAE/IES 90.1-89 are Alabama, Kansas, North Carolina, and Wisconsin. Alabama uses a set of minimum requirements and requires the use of a building energy performance calculation. Kansas has a single requirement for peak allowable heat loss. North Carolina expresses requirements in terms of watts per square foot of floor area. Wisconsin expresses requirements in terms of a thermal performance value for the exterior surface area (BTU's per hour per square foot of above-grade exterior envelope).

For more information on a specific State code, please refer to the BESP database of State codes and standards maintained by PNL. The PNL database contact is Mark Hattrup.

2.3 Residential Building Standards

2.3.1 Estimated Potential Savings from the Quality Metric Analysis of Residential Building Energy Codes *(The PNL contact is Jeff Johnson)*

The energy savings potential through implementation of the CABO 92 MEC and subsequent versions is dependent on the level of adoption and enforcement that can be achieved nationally. Currently, about 13 States have adopted codes that meet or exceed the 92 MEC. It is anticipated that in these States less than half of the buildings actually comply with these requirements. The goals of the CCAP call for $43 million to be spent between 1995 and the year 2000 to assist States with adoption, training, and enforcement. These efforts are anticipated to achieve the adoption of codes in 40 States that meet or exceed CABO MEC. Through adoption and training, compliance is expected in 80% of those buildings. The savings from the residential code adoption actions are summarized in Table 2.5. The low estimates assume current adoption and compliance levels. The high estimates assume CCAP State adoption and compliance levels.

Table 2.5. Potential Savings from Residential Building Codes

Unit Savings	Year: 2000		Year: 2010	
	Low	High	Low	High
Quads (End-use savings)	0.016	0.022	0.097	0.147
Dollars (1995 millions)	$106	$146	$688	$1,066
Greenhouse Gas Emissions (Mmtc/yr)	0.25	0.34	1.49	2.26

2.3.2 Scope, Application, and Technologies Addressed in the CABO MEC 1992 *(The PNL contact is Robert Lucas)*

The 92 MEC is a code that has energy-efficiency requirements for all buildings. However, because the EPAct identifies the MEC as the relevant code for State residential code comparison, the 92 MEC is included in this discussion. The 92 MEC is developed and published by CABO. For residential buildings, the MEC has requirements related to space heating, space cooling, and water heating. It has separate requirements for residential buildings three stories or less and all other buildings. The MEC is updated annually by CABO and is published every 3 years, with annual amendments issued between publication cycles. Any interested party can submit proposed code changes. The changes are published and hearings are held to receive comments on the proposed changes. The MEC committee formed by CABO and consisting of State and local building code officials must approve the code changes by a majority vote. The MEC exists with the intent that States or local jurisdictions adopt the code. Thirteen States have adopted the existing versions of the MEC (83, 86, 89, 92 or 93 MEC).

2.3.3 Scope, Application, and Technologies Addressed in ASHRAE Standard 90.2-93 *(The PNL contact is Robert Lucas)*

ASHRAE Standard 90.2-93 was issued in 1993. This standard applies to low-rise residential buildings and does not include transient housing such as hotels/motels. Standard 90.2-93 has requirements related to space heating, space cooling, and water heating. As of July 1994, Standard 90.2-93 has not been adopted anywhere and is in the process of being translated into code language.

2.3.4 Comparison of ASHRAE Standard 90.2-93 and the 92 MEC *(The PNL contact is Robert Lucas)*

Both ASHRAE Standard 90.2-93 and the 92 MEC specify minimum requirements for building envelopes, HVAC systems, and water heaters. On an overall national average, the stringency of the MEC and Standard 90.2-93 are similar. Table 2.6 summarizes the differences between the code and standard.

Table 2.6. Differences Between ASHRAE Standard 90.2 and the 92 MEC

Area	Difference between ASHRAE Standard 90.2 and the 92 MEC
Code language	ASHRAE 90.2 is not in code language, which means many measures are not required but rather advised (i.e., 90.2 often states that you "should" do this rather than you "shall" do this). The 92 MEC is in code language.
Simplicity	In some ways the 92 MEC is simpler than ASHRAE 90.2.
Duct location	ASHRAE 90.2 has envelope requirements as a function of duct location (inside or outside) while the 92 MEC requirements are not affected by duct location.
Effect of cooling on envelope requirements	ASHRAE 90.2 has envelope requirements as a function of a measure of cooling loads while the 92 MEC does not.
Manufactured homes	ASHRAE 90.2 has separate requirements for manufactured homes while the 92 MEC does not.
Window orientation	ASHRAE 90.2 accounts for window orientation (i.e., amount of window area facing north, east, south, and west) while the 92 MEC does not.
Window area	The 92 MEC effectively penalizes high window areas by requiring more wall insulation, better windows, or some other type of thermal improvement. ASHRAE 90.2 has less of a penalty unless the window area is very high.
Mechanical ventilation	ASHRAE 90.2 has requirements for minimum mechanical ventilation rates while the 92 MEC does not.
Equipment sizing	ASHRAE 90.2 has requirements for equipment sizing limitations while the 92 MEC does not.
Performance path	ASHRAE 90.2 allows compliance for any building with an equal or lower energy cost than a building meeting the 90.2 prescriptive requirements. The 92 MEC allows compliance for any building with an equal or lower energy consumption than a building meeting the 92 MEC prescriptive requirements. 90.2 is much more detailed in laying out groundrules for the performance path comparison.

2.3.5 Unique (or Custom) State Residential Building Energy Codes *(The PNL contacts is Laurie Klevgard)*

Some States have invested a substantial amount of time and energy in developing a standard customized for their State. For example, Florida, Hawaii, and Alaska have developed their standards with special consideration to the climate. Florida and Hawaii have codes which contain requirements that are aimed at reducing solar gains, while Alaska has unique requirements relative to basement insulation, due to the extreme cold. Oregon, New York, and California have developed their standards based on what is cost-effective for their State. Idaho, Kansas, Massachusetts, Washington, and Vermont also have customized standards.

At least 17 States have taken a more intermediate approach to date. They begin with a national standard and amend it. Some States only make minor amendments to definitions, scope, or exceptions. Other States make significant changes to the envelope requirements, which alter the stringency of the code. At least 12 States take a national model code and amend it, by summarizing the envelope requirements into a single set of prescriptive requirements that apply to the whole State, or a region in the State.

Prescriptive paths are by far the most common format for energy requirements in the State codes. There is some variation in how the prescriptive requirements are presented (i.e., U-values versus R-values). Some States also have performance-based paths as part of their codes (e.g., Washington, California, Alaska, Florida, and Kansas). The format of these performance-based paths varies widely. Kansas, for example, gives a single heat loss value to be achieved in a home. Florida, on the other hand, has a point system such that a complying home must achieve a "score" of 100 points. California has over 92% of their permit applications submitted using either their point system or whole building performance simulation.

