U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY CODES CONFERENCE 2015

CONFERENCE POST-REPORT

Prepared by the
Building Codes Assistance Project

For the
Kleinman Center for Energy Policy
at the **University of Pennsylvania**

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EXECUTIVE SUMMARY

In the world of building codes, concerns about energy usage are often seen as a separate issue from those concerning health, safety, and welfare. However, building energy codes ensure that future residential and commercial buildings will be more efficient and contribute minimally to greenhouse gas emissions. They also provide lower utility bills for consumers and reduce demand on the power grid. According to the U.S. Energy Information Administration, buildings in this country currently account for approximately 40% of all energy consumed. To support the development, adoption, implementation, and enforcement of building energy codes, the U.S. Department of Energy's Building Energy Code Program (BECP) has reinstated this annual conference after a four year hiatus. They contracted with the Building Codes Assistance Project (BCAP) to aid in planning and organizing the event.

Held in Nashville, Tennessee from March 23 through March 26, 2015, "Energy Codes in Action!" attracted over 250 representatives of the design, construction and enforcement industries, and was widely considered to be a successful re-launch of this highly valued BECP program. At the request of the Kleinman Center for Energy Policy at the University of Pennsylvania, BCAP is pleased to provide this report on major trends and themes of the conference. All available presentations from the conference can be viewed on the conference website:

http://www.energycodes.gov/events/doe-national-energy-codes-conference

HIGHLIGHTS: TRENDS AND ISSUES

TRENDS: ***National model energy codes*** have been around since 1983 and are updated and published every three years by ASHRAE and by the International Codes Council (ICC).The current model energy codes are ASHRAE Standard 90.1-2013 and the 2015 International Energy Conservation Code (IECC), which are designed to greatly improve the efficiency of our homes, offices, and virtually every other sector of the built environment. Compared to the model energy codes from 2006, today's codes require buildings to be 30%- 40% more efficient.

We are also rapidly changing the way codes are applied: where once code officials relied on a checklist of prescriptive requirements, e.g. the quantity of insulation, many industry stakeholders now realize the benefits of showing compliance with the energy code by using energy modeling software, which can visualize how the building as a whole will use energy. Although most experts agree that using the predicted performance of a building is the way of the future – not to mention essential for going beyond minimum code for achievements like Leadership in Energy and Environmental Design (LEED) certification or Zero Net Energy (ZNE) – there are still barriers and challenges to widespread implementation of this method.

On the residential code side, a new compliance path has been added which utilizes energy modeling and an Energy Rating Index (ERI) score which requires a Home Energy Rating System (HERS) rating based on climate zone. There are limited ways to guarantee that a real building will perform like its energy model. Codes based on real energy use outcomes are one likely piece of the solution. Outcome-based codes also encourage design professionals to review their building simulations, comparing projected energy use to actual energy use and identifying the reasons behind any discrepancies. In 2014, for the first time, a national model code (The ICC's International Green Construction Code) included an outcome-based code as a compliance option.

ISSUES: ***State and local-level support*** is key to achieving significant rates of energy code compliance. BCAP's involvement includes a program for code officials to become energy code ambassadors who educate their peers on components of the code; we also encourage state energy code compliance collaboratives, where stakeholders can share best practices and work through common issues. State support also comes from the Department of Energy (DOE), which recently invested $6 million to research methods of producing a measurable change in residential building energy savings through energy codes. Eight U.S. states have been selected to participate and are currently conducting field studies. Developing code compliance studies on the commercial code side is more complicated due to the wild variety of building typology and complex systems, but stakeholders are starting this process as well. A primary intended benefit of these studies is showing the cost-benefit rationale of building energy codes, incentivizing utilities to invest in improving compliance.

The age demographics of the code enforcement community point to an impending diminution of professionals in that field. One of the challenges in the near future will be understanding how to drive younger generations to become code officials. Increased implementation of technology, including energy modeling, may work as an incentive.

There is a diversity of opportunities to improve energy efficiency in buildings using codes. Although the easiest time to construct a better building is during the initial design, improving the performance of the numerous existing buildings is also a huge opportunity for savings. Certain periods in a building's life cycle enable cost-effective, design-based retrofitting. Another means to improve code compliance is collaboration with utility companies who sometimes allocate funds for energy code improvement programs such as training to architects, builders, and code officials in their service area. And although the national model energy code set a minimum standard for buildings, many more progressive cities and jurisdictions have promoted "green codes" that have targets of even lower energy usage.

