

# **The Northeast States Residential Energy Codes Support Project: A Model for Improved Energy Code Implementation through Integrated Code and Building Science Training**

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## **ABSTRACT**

In 1999, US DOE awarded the State of Vermont a grant to improve energy code implementation through the development and delivery of an integrated residential code and building science training. Vermont, partnering with other Northeast states, proposed the development of a new energy code training curriculum template that could be customized for each state and integrated with existing building science training information. In a similar way, the project would also develop a builder field guide that could be customized for each state. Both the training curriculum template and the builder field guide include information on code compliance details, advanced construction techniques and are integrated with local residential market transformation programs such as the ENERGY STAR<sup>®</sup> Labeled Homes Program, Home Energy Rating Systems (HERS), etc.

Vermont's initial project partners included the United States Department of Energy (US DOE), Northeast Energy Efficiency Partnerships (NEEP), Building Codes Assistance Project (BCAP), Richmond Energy Associates (REA), GDS Associates (GDS), Building Officials and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), North American Insulation Manufacturers Association (NAIMA) and the states of:

- Connecticut
- Maryland
- Rhode Island
- Delaware
- New Hampshire
- Vermont
- Massachusetts
- New York
- District of Columbia

Since its inception, the Northeast States Residential Energy Codes Support Project's primary goal has been to create a comprehensive builder training program that includes code and beyond-code concepts and is adaptable for use throughout the Northeast region.

The project intends to establish a network of qualified trainers in the Northeast that can deliver builder training sessions as needed. The project also continues to solicit industry and public benefit fund partners for sponsorship of training events and publication of field guides and training materials.

This paper describes this project from its early development to its current successes (and frustrations) and why it is so timely and necessary.

## Background

In 1996, the Building Codes Assistance Project (BCAP) convened a meeting of interested stakeholders to propose a National Energy Codes Support Network (NECSNET) to coordinate and increase support to states from industry. While generally supportive of energy code efforts, many of the industry trade allies indicated that states need to develop specific, coordinated proposals and that states must clearly define what it is they want industry to support (*including funding*).

Northeast states continue to update and implement their residential building energy codes based on either the Model Energy Code or its successor, the International Energy Conservation Code. Despite efforts to upgrade energy codes and implement aggressive residential energy efficiency programs, homeowners in Northeast States spent more than \$39 billion dollars for energy costs in 1997 (DOE 1997). For the 9 Northeast States (ME, VT, NH, MA, RI, CT, NY, PA, NJ), this amounts to 10% of the national residential electric use, 20% of the natural gas use and 79% of the fuel oil usage.

Looking closer at residential energy consumption in the Northeast, homes built in 1987 use about the same amount of natural gas for heating (site Btu's) as in 1997. Homes heated with fuel oil use 6.3 % more energy (Energy Information Administration, 1978, 1987, and 1997). It is true that homes in 1997 are typically larger than in 1987, but in a house-by-house comparison, our residential single family buildings aren't using less energy than they did a decade ago.

Historically, code training efforts have centered on explaining the minimum energy code requirements at workshops geared to code officials, and in some cases, builders, architects and contractors. The Northeast States Residential Energy Codes Support Project ("Project") took a different approach to training builders on energy efficiency. A training workshop curriculum was developed, to be customized for each Northeast State, integrating the following elements:

- Code Compliance Options from a Builder's Perspective
- Building Science Behind the Energy Code Requirements
- Advanced Construction Techniques
- How to Reduce Builder Call Backs and Liability Concerns Including:
  - Moisture Issues
  - Indoor Air Quality
  - Ventilation Options
  - Added Comfort
- "Building as a System" Training Focus
- ENERGY STAR<sup>®</sup> Labeled Homes

The residential energy code training curriculum emphasizes building science principles that would minimize or reduce builder call backs. In the curriculum, many construction photographs from the field were incorporated to show builders "how" and "why" problems occur in new homes and what to do to avoid them.

Problems addressed in the training curriculum include:

- Air Leakage
- Poor Insulation Installation
- Lack of Occupant Comfort
- HVAC Equipment Over-sizing
- Back-Drafting
- Incorrect Duct Installation
- Condensation
- Bulk Moisture Management
- Mold Growth, and
- Indoor Air Quality

The curriculum further explains how the energy code is organized, but focuses more on how builders can achieve maximum design flexibility while continuing to demonstrate compliance with the energy code. The training also shows builders a host of new products, technologies and construction techniques used in the industry today. Builders also learn how building beyond the minimum code requirements to achieve ENERGY STAR<sup>®</sup> Labeled Home Program efficiency levels is often a small step accomplished at minimal cost. This integrated curriculum approach is proving to be the best way to reach stakeholders with information on multiple topics in one training session.