2.4 Additions and Remodels

2.4.1 How States Typically Apply Codes to Additions and Remodels *(The PNL contact is Dave Conover)*

Building construction regulations typically cover additions, alterations, renovations, changes in use group, remodeling, and repairs to existing buildings.[a] In cases where a State or local jurisdiction has adopted a model building code, the code addresses the issue of how and to what degree the code applies to additions, alterations, etc. In cases where a State or local jurisdiction has adopted an energy code, but no building code, the scope provisions from the energy code apply.

(a) These building construction regulations include the International Conference of Building Officials (ICBO) Uniform Building Code (UBC); the Southern Building Code Congress International (SBCCI) Standard Building Code (SBC); and the Building Officials and Code Administrators International (BOCA) National Building Code (NBC).

In the case of the model building codes (NBC, UBC, SBC), the following terms have the following application.

Building Addition: An addition to an existing building is treated as if the addition were a new building. The provisions of the energy code apply to anything new and associated with the building; this would include the building envelope, lighting (other than residential buildings), and any new HVAC or service water heating (SWH) equipment or systems components.

Renovations: Provisions for renovations differ greatly, depending upon the amount of work being performed. It is possible that the degree of renovation will be so great that the entire building must be brought up to code, while renovations of a lesser degree may require only a portion or "wing" of a building to fully comply. In another situation, the code would only apply to those things being renovated.

Building Modifications: Modifications made to an existing building, such as repairs and replacements, are treated much like minor renovations, in that only a portion of the building must be brought up to code. When the cost of a repair or replacement exceeds a certain value (typically $100), only that which is being replaced or the resultant repair must meet code. Nothing else in the existing building would be subject to the code.

A final scenario for applying codes to existing buildings is a change in use group (i.e., conversion from one building type to another). In these situations, the building must be brought up to code. ASHRAE/IES Standard 90.1-89 only covers new buildings, while the 92 MEC covers both new buildings and additions. If additions are adopted outside the typical building regulation framework, they usually are the only item associated with existing buildings that would be covered. If adopted as part of a larger set of building construction regulations, the provisions from the building code would direct application of the energy provisions to these other aspects of existing buildings.

2.4.2 Example of a Retrofit Ordinance: An Overview of the San Francisco Retrofit Ordinance *(The PNL contact is Jeff Johnson)*

The San Francisco Commercial Energy Conservation Ordinance (CECO) requires implementation of energy conservation measures for typical commercial buildings at the point of sale. Each "typical" building is a composite of two or three San Francisco buildings considered to be typical of the local building stock (with assumed size, occupancy schedule, equipment, etc). The required energy conservation measures fall within the following categories: 1) HVAC, 2) service hot water measures, 3) lighting system measures, 4) commercial refrigeration measures, 5) motor-driven equipment measures, and 6) swimming pool and spa measures.

Predicted savings for typical commercial buildings range from 4% in personal service and repair shops, to over 20% in refrigerated warehouses, with an average of 12.7% savings across all building types. In terms of energy costs retained for local businesses, the typical range is $1700 per year for personal service and repair, to nearly $30,000 per year for a large office. The average cost savings per

year (excluding large office buildings) is $6000. The cost of CECO compliance would typically range from $2000 for a small neighborhood commercial building to $60,000 for a high-rise office, with the average cost at $10,500 (also excluding large office buildings). The average payback from installing these measures in these typical buildings is 1.9 year. San Francisco's CECO does not require buildings to be designed or modified in such a way that they would consume more energy than permitted by Chapter 2-53 (Title 24).

The basis for the City of San Francisco's Energy Conservation Office staff's determination that the ordinance ensures cost-effectiveness rests on the following provision within CECO: energy conservation measures which, for a particular building, can be demonstrated to have a simple payback of longer than 4 years, or the life of the measure, are exempt for that building (see Section 5322 of the CECO, General and Limited Exemptions). This provision for appealing measures that do not have a simple 4-year payback is the cornerstone of CECO's reasonableness and cost-effectiveness. Building space otherwise subject to CECO with annual energy bills less than $2000 is also exempt.

3.0 State Information

3.1 Key State Contacts

3.1.1 Directory of Key State Contacts (*The PNL Contact is Jane Carlson*)

Table 3.1 contains a list of names and phone numbers of key contacts in each of the States. The first name listed in each State typically heads the State office or agency that has been designated by the State's governor to respond to EPAct. The second and/or third names tend to be the primary technical code contact(s) for the States. Many of the States list more than three names, usually the persons listed after the third name will not have as thorough a knowledge related to building codes as the second or third person listed.

Table 3.1. State Code Contacts

Alabama	Harvey A. McKin	State Building Commission	(205)242-4082
	John Cornish	State Building Commission	(205)242-4182
Alaska	Robert Breen	Alaska Housing Finance Corporation	(907)561-1900
	Steve Baden	Alaska Housing Finance Corporation	(907)564-9246
	Ginny Moore	Alaska Housing Finance Corporation	(907)564-9202
	Cary Bolling	Energy Information Specialist	(907)561-1900
Arizona	Jack Haenichen	Arizona Energy Office of the Department of Commerce	(602)280-1403
	Jim Westburg	Arizona Energy Office of the Department of Commerce	(602)280-1300
	Amanda Ormond	Arizona Energy Office of the Department of Commerce	(602)280-1300
	Jeff Shively	Arizona Energy Office of the Department of Commerce	(602)280-1430
	Steve Ahearn	Arizona Energy Office of the Department of Commerce	(602)280-1426
Arkansas	Jim Blakley	Arkansas Energy Office	(501)682-7315
	Chris Benson	Arkansas Industrial Development Commission	(501)682-7324
	Susan Reken	Arkansas Energy Office	(501)682-7324
	Reece Stewart	Arkansas Energy Office	(501)682-4500
California	Charles Imbrecht	California Energy Commission	(916)654-5000
	Valerie T. Hall	California Energy Commission	(916)654-4064
	Jon Leber	California Energy Commission	(916)654-4064
	Marius Finn	California Energy Commission	(916)654-4064
	Nancy Jenkins	California Energy Commission	(916)654-4037

Table 3.1. (contd)