GLOSSARY

ASHRAE – Formed as the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, this global organization promotes a better and more sustainable built environment through model codes, e.g. ASHRAE Standard 90.1, and other standards and resources.

Building Codes Assistance Project (BCAP) – A non-partisan organization specializing in energy code advocacy, research and analysis, technical support, training, and code status tracking. We are dedicated to the adoption, implementation, and advancement of building energy codes.

Building performance – Describes a buildings energy-related characteristics, from how much energy it uses in a given period of time to the quality of the indoor air to occupant comfort levels. The field of building science analyzes a building's performance by conducting a number of tests.

Building life cycle – The way a building functions over its entire lifespan, from initial construction onward. Assessing long-term potential impacts of building energy usage on the environment and costs of occupancy helps stakeholders make better decisions.

Commercial energy code – Legal building requirements that apply to non-residential structures such as offices, shopping centers, and warehouses.

Construction industry – Those responsible for executing a building based on a design. The overall quality of a building – and its energy efficiency – relies heavily on how closely the construction of a building follows the proposed architectural design and engineering.

Energy Code Ambassadors Program (ECAP) – An initiative to empower existing code professionals so they may develop their familiarity and expertise with energy codes and share their knowledge throughout their jurisdiction and state. (Link to website)

Energy code compliance – The process by which the design and construction industries meet code requirements and then demonstrate that it has been done. There are multiple ways to show compliance, but this process is typically the purview of the design professional or builder. Compliance helps energy codes reach their potential once adopted by a state or jurisdiction.

Energy Code Compliance Collaborative – A forum for experts from diverse stakeholder groups impacted by energy codes to work together toward common interests and goals. (Link to website)

Energy model – A physics-based computer simulation that allows design professionals to predict how a proposed building scheme will perform. Energy modeling can be useful throughout the design process, from allowing architects to optimize how a building is shaped to letting engineers estimate what size equipment a building will need to function properly.

Energy modeling software – The umbrella term for programs that allow design professionals to perform simulations. These programs vary, with some being well-suited to rough initial calculations and others capable of more producing exact and detailed data that is acceptable for demonstrating compliance with the energy code.

Energy Rating Index (ERI) – A new method for showing that a home has achieved code compliance. This path provides flexibility for homebuilders by taking into account the efficiency of equipment such as refrigerators, washers, and dryers. A home will receive a numerical score from 0 to 100 based on how much energy it uses. This path allows prospective buyers to compare the efficiencies of houses they may be considering. (Link to factsheet)

Enforcement industry – Professionals involved in verifying that a building as constructed meets a given code. This industry is mainly composed of code officials in building inspection departments. Without a significant emphasis on enforcement, compliance with the energy code is diminished.

Leadership in Energy and Environmental Design (LEED) – A voluntary rating program that provides third-party verification that a building, home, or community meets certain criteria related to energy efficiency, water conservation, careful building material selection, resource management, renewable energy sources, occupant health, and environmental stewardship. LEED ratings identify projects that were built with the goal of high performance for occupants and for the environment. (Link to website)

Green codes – Codes that direct the design and construction of more sustainable buildings that go beyond the minimum acceptable standard to further reduce energy use and environmental impact. Similar in scope to the LEED program, the green codes are written in mandatory language to be adoptable and enforceable as part of a municipality's building code ordinance.

Greenhouse gas emissions – The release of climate change-inducing gases into the atmosphere. Greenhouse gases, which by percentage are dominated by carbon dioxide, can be traced in part to the built environment. Our buildings use roughly 40% of the energy we generate, driving the activity of power plants that in turn produce harmful emissions. Even modest improvements in building energy efficiency will have huge positive impacts.

Home Energy Rating System (HERS) – A tool used in green building construction, home energy auditing and certification programs. Recognized as an official verification of energy performance many government organizations, it is the industry standard that measures a home's performance.