The results of recent studies of residential new construction and local code officials conducted in the states of Massachusetts, New York, New Hampshire and Rhode Island reinforce a strong need for integrated training for the building community (Peregrine Energy Group 2002; Nguyen Phoung 2001; Xenergy Inc. 2001). More specifically:

- The survey of local officials in New Hampshire and Rhode Island indicated they want more training on HVAC, code regulations, compliance software, glazing and building envelope.
- The New York survey revealed that code officials believe that one of the major obstacles to energy code compliance is the lack of understanding by builders of the requirements.
- The Massachusetts study indicated that builders should be targeted for training and information dissemination; information on good or exemplary practices and improved energy efficiency technologies should be made available to builders and their contractors; and code officials should be informed of these practices and technologies.

In general, the Project provides the following advantages to the region:

- Offers economies of scale by allowing states to utilize a state-of-the-art energy code training curriculum designed for Northeast states.
- Reduces administrative burdens on participating states.
- Capitalizes on the regional nature of building suppliers' distribution network.

- Provides a seamless set of services and materials to stakeholders across the Northeast.
- Enables rapid transfer of successful approaches to Northeast states developing advanced residential energy code training curriculum for builders.
- Provides consistent materials and coordinated training support for residential energy code implementation activities throughout the Northeast based on the 2000 IECC and helps develop Northeast capabilities to ensure codes are supported through specific materials, deployment and evaluation activities that become institutionalized. This simplifies efforts, avoids unnecessary duplication, reduce costs and improve effectiveness.
- Broadens the resources available for residential energy code outreach and training by coordinating individual state efforts, including support from industry, trade allies, and utilities (by linking ratepayer-funded energy efficiency programs for new construction to building energy codes) to sustain the project after the grant period and ensures coordination with these programs in order to maximize the potential for achieving improved energy efficiency in new residential buildings.

## **Integrating the Curriculum**

The challenge was to develop a training curriculum that incorporated several unique elements that was not confusing to the audience. The Project’s early training workshops completely integrated code requirements with ENERGY STAR<sup>®</sup> to show the builder how simple and inexpensive it was to build beyond code. We found builders would confuse code requirements with ENERGY STAR<sup>®</sup> requirements. We also found some builders left the training believing ventilation systems were a code requirement when they are not. Therefore, it was very important for the training curriculum to be organized in such a way that was very clear to the audience.

The key was to organize the curriculum in a way that integrates code, beyond code and building science principals while creating the proper delineation between each element. The following sections provide more detail on the main elements of the integrated training curriculum.

1. *Energy code requirements.* One of the fundamental decisions made early on in this project was to approach energy code compliance from a “Builder’s Perspective”. This means the training curriculum would only include the essential requirements of the energy code presented in “builder-ese” rather than in code language. For example, many states in the Northeast region are updating to the 2000 International Energy Conservation Code (IECC). In most states, builders can choose from ten different compliance paths to demonstrate compliance (Chapter 4, Chapter 5 offers 4 options, Chapter 6, Chapter 11 of the International Residential Code, and 3 paths in the MECcheck<sup>™</sup> system). Our training briefly mentions the available compliance paths but focuses on the MECcheck<sup>™</sup> system as developed by US DOE and PNNL. More specifically, within the MECcheck system, the training presents in detail the MECcheck software and the MECcheck Prescriptive Packages. This compliance option greatly simplifies code compliance while providing maximum design flexibility for the builder.

2. *Advanced Construction Techniques.* Many new technologies, products, materials and construction techniques are available to builders today. The training curriculum provides numerous examples of how these advanced construction techniques have been applied successfully or unsuccessfully in the field. The goal is to provide useful information about new products and technologies to builders while dispelling much of the misinformation that exists. Overall, we hope to help the builder understand the proper use of new building technologies while minimizing their risk.
3. *Reducing Builder Call Backs and Liability Concerns.* According to recent national statistics from the National Association of Home Builders:

**“The #1 Callback for Builders on a Newly Constructed Home is Due to Moisture Problems at an Annual Cost of \$5.3 Billion Dollars.”**