Colorado	Wade Buchanan	Colorado Office of Energy Conservation	(303)620-4292
	Tom Brotherton	Colorado Office of Energy Conservation	(303)620-4292
	Sheila Ton	Colorado Office of Energy Conservation	(303)620-4292
	Rick Cowlishaw	Colorado Office of Energy Conservation	(303)620-4292
	Rod Vanderwall	Colorado Office of Energy Conservation	(303)620-4292
	Nancy Tipton	Colorado Office of Energy Conservation	(303)620-4292
	Linda Smith	Colorado Office of Energy Conservation	(303)620-4292
Connecticut	Donald J. Vigneau	Connecticut Department of Public Safety	(203)238-6011
	Daniel Tierney	Connecticut Department of Public Safety	(203)238-6011
Delaware	John Posdon	Division of Facilities Management	(302)739-5644
	Charlie Smissor	Delaware Department of Administrative Services	(302)739-5644
Florida	Richard W. Dixon	Florida Department of Community Affairs	(904)487-1824
	Jim Tait	Florida Energy Office	(904)488-6764
Georgia	Jim Higdon	Georgia Department of Community Affairs	(404)656-5526
	Eugene A. Maskal	Georgia Department of Community Affairs	(404)656-5526
	Jack Jacobs	Georgia Department of Community Affairs	(404)656-5526
Hawaii	Maurice H. Kaya	Hawaii Department of Business Economic Development	(808)587-3812
	Howard Wiig	Hawaii Department of Business Economic Development	(808)587-3811
Idaho	Gary H. Gould	Idaho Department of Labor & Industrial Services	(208)334-3950
	Jack A. Rayne	Idaho Department of Labor & Industrial Services	(208)334-3896
	Wayne Larson	Idaho Department of Labor & Industrial Services	(208)334-2183
	Gary Malmen	Idaho Department of Labor & Industrial Services	(208)334-2183
	Joe Meyer	Idaho Department of Labor & Industrial Services	(208)334-2183
Illinois	John S. Moore	Illinois Department of Energy & Natural Resources	(217)785-2002
	Peter Jackson	Illinois Department of Energy & Natural Resources	(312)814-4747
Indiana	Gerald Dunn	Indiana Department of Fire & Building Services	(317)232-1402
	Marlys Pedtke	Indiana Department of Fire & Building Services	(317)232-1402
	Monica L. Cannaley	Indiana Department of Fire & Building Services	(317)232-6209
	Dave Bills	Indiana Department of Fire & Building Services	(317)232-1400
	Steve Schultz	Indiana Department of Fire & Building Services	(317)232-1400
Iowa	Roy Marshall	Iowa State Building Code Bureau	(515)281-3876

Table 3.1. (contd)

	Gary Forshee	Iowa State Building Code Bureau	(515)281-3876
	Pat Senferer	Iowa State Building Code Bureau	(515)281-3876
Kansas	Susan Seltsam	Kansas Corporation Commission	(913)271-3100
	James Ploger	Kansas Corporation Commission	(913)271-3349
	Dr. Richard Hayter	Kansas State University	(913)532-6026
	Larry Holloway	Kansas Corporation Commission	(913)271-3222
Kentucky	Charles A. Cotton	Kentucky Department of Housing Buildings & Construction	(502)564-8044
	George Mann	Kentucky Department of Housing Buildings & Construction	(502)564-7811
	Jack M. Rhody	Kentucky Department of Housing Buildings & Construction	(502)564-8090
	Thomas Barnes	Kentucky Department of Housing Buildings & Construction	(502)564-3580
	Jimmy Dean	Kentucky Department of Housing Buildings & Construction	(502)564-7811
Louisiana	Jerry Jones	Louisiana Department of Natural Resources	(504)925-4920
	Diane D. Smith	Louisiana Department of Natural Resources	(504)342-2133
	Ernest J. Singleton	Louisiana Department of Natural Resources	(504)342-1977
	Wade Byrd	Louisiana Department of Natural Resources	(504)342-3476
Maine	Leonard A. Dow	Maine Department of Economics & Community Development	(207)624-6800
	Michael W. Aube	Maine Department of Economics & Community Development	(207)287-2656
	Andrew P. Wynn	Maine Department of Economics & Community Development	(207)624-6821
	Carolyn Manson	Maine Department of Economics & Community Development	(207)287-2656
Maryland	Gerald L. Thorpe	Maryland Energy Administration	(301)974-3755
	James Hanna	Maryland Department of Housing & Community Development	(410)514-7220
	Jim Magliano	Maryland Department of Housing & Community Development	(410)514-7220
Massachusetts	Thomas Rogers	Massachusetts Board of Building Regulations & Standards	(617)727-3200
	Thomas Reilly	Massachusetts Board of Building Regulations & Standards	(617)727-3200
Michigan	Henry Green	Michigan Department of Labor	(517)322-5247
	William E. Lycos	Michigan Department of Labor	(517)322-5247
	Robert Konydyk	Michigan Department of Labor	(517)322-1705

Table 3.1. (contd)

	Barry Tennison	Michigan Department of Labor	(517)322-1798
Minnesota	Thomas R. Joachim	Minnesota Division of Building Codes & Standards	(612)296-4639
	Fred Priver	Minnesota Division of Building Codes & Standards	(612)296-1658
	Mike Godfrey	Minnesota Division of Building Codes & Standards	(612)296-1658
	Scott McLellan	Minnesota Division of Building Codes & Standards	(612)296-1658
Mississippi	Chester B. Smith	Mississippi Dept. of Economic & Community Development	(601)359-6600
	Wes Miller	Mississippi Energy Office	(601)359-6600
	Andrew Jenkins	Mississippi Department of Energy & Transportation	(601)359-6600
Missouri	John A. Buchanan	Missouri Department of Natural Resources	(302)751-5664
	Mike Amelunke	Missouri Department of Natural Resources	(314)751-6861
	Lesa Jenkins	Missouri Department of Natural Resources	(314)751-6981
	Dave Bedan	Missouri Department of Natural Resources	(314)751-6981
	Brenda Wilburs	Missouri Department of Natural Resources	(314)751-5956
Montana	James F. Brown	Montana Department of Commerce	(406)444-3933
	Stephanie Brandenberger	Montana Department of Commerce	(406)444-3933
Nebraska	Lynn Chamberlin	Nebraska State Energy Office	(402)471-2867
	Kirk Conger	Nebraska State Energy Office	(402)471-2867
	Robert Harris	Nebraska State Energy Office	(402)471-2867
Nevada	Rose McKinney-June	Nevada State Energy Office	(702)687-4909
	Dave McNeil	Nevada State Energy Office	(702)687-4909
New Hampshire	Douglas Patch	New Hampshire Public Utilities Commission	(603)271-2431
	John C. Cutting	New Hampshire Public Utilities Commission	(603)271-2431
	George McClusky	New Hampshire Public Utilities Commission	(603)271-2431
New Jersey	William Connolly	New Jersey Department of Community Affairs	(609)292-7899
	Mitchell Malec	New Jersey Department of Community Affairs	(609)292-7898
	Michael Baier	New Jersey Department of Community affairs	(609)530-8793
	Bill Hartz	New Jersey Department of Community Affairs	(609)292-7898
New Mexico	Robert Unthank	New Mexico Regulation & Licensing Department	(505)827-7041
	Pat Van Dergriff	New Mexico Regulation & Licensing Department	(505)827-7041
	Fred Navarez	New Mexico Regulation & Licensing Department	(505)827-7041
	Carol Campbell	New Mexico Regulation & Licensing Department	(505)827-7041

Table 3.1. (contd)