Insulation – Material that provides a thermal barrier between indoor space and outdoor space, slowing the rate at which heat is lost or gained. Insulation is especially important in areas with colder climates, where the infiltration of cold air into drafty buildings can rapidly drive up heating costs as occupants try to maintain a comfortable interior temperature by using more energy. Insulation also prevents condensation and can control noise levels between adjacent spaces.

International Codes Council (ICC) – A member-driven organization dedicated to the development of model codes and standards that are then used in the process of design and construction. The suite of International Codes, or I-Codes, apply to energy efficiency but also to minimum safeguards, e.g. fire prevention and structural integrity. (Link to website)

International Energy Conservation Code (IECC) – Published by ICC every three years, this code sets minimums for building energy use and contains chapters on both residential and commercial buildings. The majority of states have adopted some version of the IECC.

Model energy code (MEC) – Developed by a coalition of experts, government officials, and industry representatives, these codes govern aspects of buildings including insulation; windows and doors; heating, ventilation, and air conditioning (HVAC); systems; equipment; and lighting. Once published, these codes are then adopted. In some cases, this will happen at the state level. However, sometimes the timeline for code adoption will vary among jurisdictions within the state.

Prescriptive requirements – The most commonly used component of the code, which stipulates the stringency of material and equipment components that a building must use, regardless of the overall energy efficiency of the building.

Residential energy code – Legal building requirements that apply to homes, typically one- and two-family dwellings and townhomes, both newly built and renovated.

U.S. Department of Energy's Building Energy Code Program (BECP) – A group with the mission of supporting building energy code development, adoption, implementation, and enforcement processes. BECP strives to maximize the potential for practical, cost-effective energy efficiency improvements while maintaining a safe and healthy built environment. (Link to website)

Zero Net Energy (ZNE) – Describes a high-performance building that provides normal levels of occupant comfort while utilizing no more energy from the grid than it is able to produce on-site. This is achieved through a combination of methods which typically include careful orientation of the building relative to the sun, renewable on-site energy generation (e.g. solar panels), and the highest levels of energy efficiency in the building envelope and HVAC equipment.

FORUM ON THE FUTURE OF ENERGY CODES

Industry experts highlighted some of the important factors that will lead to substantive changes in the code development and enforcement industry, discussed impacts on jobs, and identified strategies for preparing the industry for these changes.

PRESENTATIONS

Ravi Shah *(moderator)*, City of Carrollton, TX

Roadmap Toward a Predictive Performance-Based Commercial Energy Code
Bing Liu, Pacific Northwest National Laboratory (PNNL)

Utilizing Energy Targets in zEPI and Outcome-Based Codes
Jim Edelson, New Buildings Institute (NBI)

Green to Zero- Sustainability and Resilience in Building Codes
Maureen Guttman, Building Codes Assistance Project (BCAP)

The Evolution of Departments, Professionals and Practices
Ryan Colker, National Institute of Building Sciences (NIBS)

NOTES AND COMMENTARY

According to Bing Liu, PNNL, only a very small percentage of buildings comply with energy codes using the performance path. Problems include:

- Energy use varies with design
- Baseline is a moving target
- Increase in unregulated loads such as equipment
- Too many performance methods (ASHRAE 90.1, 189.1, LEED, IgCC, etc.)
- Buildings often do not perform as designed
- Actual building performance (EUI) not compared to model for verification

PNNL is working on ways to increase the usage of this path.

NBI has a groundbreaking project with the Pacific Coast Collaborative to help reach carbon goals and ZNE target by 2030. The Pacific Coast Collaborative is the 3rd largest economy and is comprised of Washington, Oregon, California, and British Columbia. The ZNE as a policy target is where we are going; it is not "where we've been" nor "percentage better than the last code". This means that different individual buildings, energy code baselines, and even building portfolios can all be compared on the same scale. The Zero Energy Performance Index (zEPI) is a scalar representing the ratio of the energy performance of a proposed design (or existing building) compared to the average energy performance of the building stock from the given benchmark year (2000). While the performance path in the 2015 IgCC uses zEPI and the proposed building performance, compliance with the outcome-based path depends on actual energy data for the building and building site.

Ryan Colker at NIBS spoke about a worker shortage and how 50% of building departments in the country are comprised of nine people or fewer. The future of code officials is complicated by the high percentage of the professional community that will be retiring within the next five or ten years. 80% of building departments still require paper permits.