- Since this problem is so common in the industry, the Northeast States Residential Energy Codes Support Project curriculum includes detailed information for builders on how to minimize moisture problems in new housing. Condensation problems, mold growth and issues surrounding bulk moisture management are all discussed in detail during the training. In addition, other non-energy issues such as Indoor Air Quality, Ice Damming, Frozen Pipes, Ventilation Options and Occupant Comfort Concerns are addressed in the training.
4. *Building as a System.* Builders are introduced to the fundamental concept of “Building as a System”. The training curriculum reinforces how the occupants, the building, the equipment and the environment all impact how a building will perform. As in commercial buildings, the interactive effect of individual building systems needs to be considered in housing. For example, a moisture problem in an attic can actually be the result of excessive moisture levels in the basement. Similarly, chemicals stored in basements or garages can enter the duct system to be transported to the home’s living spaces. In both instances, the source of the problem is far removed from the symptoms. Thinking of the building as a system can offer other advantages to the builder as well. From a construction perspective, the additional costs of a better insulated and tightly constructed building envelope can be offset by the reduced costs of a smaller heating/cooling and distribution system. Overall, the entire building system performs better and costs approximately the same to build.
  5. *Energy Star<sup>®</sup> Labeled Homes.* The workshop curriculum includes general information that can be customized on residential efficiency programs offered by individual states or utilities. Program benefits and requirements are presented to the builder to encourage construction that exceeds energy code requirements. In many states, the beyond code program is the ENERGY STAR<sup>®</sup> Labeled Homes Program. The curriculum shows builders how many of the techniques they are currently using will help them meet beyond code program standards.

Each section of the curriculum includes information that is integrated into a seamless training workshop for builders.

### **Customizing the Curriculum for Each State**

The majority of the training curriculum will be applicable from state to state in the Northeast region. Since Northeast states all have climates that require reasonably similar construction strategies and design approaches for residential buildings, the building science information is consistent from state to state. However, states all have unique aspects to their energy codes and their energy efficiency programs. As an example, energy code requirements for insulating foundation walls are very state specific in the region. Also, ENERGY STAR<sup>®</sup> Labeled Home Program requirements can differ dramatically from state to state. Therefore, specific aspects of the code portion of the training and any beyond-code efficiency program requirements must be customized. To accurately customize the curriculum, partner organizations in each state will play a key role in determining the correct information to be added to the program. Once the training curriculum is customized with energy code requirements applicable in that state together with the specific aspects of energy efficiency programs, the curriculum can be used as needed.

### **Builder Field Guide**

As part of the project, a builder field guide is under development to be used together with the training when it is available. Like the training curriculum, the field guide will be customized for each state. The field guide will be designed to present information clearly and concisely for use in the field and will include the following information:

- An integrated approach to building science techniques and high-efficiency technologies.
- State-specific code compliance for both single and multi-family buildings.
- State-specific information including ENERGY STAR<sup>®</sup> Labeled Homes, code agencies, code information, utility programs, and other efficiency programs.
- “Building As a System” Training Focus with an Emphasis on Non-energy Benefits such as Indoor Air Quality, Added Comfort, Quieter, Etc.
- Information for builders to give to field crews or subcontractors.

### **Tool Kits**

Builder workshops are significantly more effective when actual examples of new products, technologies and equipment are available for inspection during the training. New window technologies, advanced construction techniques, innovative insulation systems, new types of sealants, ventilation systems, control strategies, building materials, etc. are included in our trainer “tool kits” to show builders first hand the options they have when they build their next house.

## **Train-the-Trainer**

The project intends to establish a network of qualified trainers in the Northeast that can deliver builder training sessions as needed. Recruiting experienced trainers knowledgeable in energy codes, advanced construction techniques and building science fundamentals who can also speak to builders can be very difficult. These individuals are typically extremely busy and in high demand. Therefore, a goal of this project is to work with each state to identify and train the most experienced trainers in each state. It is often necessary to train a second small group of highly-qualified, lesser experienced trainers to avoid problems with workshop scheduling. It is critical to select trainers that are experienced in the building industry and are comfortable presenting to builders.

The first step for potential trainers is to attend a workshop in their area as performed by an individual extremely familiar with the curriculum. The second step is to conduct a comprehensive train-the-trainer session to discuss all parts of the training in detail. As part of this session, speakers will be given speaker notes that outline the main ideas or concepts to be presented on each slide of the curriculum and adequate time is provided for questions to allow prospective trainers to become comfortable with the material.

Once the states have a curriculum customized for each state and qualified trainers that are familiar with the curriculum are trained, workshops can be delivered using the “tool kits” and builder field guides with minimum involvement or assistance from the Project’s developers.