	Remiho Pacheco	New Mexico Regulation & Licensing Department	(505)827-7036
	Sam England	New Mexico Regulation & Licensing Department	(505)827-7037
N. Carolina	Daschiel Propes	North Carolina Department of Insurance	(919)733-3901
	John Wiggins	North Carolina Department of Insurance	(919)733-3901
	J. Lee Hauser	North Carolina Department of Insurance	(919)733-3901
	Alan Barringer	North Carolina Department of Insurance	(919)733-3901
	Patrick Walker	North Carolina Department of Insurance	(919)733-3901
	Jesse Allred	North Carolina Department of Insurance	(919)733-3901
	Henry Webster	North Carolina Department of Insurance	(913)733-3901
	Jeffrey Kanner	North Carolina Department of Insurance	(913)733-3901
North Dakota	Shirley Dykshoorn	Office of Intergovernmental Assistance	(701)224-2094
	Richard Grey	Office of Intergovernmental Assistance	(701)224-2094
	Jim Boyd	Office of Intergovernmental Assistance	(701)224-2094
	Kim Christianson	Office of Intergovernmental Assistance	(701)224-2094
Ohio	James Conrad	Ohio Department of Administrative Services	(614)644-9639
	Steven P. Regoli	Ohio Board of Building Standards	(614)644-2613
	Jan Solkoniri	Ohio Board of Building Standards	(614)644-2613
Oklahoma	Paula Hearn	Oklahoma Department of Central Services	(405)521-2111
	Abe Fawzy	Oklahoma Department of Central Services	(405)521-2111
Oregon	Gary Wicks	Dept. of Consumer and Business Services Bldg. Codes Div	(503)378-8319
	Peggy Collins	Dept. of Consumer and Business Services Bldg. Codes Div	(503)378-3176
	Alan Seymour	Dept. of Consumer and Business Services Bldg. Codes Div	(503)378-8319
	Terry Swisher	Dept. of Consumer and Business Services Bldg. Codes Div	(503)373-7488
	Junior Owings	Dept. of Consumer and Business Services Bldg. Codes Div	(503)373-7509
	Darrell Huber	Dept. of Consumer and Business Services Bldg. Codes Div	(503)378-4150
	Mike Ewert	Dept. of Consumer and Business Services Bldg. Codes Div	(503)373-7529
	Chuck Monschein	Dept. of Consumer and Business Services Bldg. Codes Div	(503)378-3080
	Walter Friday	Dept. of Consumer and Business Services Bldg. Codes Div	(503)378-3671
Pennsylvania	Daniel J. Desmond	Pennsylvania Energy Office	(717)783-9981
	Charles Sludden Jr.	Pennsylvania Department of Labor and Industries	(717)787-3323
	John Boyer	Department of Community Affairs	(717)783-7847

Table 3.1. (contd)

	Mark R. Fortney	Pennsylvania Energy Office	(717)783-9981
	Brian T. Castelli	Pennsylvania Energy Office	(717)783-9981
Rhode Island	Joseph A. Cirillo	Rhode Island State Building Commission	(401)277-3529
	Kurt Stenburg	Rhode Island State Building Commission	(401)277-3033
S. Carolina	Gary Wiggins	South Carolina Building Code Council	(803)734-4182
	Preston Carter	South Carolina Building Code Council	(803)734-4182
South Dakota	Fred Baatz	South Dakota Office of Economic Development	(605)741-3603
	Merrill Van Gerpen	Governor's Office of Energy Policy	(605)773-3603
Tennessee	Cynthia Oliphant	Tennessee Department of Economic & Community Affairs	(615)741-6671
	Clinton A. Berry	Tennessee Department of Economic & Community Affairs	(615)741-6671
	Gwen Harris	Tennessee Department of Economic & Community Affairs	(615)741-6671
	Stratton	Tennessee Department of Economic & Community Affairs	(615)741-2994
Texas	Pete Parsons	Texas State Energy Conservation Office	(512)463-1834
	Mike Wiley	Texas Governor's Energy Office	(512)463-1931
	Lee Gros	Texas Governor's Energy Office	(512)463-1931
	Lolly Garcia	Texas State Energy Conservation Office	(512)463-1834
Utah	David Robinson	Utah Department of Commerce	(801)530-6628
	Jud Weiler	Office of Energy Services	(801)530-6731
	Michael R. Johnson	Office of Energy Services	(801)530-8657
Vermont	Richard Sedano	Vermont Department of Public Services	(802)828-2811
	Stuart Slote	Vermont Department of Public Services	(802)828-2811
	David Lamont	Vermont Department of Public Services	(802)828-2811
Virginia	Jack A. Proctor	Virginia Department of Housing & Community Development	(804)371-7150
	Carolyn R. Williams	Virginia Department of Housing & Community Development	(804)371-7170
	Wayne Beachy	Virginia Department of Housing & Community Development	(804)371-7183
	George Richman	Virginia Department of Housing & Community Development	(804)371-7170
	Norman Crumpton	Virginia Department of Housing & Community Development	(804)371-7160
Washington	Gene Colin	Washington State Department of Community Development	(206)586-3423
	Judith Darst	Washington State Building Codes Council	(206)586-3423
	Roland Levasseur	Department of Labor & Industry	(206)956-5269
	Daniel Wolfenbarger	Department of Labor & Industry	(206)956-5225

Table 3.1. (contd)

	Kermit Robinson	Washington State Building Codes Council	(206)586-3423
	Willie O'Neil	Washington State Department of Community Development	(206)586-3423
West Virginia	Walter Smittle	State Fire Commission	(304)558-2191
	Richard Corcovilos	State Fire Commission	(304)348-2191
	A. B. Corley	State Fire Commission	(304)348-2191
	Larry Beckett	Structural Barriers Compliance Board	(304)558-0530
Wisconsin	Sheehan Donoghue	Department of Industry, Labor, & Human Relations	(608)266-9706
	Ergun I. Somersan	Department of Industry, Labor, & Human Relations	(608)266-5658
	Richard Meyer	Department of Industry, Labor, & Human Relations	(608)266-3080
	Gerald P. Marx	Department of Industry, Labor, & Human Relations	(608)266-9706
	John Eagon	Department of Industry, Labor, & Human Relations	(608)266-9706
	Robert DuPont	Dept. of Industry, Labor, & Human Relations	(608)266-8984
	Richard Acker	Dept. of Industry, Labor, & Human Relations	(608)266-7907
	Carol Skornicaka	Dept. of Industry, Labor, & Human Relations	(608)266-7552
Wyoming	Oliver (Gene) Brooks	Wyoming Dept. of Fire Prevention & Electrical Safety	(307)777-7288
	Bruce Casperson	Wyoming Dept. of Fire Prevention & Electrical Safety	(307)777-7288
American Samoa	Reupena Tagaloa	Territorial Energy Office of the Governor	(684)699-1101
Commonwealth	Joycelyn Guerrero	Commonwealth of the Northern Marina Islands	(670)322-9229
Dist. of Columbia	Theodore Holmes	District of Columbia Energy Office	(202)673-3250
	Howard Ebenstein	District of Columbia Energy Office	(202)727-4700
	Charles Clinton	District of Columbia Energy Office	(202)727-1800
Guam	Mike B. Brown	Guam Energy Office	(671)477-0538
Puerto Rico	Rene Rodriquez	Regulations & Permits Administration	(809)721-8282
U.S. Virgin Islands	Claudette Young-Hinds	Virgin Island Energy Office	(809)772-2616
	Alan D. Smith	Department of Planning & Natural Resources	(809)774-3320

3.2 Current State Code Status

3.2.1 Current State Code Status (*The PNL Contact is Mark Hattrup*)

Table 3.2 contains the status of the States' building energy efficiency codes as of Nov 1, 1994.