LEARNING OBJECTIVES

- *Articulate drivers of change in the building regulatory industry*
- *Understand the roles and responsibilities of participants in the design, construction, operations and regulatory process in code compliance*
- *Learn a predictive performance-based commercial energy code and how this new compliance path will impact your job*
- *Identify potential industry-wide changes that are needed to accommodate externally-driven changes*
- *Understand relationships between different types of building regulations falling under the "green" or "sustainability" umbrella*

COMPLIANCE SUPPORT:
STRATEGIES FOR STATES AND MUNICIPALITIES

This session covered recent initiatives in providing direct support to building departments with additional resources to support energy codes and encourage collaboration and information sharing. Specific projects covered included IMT and NRDC's City Energy Project and BCAP's Energy Code Ambassadors Program.

PRESENTATIONS

Transforming the Culture of Energy Codes via State Compliance Collaboratives and Energy Code Ambassadors
Maria Ellingson *(moderator)*, Building Codes Assistance Project (BCAP)

ECAP – Spreading the Energy Code Gospel
John Umphress, Austin Energy Green Building

Engaging Cities to Improve Code Compliance
Ryan Meres, Institute for Market Transformation (IMT)

Getting to Compliance in Washington, D.C.
Kimberly Newcomer, District of Columbia Department of Consumer and Regulatory Affairs

NOTES AND COMMENTARY

- **Energy Code Compliance Collaborative**
  - Brings together stakeholders impacted by energy codes to discuss and work through common issues with compliance.
  - Established in nine states so far: Colorado, Delaware, Idaho, Oklahoma, Nebraska, New Hampshire, Nevada, Pennsylvania, and Texas.
  - Some collaboratives doing low-cost/high-impact results; for example, Nebraska is educating new senators on energy code benefits.
- **Energy Code Ambassador Program (ECAP)**
  - Establishes a network of support for code officials by training and positioning code officials as regional spokespersons and mentors for peers and the construction industry
  - Working in Alabama, Idaho, Nevada, Ohio, Oklahoma, Texas, Utah, and Wyoming
- **Engaging Cities to Improve Code Compliance**
  - IMT's City Energy Project is working with code departments in ten major cities (Salt Lake City, Denver, Houston, Chicago, Atlanta, Orlando, Los Angeles, Kansas City, Philadelphia, Boston) to improve compliance
  - A major challenge is lack of documentation
  - Developing solutions specific to the problems encountered
- **Getting to Compliance in Washington, D.C.**
  - Created its own "Green Division" to regulate Green Building Act, Energy Conservation Code, and Green Construction Code
  - Conducts all aspects of energy code review and enforcement
  - Studied their own code enforcement process, developed solutions, and is continually improving

LEARNING OBJECTIVES

- *Learn how the City Energy Project (CEP) and BCAP help states and municipalities achieve energy code compliance*
- *Learn about the various resources, tools, and trainings that CEP and BCAP offer*
- *Learn about strategies that local adopters of CEP and BCAP have used*
- *Learn about challenges that local adopters have encountered and steps to get past common roadblocks toward greater energy efficiency*

RESIDENTIAL COMPLIANCE: STATE STRATEGIES FOR QUANTIFYING CODE COMPLIANCE

The DOE Building Energy Codes Program (BECP) provided an overview of one of its newest projects, a $6 million investment to research the ability of energy code education, training and outreach programs to produce a significant, measurable change in residential building energy savings. Eight U.S. states have been selected to participate and are currently conducting field studies. Representatives from each state provided insight on their experiences thus far and upcoming activities.

PRESENTATIONS

Jeremy Williams *(moderator)*, U.S. Department of Energy

Overview of the Field Study Methodology
Rosemarie Bartlett, Pacific Northwest National Laboratory (PNNL)

Alabama
Ryan Meres, Institute for Market Transformation (IMT)

Arkansas and Georgia
Lauren Westmoreland, Southeast Energy Efficiency Alliance (SEEA)

Kentucky
Isaac Elnecave, Midwest Energy Efficiency Alliance (MEEA)

Maryland
David St. Jean, Maryland Energy Administration

North Carolina
Jeff Tiller, Appalachian State University

Pennsylvania
Mike Turns, Performance Systems Development (PSD)

Texas
Rodney Sobin, National Association of State Energy Officials (NASEO)

NOTES AND COMMENTARY

The overall goal is to increase savings from energy codes by determining "whether an investment in building energy code education, training, and outreach programs can produce a significant, measurable change in residential building energy savings". The states participating are Alabama, Arkansas, Georgia, Kentucky, Maryland, North Carolina, Pennsylvania, and Texas; Michigan also has a related project. The projects have begun only recently; there are some preliminary findings. DOE's homepage on these residential energy code field studies can be found here.