## **Industry Partners**

It has been essential for the Project to partner with national and local industry to provide the highest quality training possible. Industry partners continue to assist the training effort in a couple of ways. First, industry partners supply examples of new technologies and products for display during the training. Samples of high-performance windows, innovative insulation systems, ventilation systems, control strategies, building materials, etc. are excellent visual displays. Second, it continues to be important for industry and public benefit funds to help offset the cost of experienced trainers by sponsoring training events and by minimizing the cost to states of printing builder field guides and workshop training materials.

## **Marketing to the Builders**

Both the building supply industry and energy code implementers market to the same audience: builders. One way to combine these interests is for industry to present energy code information and training as another service within their marketing efforts. Massachusetts and Vermont have had considerable success with this strategy. They have gained valuable experience through partnering with local building suppliers and/or the Northeast Retail Lumber Association to deliver residential energy code training sessions. Within a one year period, both states were able to provide more than three times the number of workshops provided for through U.S. DOE funding and have trained thousands of builders, contractors, designers and trades persons. In Vermont, lumberyards and trade allies have provided nearly

all expenses beyond the initial U.S. DOE/Vermont Department of Public Service (VT DPS) sponsored residential energy code training workshops.

Partnering with the state and local Builder Associations is another essential element to spread the word on the workshops to builders. These local builder associations can host trainings at their local offices and they have extensive experience partnering with others in their area to help find interested workshop sponsors.

When marketing the workshops, it is often difficult to know if the “code” or the “beyond code” marketing message will best capture the builder’s interest. Often, the energy code training message will dominate since the requirements are mandatory (especially if a state is updating their energy code requirements). However, if incentives are available for a beyond code program such as ENERGY STAR<sup>®</sup>, many builders may be looking for information on that program for fear of losing a competitive advantage. One advantage of an integrated training approach, however, is that it doesn’t really matter which marketing “hook” captures the builder’s interest. All builders learn the energy code requirements, how to build cost-effectively beyond the code *and* about the building science concepts that bind the two together.

## **Results in 2001**


Through Phase I of this Project, under the auspices of the VT DPS, an integrated workshop curriculum (PowerPoint presentation) was developed that could be customized for each state. The main ingredients of the training curriculum are:

- Minimum Energy Code Requirements.
- ENERGY STAR<sup>®</sup> Homes Program Opportunities.
- Efficient Design, Construction and Installation Techniques with an Emphasis on Building Science.

This training concept was used in whole or part in training workshops in Massachusetts, New York and Pennsylvania in 2001. In New York, the NYS Energy Research and Development Authority’s (NYSERDA) ENERGY STAR<sup>®</sup> Labeled Homes Program provided considerable funding to offset the full cost of training to New York State builders. The New York State Builder’s Association – Research and Education Foundation effectively worked with local builder associations and sponsors throughout the state to schedule the workshops.

The New York Team (See Figures 1 & 2) also established additional benefits through a partnership with the Energy and Environmental Building Association (EEBA) for builders that attended the training to provide them with an EEBA Builder’s Guide and an introductory EEBA membership.

Figure 1. NY Training Program Overview



## Northeast States Residential Builder Training Program

Project Overview:


The **Northeast States Residential Builder Training Program** is a complete training program for builders, designers, contractors and code officials on energy code and advanced residential construction techniques. A regional network of expert trainers will deliver the training workshops each tailored to local energy code requirements and efficiency program opportunities. The trainers deliver these workshops on demand as new codes are adopted or updated or as new efficiency programs are offered. The program can also be easily integrated with other local or national programs such as HERS, ENERGY STAR®, EEBA and Building America.

Training Workshops:

While the primary audience will be builders, the project will also promote the workshops to designers, contractors, and code officials. The main features of the program are:

**Benefits to Builders**

- ✓ Details on Code & Advanced Construction Strategies.
- ✓ ENERGY STAR® Program Overview and Requirements
- ✓ Reduced Builder Call Backs, Liability, Moisture Problems
- ✓ Emphasis on Non-energy Benefits such as Indoor Air Quality, Added Comfort, Quieter, Etc.
- ✓ "Building As a System" Training Focus



Builder Field Guides:

The builder field guides are designed to present information clearly and concisely for use in the field. Like the workshops, the field guides contain features such as:

- ✓ An integrated approach to building science techniques and high-efficiency technologies.
- ✓ State-specific code compliance for both single and multi-family buildings.
- ✓ State-specific information including ENERGY STAR®, code agencies, code information, utility programs, and other efficiency programs.
- ✓ "Building As a System" Training Focus with an Emphasis on Non-energy Benefits such as Indoor Air Quality, Added Comfort, Quieter, Etc.
- ✓ Designed for builders to give to field crews or subcontractors

In Pennsylvania, the Pennsylvania Housing Research Center (PHRC) conducted residential energy code workshops for code officials, builders, architects and contractors in 2001 with an integrated curriculum based on a pilot training developed in collaboration with the Project. The PHRC, through its strong relationship to the local builder associations throughout the state, has conducted numerous energy workshops for builders.