Table 3.2. Current Status of the States' Building Energy Efficiency Codes.

State	State Code Authority	Scope of Authority	Current Commercial Code	Current Residential Code
Alabama	Regulation by Building Commission	State owned and funded projects	State developed based on 90A-80	None
Alaska	Regulation by Department of Community and Regional Affairs	State-financed community and residential buildings	None	State developed
Arizona	Regulation by Department of Commerce as directed by legislation	New capitol projects (state buildings)	State developed	State developed
Arkansas	Regulation by Energy Commission as directed by legislation	State-owned buildings	1977 MCEC	Based on 1977 MCEC
California	Regulation by Energy Commission as directed by legislation	All buildings	State developed version of 90.1-89	State developed
Colorado	Legislation	Residential buildings but code is no longer actively enforced	None	Based on 1977 MCEC
Connecticut	Regulation by Codes and Standards Committee and State Building Inspector	All buildings	1989 BOCA	State developed
Delaware	Legislation	New nonresidential public buildings > 5000 sq.ft.	90.1-89	none
Florida	Legislation with revision by the Dept. of Community Affairs	All buildings	State developed 90.1-89	State developed
Georgia	Regulation by Board of Community Affairs	All buildings	90.1-89 with amendments	State developed based on MEC 92
Hawaii	Legislation	All commercial buildings	State developed 90.1-89	State developed
Idaho	Legislation	State-funded buildings	89 MEC	State developed
Illinois	State Administrative Procedure Process	State Owned or leased buildings	90.1-89	None
Indiana	Regulation by Fire Prevention and Building Commissions	All buildings	92 MEC	92 MEC
Iowa	Regulation by State Building Code Commissioner, approved by Building Code Advisory Council	All State or locally owned public buildings and those open to the public	92 MEC	92 MEC + amendments

Table 3.2. (contd)

State	State Code Authority	Scope of Authority	Current Commercial Code	Current Residential Code
Kansas	Legislation	Public buildings	Unique State developed code	State developed
Kentucky	Regulation by Board of Housing, Buildings, and Construction	All buildings, except single-family dwellings, which are not occupied by local governments	1993 BOCA	1993 BOCA
Louisiana	None-would require legislation	Not applicable	None	None
Maine	Legislation	All buildings	Standard 90.1-89	State developed
Maryland	Legislation	All buildings	1993 BOCA	1993 BOCA
Massachusetts	Regulation by Building Code Commission	All buildings	State developed 90.1-89	State developed
Michigan	Regulation by Construction Code Commission	All buildings	1990 BOCA or equal	1993 BOCA
Minnesota	Regulation by Department of Public Service, Energy Division	All buildings	State written 89 MEC	State developed
Mississippi	Regulation by Department of Economic and Community Development	State-owned and State leased buildings	1977 MCEC	State developed
Missouri	Regulation by Office of Administration, Division of Design and Construction	State-funded buildings	90.1-89	None
Montana	Regulation by Department of Commerce, Building Code Bureau	All buildings	89 MEC	92 MEC + amendments
Nebraska	Legislation with Regulation by Building Energy Conservation Board	All buildings	83 MEC	83 MEC
Nevada	Legislation with Regulation by Office of Community Services	All buildings	86 MEC	86 MEC
New Hampshire	Regulation by Public Utilities Commission	All buildings	State developed 90.1-89	State developed
New Jersey	Regulation by Department of Community Affairs	All buildings	1993 BOCA	1993 BOCA
New Mexico	Regulation by General Construction Bureau	All buildings	89 MEC	92 MEC
New York	Regulation by Energy Office	All buildings	State developed 90.1-89	State developed
North Carolina	Regulation by Building Code Council	All buildings	State developed	State developed
North Dakota	Regulation by Office of Management and Budget	All buildings	92 MEC	92 MEC

Table 3.2. (contd)

State	State Code Authority	Scope of Authority	Current Commercial Code	Current Residential Code
Ohio	Regulation by Board of Building Standards	All buildings	1993 BOCA	1993 BOCA
Oklahoma	Regulation by Office of Public Affairs	State-owned and State leased buildings	1993 BOCA	None
Oregon	Regulation by Building Codes Agency	All buildings	State developed 90A-80	State developed
Pennsylvania	Legislation with revisions by Building Energy Conservation Committee	All buildings	State developed 90A-80	State developed
Rhode Island	Regulation by Building Codes Standards Committee	All buildings	1993 BOCA	State developed
South Carolina	Legislation	All buildings	93 MEC	State developed
South Dakota	Legislation	Residential buildings but code is no longer actively enforced	None	Based on 1977 MCEC
Tennessee	Legislation	All buildings	92 MEC	92 MEC
Texas	Regulation by Building Commission	State buildings and residential buildings of State-supported institutions of higher education	Standard 90.1-89	None
Utah	Regulation by Building Code Commission	All buildings	89 MEC	89 MEC
Vermont	Regulation by Department of Labor and Industry	Publicly funded buildings, and some residential buildings	State developed based on 90.1	State developed
Virginia	Regulation by Board of Housing and Community Development	All buildings	93 MEC	1993 BOCA - mandatory reference to 93 MEC
Washington	Regulation by Building Code Council	All buildings	State developed based on 90.1-89	State developed
West Virginia	Legislation	All buildings	1990 BOCA	1990 BOCA
Wisconsin	Regulation by Building Code Advisory Review Board	All buildings	State developed 90A-80	State developed
Wyoming	Regulation by Department of Fire Prevention and Electrical Safety	All buildings other than farm buildings	89 MEC	89 MEC

3.3 State Ranking in Construction Volume

3.3.1 Number and Type of New Commercial Buildings Built per State in 1993 (*The PNL Contact is Michelle Friedrich*)

Table 3.3 contains information on the number and type of new commercial buildings built in each State in 1993. The information shows the number of new commercial buildings that could potentially be impacted by commercial building energy codes. The information comes from the U.S. Bureau of the Census Construction Statistics Division, Building Permits Branch, 1993 Building Permits Survey.