Confidentiality is a key concern since this is a residential study. No owner-occupied homes are included in the data and each house is only visited once.

The study comprises three main stages:

1. A pre-program **baseline study** to identify the energy use in typical single-family residential buildings in a given state and opportunities for improving energy efficiency

LEARNING OBJECTIVES

- *Obtain an introductory overview of the project*
- *Identify the primary components of the field study methodology*
- *Review current status of state activities*
- *Discuss strategies, challenges, and opportunities*

2. An **education, training and outreach** phase targeting issues identified through the baseline study
3. A **post-study** to identify the change in energy use following the education, training and outreach activities

Ideally, this project will provide a quantifiable impact for education, training, and outreach so that utilities can provide future funding for such activities, and claim measurable savings toward their energy efficiency goals.

Methodology is available online here.

- Developed by PNNL
- Focus on individual code requirements rather than whole home
- Sample size of 63 observations of key items
- Only new, site-built, single-family homes are included in the study
- A single visit per site to observe key items

ALABAMA | Partners: IMT, Alabama Center for Excellence in Clean Energy Technology, Britt/Makela Group, Institute for Building Technology and Safety

- State has been on 2009 code since 2012, when they adopted an energy code for the first time
- Sample plan consisted of 29 jurisdictions (5 counties, 24 cities/towns); one jurisdiction refused to participate and had to be substituted
- This field study began in January 2015; 48 of 63 jurisdictions are complete at this time with 515 data points so far
- Visited 18 jurisdictions in person to speak to code official, staff, or elected official; gathered information on funding, barriers to compliance, electronic processes, etc.
- Found that some jurisdictions are enforcing 2003 code or no code at all
- A final report is expected in May
- Team is also assembling a utility/regulatory working ground and project advisory group which will begin training (the second phase of the project) later this year
- Link to Alabama Residential Energy Code Field Study website

ARKANSAS AND GEORGIA | Partners: SEEA, Arkansas Energy Office, Southface, Georgia Dept. of Community Affairs, Georgia Environmental Finance Authority (GEFA), and Advanced Energy

- Haven't started baseline study in AR; visited 25 houses in GA so far
- Utility involvement
- Held three open energy code forums in each state (Savannah, Atlanta, and Perry to learn "why" and "what" the problems are. Participants include code officials, builders, trades, design professionals, associations
- When asked *"how much do you think codes are being complied with?"*, code inspectors, HVAC contractors, heads of associations reported from the three meetings: 58%, 57% and 48%
- Now also including a statistically significant sample for GA Power territory (additional samples)

PENNSYLVANIA

- Seeks market-based approaches to increase energy code compliance
- Project is creating connections between builders and HERS raters (during consultations); it's a first step in moving them to above-code programs.
- Using "E-Code Assistant"- a tablet-based interactive inspection checklist for inspectors and project managers

- Challenge of obtaining permits is solved by the state's Right to Know law
- 2562 municipalities total (this is the level at which energy code is enforced)
- Sample created: 45 or 46 municipalities in eastern third of state, where participating utilities are located
- So far, they've collected 75% of permit data needed; and have observed 25% of key items; they don't have many observations of wall insulation, blower door and duct testing
- They offer a voucher for a "free energy rating" as an incentive to get builder participation
- They held a stakeholder meeting with industry and utilities to encourage their involvement.
- They've offered circuit rider training to 15 different municipalities
- Training, education, and outreach via:
  - Stakeholder meetings
  - Building consultation by HERS raters
  - Circuit rider training
- Preliminary findings include:
  - Blower door test results showed under 7ACH50
  - Duct leakage is relatively high
  - Duct boots are not sealed to subfloor or drywall in some cases
  - Recessed lighting was also an issue when it was not sealed to finished ceiling surface