Overall, in the Northeast region since 2001, the Project has completed the following:

- Developed an integrated training curriculum on residential energy codes, ENERGY STAR<sup>®</sup> Homes Program and building science including advanced design and construction techniques;
- Partnered with NYSERDA and the New York State Builder's Association, Research and Education Foundation, to conduct 20 workshops to 400 builders;
- The Project is Meeting with the State of Maryland's Energy Administration to organize trainings in 2002/2003.
- The Project has expanded to include the participation of the states of New Jersey and Pennsylvania in 2001;
- Provided curriculum to MA and PA which have incorporated it into their training materials;
- Conducted a train-the-trainer workshop in Pennsylvania for PHRC;
- Conducted a training in collaboration with Harvey Industries for architectural specifiers; and
- Initiated development of state-specific builder field guides for nine Northeast states.

**Figure 2. NY Program Overview**



## Northeast States Residential Energy Efficient Construction Builder Training Program

Marketing Strategy:


The **Northeast States Residential Builder Training Program** will partner with each state to assess their specific builder training needs and to integrate code requirements and efficiency program opportunities into the curriculum. Within each state, NEEP will work with local builders associations, manufacturers, local building suppliers and utilities to form a project team to market workshops to local builders. Local partners secure classroom space, local sponsors and market each event to the local audience. NEEP provides camera-ready marketing materials and links national sponsors to the event.

Project Team:

A strong project team exists for this project in New York providing an example of what can be done. This unique project team includes federal and state agencies, utilities, homebuilder associations, manufacturers, lumberyards and energy efficiency organizations. The project intends to duplicate this team approach in each partner state.

**NEW YORK PROJECT TEAM**

- ✓ US DOE - Initial Project Funding
- ✓ GDSIREA - Initial Project Management
- ✓ NEEP - Project Design & Ongoing Project Management
- ✓ BCAP - Project Design & Ongoing Project Support
- ✓ NAIMA - Project Funding & Manufacturer Involvement
- ✓ CSG - Field Guide Development
- ✓ EEBA - Field Guide and Training Collaboration
- ✓ NYState Energy Research & Development Authority-Project Funding & Support
- ✓ NY State Builders Association - Research & Education Foundation - Pilot Trainings & Local Marketing Support
- ✓ ENERGY STAR<sup>®</sup> - Project Technical Support
- ✓ Regional Lumberyards - Local Marketing & Logistical Support



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## Opportunities and Next Steps

One of the fundamental goals of the Multi-state Project is to improve residential energy code compliance through outreach and education. This is accomplished by partnering with states, trade allies, utilities and other market participants to develop and conduct advanced building energy code training that focuses on energy code requirements, ENERGY STAR<sup>®</sup> Homes program, building science and best practice solutions.

In 2002, New York, Pennsylvania, the District of Columbia, New Hampshire, New Jersey, Rhode Island and Maryland will conduct workshops using the Project's materials. Massachusetts, Rhode Island, Delaware and Vermont are looking to schedule workshops in 2003. It is anticipated that all of the Northeast States will utilize the companion Builder's Field Guide after it is completed in the summer 2002.

Materials developed under this project will also be available to interested states in other regions including Idaho, Montana, Oregon and Washington through the Northwest Energy Code Collaborative. States in the Midwest and the Southwest have also indicated their interest in the materials being developed and about the multi-state approach to energy code outreach and training.

Since 1999, the Northeast States Residential Energy Codes Support Project has proven to be an effective regional approach to developing an integrated builder training curriculum on energy code compliance, advanced building techniques and beyond code efficiency programs. The experience gained from developing this project in the Northeast and from partnering with industry, trade allies, and ratepayer-funded energy efficiency programs to further energy code outreach and training will be invaluable in promoting this model to other states and regions. Through the efforts of this project, the authors of this paper believe we are slowly transforming the residential building industry in the Northeast one builder at a time.

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