Table 3.3. Number and Type of New Commercial Buildings Built in Each State in 1993

State (Rank):	Type 1[a]	Type 2[a]	Type 3[a]	Type 4[a]	Type 5[a]	Type 6[a]	Type 7[a]	Type 8[a]	Total
Alabama (16)	16	54	93	78	20	352	55	672	1340
Alaska (49)	4	5	10	9		22	1	51	102
Arizona (24)	58	153	46	44	12	144	54	375	886
Arkansas (22)	24	38	64	55	27	188	48	479	923
California (2)	152	300	220	193	33	811	161	2242	4112
Colorado (29)	29	58	28	40	15	138	46	335	689
Connecticut (40)	4	29	14	19	12	53	30	146	307
Delaware (47)		4	6	1		26	3	126	166
DC (51)			1		1	7	2	4	15
Florida (3)	94	398	279	207	90	839	110	1618	3635
Georgia (6)	56	159	175	91	45	428	68	1142	2164
Hawaii (43)	2	20	16	10	3	51	17	97	216
Idaho (37)	17	31	29	20	5	100	11	237	450
Illinois (9)	40	114	77	131	56	379	46	956	1799
Indiana (11)	21	89	86	72	22	377	51	1006	1724
Iowa (27)	13	45	29	83	28	158	31	390	777
Kansas (33)	15	25	39	35	24	114	29	262	543
Kentucky (19)	38	69	51	51	46	196	25	489	965
Louisiana (20)	15	41	82	31	24	198	40	519	950
Maine (38)	15	49	18	33	13	56	19	157	360
Maryland (26)	18	156	49	33	18	108	31	392	805

Table 3.3. (contd)

State (Rank):	Type 1[a]	Type 2[a]	Type 3[a]	Type 4[a]	Type 5[a]	Type 6[a]	Type 7[a]	Type 8[a]	Total
Massachusetts (31)	13	87	12	25	28	73	58	276	572
Michigan (10)	34	129	95	102	37	392	41	949	1779
Minnesota (21)	79	77	43	73	20	126	25	482	925
Mississippi (25)	25	54	63	52	24	161	46	438	863
Missouri (18)	46	62	85	66	29	277	32	489	1086
Montana (42)	26	8	5	4	2	40		177	262
Nebraska (35)	15	42	18	46	10	106	12	226	475
Nevada (32)	29	83	18	14	2	150	8	252	556
New Hampshire (44)	5	17	3	20	6	30	4	111	196
New Jersey (34)	2	68	24	39	19	125	33	221	531
New Mexico (36)	21	18	16	27	4	107	9	256	458
New York (8)	40	149	79	113	44	267	48	1070	1810
North Carolina (4)	41	182	293	122	80	659	175	1253	2805
North Dakota (45)	4	14	6	17	2	44	5	86	178
Ohio (5)	32	185	110	81	43	482	96	1629	2658
Oklahoma (28)	10	46	59	45	36	112	43	402	753
Oregon (23)	42	84	51	41	20	185	60	421	904
Pennsylvania (7)	64	154	105	137	71	404	75	959	1969
Rhode Island (50)	1	4	4	2	4	10	9	38	72
South Carolina(14)	25	126	169	90	19	300	37	888	1654
South Dakota (39)	36	25	12	24	15	68	6	162	349
Tennessee (13)	121	91	130	89	36	449	68	674	1658
Texas (1)	134	199	294	251	118	946	236	2417	4595
Utah (30)	45	42	41	44	12	132	14	310	640
Vermont (48)	3	18	2	9	3	30	9	86	160
Virginia (17)	47	95	89	70	25	248	80	654	1308
Washington (12)	64	123	63	84	28	473	81	745	1661
West Virginia (41)	6	15	29	20	4	63	9	147	293
Wisconsin (15)	82	83	57	122	45	316	28	810	1543

Table 3.3. (contd)

State (Rank):	Type 1[a]	Type 2[a]	Type 3[a]	Type 4[a]	Type 5[a]	Type 6[a]	Type 7[a]	Type 8[a]	Total
Wyoming (46)	24	9	4	11	4	17	5	99	173

(a) Commercial Building Types:

Type 1: Hotels, Motels, and Tourist Cabins
Type 2: Amusement, Social, and Recreational (e.g., theaters and radio/TV studios)
Type 3: Churches and Other Religious Buildings
Type 4: Service Stations and Repair Garages
Type 5: Hospitals and Institutional Buildings (e.g., nursing/rest homes)
Type 6: Offices, Banks, and Professional Buildings
Type 7: Schools and Other Educational Buildings
Type 8: Stores and Customer Services (e.g., bakery, restaurants, and warehouses)

3.3.2 Number and Type of New Residential Buildings Built per State in 1993 (*The PNL Contact is Michelle Friedrich*)

Table 3.4 contains information on the number and type of new residential buildings built in each State in 1993. The information shows the number of new residential buildings that could potentially be impacted by residential building energy codes in a year. The information comes from the U.S. Bureau of the Census Construction Statistics Division, Building Permits Branch, 1993 Building Permits Survey.

Table 3.4. 1993 Residential Construction Volume (# of buildings) by State and Building Type

State (Rank):	Type of Residential Buildings				Total
	Single Family	Two Family	Three and Four Family	Five Family or More	
Alabama (27)	12,815	125	77	252	13,269
Alaska (49)	1,352	30	21	12	1,415
Arizona (10)	34,714	228	173	270	35,385
Arkansas (35)	6,969	553	134	115	7,771
California (2)	69,568	703	670	953	71,894
Colorado (14)	25,855	240	96	276	26,467
Connecticut (34)	7,831	43	17	59	7,950
Delaware (40)	4,646	55	9	7	4,717
Dist. of Columbia (51)	99		14	1	114
Florida (1)	91,261	985	529	1,336	94,111
Georgia (4)	47,599	384	91	411	48,485
Hawaii (39)	4,614	68	29	172	4,883

Table 3.4. (contd)

State (Rank):	Type of Residential Buildings				Total
	Single Family	Two Family	Three and Four Family	Five Family or More	
Idaho (31)	8,770	163	234	147	9,314
Illinois (7)	36,232	779	441	412	37,864
Indiana (13)	25,883	475	104	274	26,736
Iowa (36)	7,350	146	88	185	7,769
Kansas (30)	8,940	223	60	94	9,317
Kentucky (28)	12,357	249	192	224	13,022
Louisiana (29)	10,363	84	19	23	10,489
Maine (42)	3,638	17	7	16	3,678
Maryland (15)	25,393	91	3	272	25,759
Massachusetts (24)	15,820	209	41	78	16,148
Michigan (11)	33,669	210	161	350	34,390
Minnesota (18)	22,954	126	74	272	23,426
Mississippi (37)	6,870	78	59	95	7,102
Missouri (22)	18,318	494	242	107	19,161
Montana (46)	1,912	110	55	67	2,144
Nebraska (38)	5,463	112	49	108	5,732
Nevada (21)	19,472	96	98	339	20,005
New Hampshire (41)	3,724	26	12	22	3,784
New Jersey (20)	21,340	379	38	170	21,927
New Mexico (33)	8,145	29	57	22	8,253
New York (19)	21,099	1,157	331	218	22,805
North Carolina (5)	45,855	494	152	471	46,972
North Dakota (48)	1,571	21	26	56	1,674
Ohio (9)	34,051	678	563	648	35,940
Oklahoma (32)	8,280	100	24	16	8,420
Oregon (25)	15,215	314	174	361	16,064
Pennsylvania (8)	35,916	284	158	214	36,572
Rhode Island (43)	2,413	24	9	2	2,448
South Carolina (23)	18,672	153	52	163	19,040
South Dakota (44)	2,292	31	40	73	2,436
Tennessee (16)	24,065	244	184	193	24,686
Texas (3)	62,672	339	232	928	64,171
Utah (26)	13,856	117	213	177	14,363
Vermont (47)	1,967	16	17	24	2,024

Table 3.4. (contd)

State (Rank):	Type of Residential Buildings				Total
	Single Family	Two Family	Three and Four Family	Five Family or More	
Virginia (6)	39,361	263	138	425	40,187
Washington (12)	30,418	587	341	701	32,047
West Virginia (45)	2,198	28	15	26	2,267
Wisconsin (17)	21,652	991	326	579	23,548
Wyoming (50)	1,060	20	14	1	1,095

The reader should note that a portion (approximately 2%) of the three, four, and five or more family residential buildings will be greater than three stories.[a] Residential structures that are more than three stories are typically built to a code for commercial and "high-rise" residential buildings and would not represent a portion of the potential impact of residential building energy codes.

3.4 State Needs

3.4.1 State Reported Technical Support Needs (*The PNL Contact is Mark Hattrup*)

Table 3.5 contains information from the 1994 BESP State Needs Assessment Survey and the 1994 BESP State Workshops.

During the spring of 1994, PNL, on behalf of the DOE Office of Codes and Standards, conducted a mail survey of State agencies (the State Needs Assessment) involved with building codes (including each State energy office) to determine what resources they would find most helpful in complying with the residential and commercial energy efficiency requirements of EPAct. During this time, PNL also conducted five 2-day Regional Building Energy Codes and Standards workshops across the United States. The workshops were designed to provide information to State-level officials about EPAct, the CCAP, and other codes and standards information. In addition to receiving information on the above topics, workshop participants were also encouraged to inform DOE of their needs, particularly with regard to implementing building energy codes, enhancing current implementation efforts, and building on training efforts already in place.

(a) This information is from Table 15: Characteristics of New Multifamily Buildings, by Region: 1989 to 1993, found in *Characteristics of New Housing: 1993*, Current Construction Reports, C25/93-A, U.S. Department of Housing and Urban Development, U.S. Department of Commerce Economics and Statistics Administration - Bureau of the Census.

Table 3.5. Highlights of State Needs for Technical Assistance

Type of Assistance	State(s)
Training For: (stakeholder group)	
Code inspectors	AZ, CO, CT, DE, IL, KS, MI, MT, SC
Home builders	AR, DE, MA, PA, WI
Architects/designers	AR, DE, MA
Utilities	AR
Bankers	WI
Building suppliers	WI
No specific stakeholders identified	AL, FL, GA, ME, RI, UT, TN, VA, VT, USVI, WV
Training Materials	
Videos - construction techniques "how & why"	AL, AK, CO, CT
User manuals	AL, CT
Educational Materials	
Information on successful code implementation programs	CA, IL, MS, WI
Summarize why codes are important	MO
Public education - Energy info to buyers and renters	UT
Software	
Compliance software	AL, CO, CT, NJ, WA
Life cycle cost software (cost benefit)	AL, NE, PA
Database of construction costs, fuel costs, economic parameters	PA
Compliance Checklists	CO, NE
Code Activities	
Help develop more user friendly codes	DC, IA, ID, KS, KY, SC
Evaluate new technology for potential inclusion	CA
Modify MEC to include radiant heat gain/control	NV
Info on the Economics of Code Adoption	AL, UT, NV, WV
Expert Testimony During Code Adoption Process	AL, WY, (Several other States have requested expert testimony following the workshops)
Assistance Monitoring Effects of Code Implementation	HI
EPACT Information	
Guidelines/highlights of EPAct compliance	CA, VA
EPAct justification - persuade State to comply	IA, LA
Report from DOE on status of States reaction to EPAct	NJ
Clarification of EPAct lighting requirements	MN

3.4.2 States' Reported Tool/Material Needs from the 1994 BESP State Needs Assessment Survey (*The PNL Contact is Mark Hattrup*)

Table 3.6. Tools and Materials in Order (High to Low) of Reported Usefulness

Residential or Commercial?	Tool/Material	Usefulness Rating 1 = Low 7 = High	Number of "Top 5" Votes	Meet State Needs in 12 Months?	Meet State Needs in 2-5 Years?	Meet State Needs in 5-10+ Years?
C	ASHRAE/IES Standard 90.1-89 Training materials	5.8	16	(14)[1] 47%	(14)[1] 47%	(2)[1] 7%
C	ASHRAE/IES Standard 90.1-89 Code Manual	5.7	16	(13) 42%	(14) 45%	(4) 13%
C	Software for Section 13 (energy cost budget method) of 90.1-89	5.6	10	(10) 32%	(18) 58%	(3) 10%
R	MEC training materials	5.5	15	(18) 56%	(13) 41%	(1) 3%
C	ASHRAE/IES 90.1-89 Code language version	5.4	10	(12) 43%	(13) 46%	(3) 11%
R	MEC users manual	5.3	14	(15) 46%	(16) 49%	(2) 6%
R	Computerized residential code compliance program	5.0	14	(12) 41%	(14) 48%	(3) 10%
C	Building prototype design and construction technique guides for code complying buildings	5.0	4	(5) 17%	(23) 77%	(2) 7%
C	Computerized commercial code compliance calculation program	5.0	9	(7) 23%	(20) 65%	(4) 13%
B	Specifier guides for residential and commercial lighting fixtures	4.8	3	(11) 39%	(16) 57%	(1) 4%
C	Computer automated code compliance & building permit forms	4.7	11	(5) 17%	(22) 76%	(2) 7%
B	Ventilation compliance guides for building energy codes	4.7	6	(10) 36%	(13) 46%	(5) 18%
C	Building component energy efficiency trade-off guide	4.7	4	(8) 30%	(16) 59%	(3) 11%
B	Specifier guides for windows, skylights, doors & other building components	4.6	2	(10) 37%	(14) 52%	(3) 11%
B	Energy code compliance construction technique demonstration videos	4.3	2	(4) 14%	(22) 79%	(2) 7%

R = residential, C = commercial, B = both | 1 = number of States responding

3.4.3 States' Reported Potential Uses for Incentive Funding from the 1994 BESP State Needs Assessment and State Workshops (*The PNL contact is Mark Hattrup*)

Table 3.7. Potential Applications of Incentive Funding

State	Potential Uses of EPACT Incentive Funding
Alabama	Assist with developing training materials and conducting workshops.
Arizona	Education and training.
Arkansas	Marketing, enforcement, and communication with public and stakeholders in addition to workshops.
California	Conduct public workshops with industry groups and provide travel funds as necessary for meeting with other States code professionals to share code development/implementation ideas.
Colorado	Provide expert testimony during the adoption process, training workshops for building officials, a video describing changes from existing practice, checklists and compliance worksheets, and compliance software.
Connecticut	Produce/Procure training materials (need to understand code to enforce it).
Delaware	Provide training for code enforcement officials on building energy codes.
Florida	Update State code for better compliance with EPAct, develop a training program for designers on 90.1-89, and develop user-friendly compliance methods.
Georgia	Restrict building permits if plans presented do not comply with code. Review should be in writing and be specific.
Hawaii	Help meet requirements of EPAct legislation by intensifying the education process for all decision-making bodies.
Idaho	Provide training.
Illinois	Provide training workshops and materials, finalize code language, and respond to technical questions related to code language and code implementation. Develop enforcement/compliance mechanisms and provide training.
Kansas	Implement a Home Energy Rating System (HERS); DOE grants for training design professionals, building contractors, and code officials will be leveraged with registration fees of participants. Fund education campaign to be advertised by the utilities to communicate new requirements to their customers.
Louisiana	Provide training.
Massachusetts	Provide training.
Michigan	Provide additional training and develop compliance material.
Minnesota	Train practitioners, building officials, and lighting designers.
Mississippi	Apply to the general implementation of codes.
Montana	Training and enforcement support.
Nebraska	Train and subsidize costs of out-of-State inspectors (FTEs). Develop 1-2 page prescriptive costs worksheet and/or user-friendly software for builders. Hire FTE to do training.

Table 3.7. (contd)

State	Potential Uses of EPACT Incentive Funding
Nevada	Provide training, and (possibly) evaluate and develop standards for HVAC system efficiency in new construction in Southern Nevada.
New Hampshire	Train design and enforcement professionals.
New Jersey	Training code officials and others on the new requirements. Part of this training might include training on the use of the Ball State program. Additionally, we would use some of the fund to defer the cost of buying the right to the program for our code officials.
New York	Cover contractual activities under New York's control (assess EPAct's impact), educate design/enforcement and building professionals if possible.
N. Carolina	Train inspectors and contractors.
North Dakota	Train enforcement officials and contractors.
Ohio	Train enforcement officials and contractors if fiscally possible.
Oregon	Provide training.
Pennsylvania	Print and distribute camera ready copy of DOE materials.
Rhode Island	Upgrade insulation levels in existing buildings, buy energy-efficient retrofits.
South Carolina	Develop and provide training.
Tennessee	Provide training courses and create a "buy-down" program.
Texas	Develop a series of case studies showing benefits of standards. Develop HERS, establish a central/regional compliance review and enforcement system, and an appeals/arbitration board.
Utah	Cover printing and training costs, and educational programs for lenders/ appraisers/architects/engineers/designers. Train inspectors and have demonstration projects.
Vermont	Update "Evaluating Energy Conservation Opportunities Under Act 250." Work with utilities to develop new residential DSM programs patterned after the Washington Electric Cooperative Program.
Virginia	Provide training for building officials.
Washington	Fund participation in national code development and integration of national code to State format. Study cost/benefit of code installed measures, and participate in evaluation of policy analysis.
West Virginia	Provide training on ASHRAE 90.1 and MEC.
Wisconsin	Complete calibration and marketing of HERS and energy efficient new construction, leverage by utility and builder/contractor dollars. Develop State code specific compliance software, develop worksheets and training materials for local enforcement.
Wyoming	Provide training of designers, inspectors, and contractors if fiscally possible.

4.0 Stakeholder Information

4.1 Relevant Stakeholders

4.1.1 Directory of Key Contacts (*The PNL Contact is Jane Carlson*)

Table 4.1. Stakeholder Organizations

Organizations	Contact Name	Telephone
Alliance to Save Energy (ASE)	William Nitze, Pres.	(202)857-0666
American Consulting Engineers Council (ACEC)	Howard Messner, Exec. VP.	(202)347-7474
American Council for an Energy Efficient Economy (ACEE)	Al Kurki, Exec. Dir.	(202)429-8873
American Gas Association (AGA)	Michael Baly, Pres.	(703)841-8400
American Institute of Architects (AIA)	James Cramer, CEO	(202)626-7300
American Public Power Association (APPA)	Larry Hobart, Exec. Dir.	(202)467-2900
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)	Frank Coda, Exec. Dir. - Sec.	(404)636-8400
American Society of Mechanical Engineers (ASME)	Dr. David Belden, Exec. Dir.	(212)705-7722
American Solar Energy Society (ASEA)	John Lillard, Gen. Counsel	(202)452-9000
Association of Major City Building Officials (AMCBO)	Marla McIntyre, Sec.	(703)481-2026
Building Officials and Code Administrators International (BOCA)	Clarence Bechtel, CEO	(708)799-2300
Building Owners and Managers Association International (BOMA)	Mark Hurwitz, Exec. VP.	(202)408-2662
Council of American Building Officials (CABO)	Richard Kuchnicki, Pres.	(703)931-4533
Edison Electric Institute (EEI)	Thoma Kuhn, Pres.	(202)508-5000
Energy Efficient Building Assoc., Inc. (EEBA)	William Lemke, Exec. Dir.	(715)675-6331
Electric Power Research Institute (EPRI)	Richard Balzhiser, Pres.	(415)855-2000
Gas Appliance Manufacturers Association (GAMA)	C. Reuben Autery, Pres.	(703)525-9565
Glazing Industry Code Committee	William Birch, Admin.	(913)266-7014
Illuminating Engineering Society of North America (IESNA)	William Hanley, Exec. VP.	(212)705-7913
International Association of Lighting Designers (IALD)	Marion Greene	(212)206-1281
International Association of Plumbing and Mechanical Officials	Arthur Lettenmaier, Exec. Dir.	(714)595-8449
International Conference of Building Officials (ICBO)	James Bihr, Pres.	(310)699-0541
Mechanical Contractors Association of America (MCAA)	James Noble	(301)869-5800

Table 4.1. (contd)

Organizations	Contact Name	Telephone
National Academy of Code Administration (NACA)	Ralph Liebing, Exec. Dir.	(513)632-8643
National Association of Home Builders (NAHB)	Kent Colton, Exec. VP.	(202)822-0200
National Association of Home Builders-Research Center	Peter Yost	(301)249-4000
National Association of State Energy Officials (NASEO)	Frank Bishop	(202)546-2200
National Concrete Masonry Association (NCMA)	John Heslip, Pres.	(703)713-1900
National Conference of State & Building Codes and Standards (NCSBCS)	Robert Wible, Exec. Dir.	(703)437-0100
National Electrical Contractors Association (NECA)	John Gram, Exec. VP.	(301)657-3110
National Fenestration Rating Council (NFRC)	Juliette Lang Cahn, Chair Women	(301)589-6372
National Governors Association (NGA)	Raymond Scheppach, Exec. Dir.	(202)624-5300
National Institute of Building Sciences (NIBS)	Dave Harris, Pres.	(202)289-7800
National League of Cities (NLC)	Donald Borut, Exec. Dir.	(202)626-3000
National Multi Housing Council (NMHC)	Jonathan Kempner, Pres.	(202)659-3381
Natural Resources Defense Council (NRDC)	John Adams, Exec. Dir.	(415)727-2700
North American Insulation Manufacturers Association (NAIMA)	Kenneth Mentzer, Exec. VP.	(703)684-0084
Polyisocyanurate Insulation Manufacturers Association (PIMA)	Jared Blum, Pres.	(202)624-2709
Sheet Metal & Air Conditioning Contractors National Association (SMACNA)	John Sroka, Exec. VP.	(703)803-2980
Southern Building Code Congress, International (SBCCI)	William Tangye, CEO	(205)591-1853
U.S. Conference of Mayors (USCM)	J. Thomas Cochran, Exec. Dir.	(202)293-7330

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