KENTUCKY | Project partners: MEEA, DEDI (Dept. of Energy Development and Independence), DHBC (state code agency), subcontractors, stakeholders

- Current residential code is the 2009 IECC with minor amendments; commercial code is 2012
- HVAC and plumbing is enforced at state level, so permits for all new buildings are available; this has helped a lot. Enforcement happens in three ways, depending on the status of the jurisdiction.
- Field study starting April 6
- Adding HVAC sizing and duct design to data collection at state's request
- Samples coordinated with utility regions for reporting on compliance to utilities
- There are many co-ops and IOUs in KY
- <u>Sampling plan:</u>
  - 37 counties, 3 municipalities (40 areas)
  - They'll establish a code compliance collaborative (utilities, HVAC contractors, others) and structure to assist the project and continue on afterwards; one meeting held so far
- <u>Training/outreach plan (to begin July 1):</u>
  - Advanced training (topic and role-based training (field training)
  - Circuit rides (8-10 visits per month)
  - Establish a hotline
  - Online courses via Learning Management System

MARYLAND | Project partners: Newport Partners and Edge Energy

- State statute requires adoption of new IECC every 3 years as it is published; may be amended but not weakened. Localities must adopt within 6 months, are responsible for enforcement.
- Started data collection in late January
- Newsletter includes an energy code contest, and winner gets a small prize. Emails out to code officials regularly. Have a code coach hotline.

NORTH CAROLINA

- 35 jurisdictions participating
- Have sampled about 110 homes (will be over 200 homes to get the 63 points of data by the end)
- Sampling must happen in five week timeframe of new home construction
- State requires duct testing; they want to know if this is being done
- Haven't collected enough air leakage or duct testing data yet
- Homes should have 75% efficient lighting; they're not seeing that
- Also doing a qualitative survey
- Developing educational programs, but it's a challenge to get builders to attend

TEXAS

- They aren't sampling the whole state – just 30 counties in SE Texas near Houston, which represents 30% of all permits, 26% of state population
  - Some incorporated, some not; all in Climate Zone 2
- Eliminated exceptions from the sampling (e.g., homes with basements; homes over 5,000 sq. ft.; and "stilt-built" homes in hurricane coastal area
- Viral approach to education:
  - Energy code ambassadors teaching others (Richard Morgan of SPEER to lead Ambassadors role)
  - Regional working groups developed to engage builders, contractors, and inspectors
  - Speakers' bureau; webinars and in-person training
  - Training will be targeted, based on field data
- Electric Utility Marketing Managers (EUMMOT) represents all utilities in Texas and offered a matching grant and assistance in designing new programs for utilities. Even though only three utilities are represented in this study area, all utilities are interested in findings.

MICHIGAN | Partners: Detroit Edison (DTE) (electric-only utility), Consumers Energy (gas and electric). Represents a good portion of state, but not statewide; Britt/Makela, MEEA, and MSU professor Tim Mzorski

- Residential baseline study to establish current compliance, then assessing potential for savings
- Developing attribution model for utilities
- Assessing cost-benefit ratio to see if utilities want to proceed with project
- Two phases for baseline study: Residential and Commercial
- The plan consists of...
  1. Interviewing code officials
  2. Planning for the sample
  3. Collecting the field data
- So far, it's taking 2.6 visits per site to verify three code provisions
- Some problems with methodology:
  1. GA Power has an above-code program; these homes won't be eliminated from samples so this will skew results
  2. If a provision isn't complied with because it was traded off, it may show the home doesn't comply when it actually does
  3. They won't know whether training actually works, or if one type of training works better than another

TWO EXPERIENCES:
A DEEP DIVE INTO ENERGY CODES EAST AND WEST

This session took a closer look at residential and commercial energy code content from two very unique parts of the country. First, Appalachian State University showed the bad, the good, and the best when it comes to residential energy code compliance in North Carolina. Then, the City of Seattle provided a look into one of the more progressive and rapidly improving, commercial codes in the United States.

PRESENTATIONS

Mark Lessans *(moderator)*, U.S. Department of Energy

North Carolina: Details and Lessons Learned from the Field
Chuck Perry, Appalachian State University

Seattle: Life on the Cutting Edge *(no link available)*
Duane Jonlin, Seattle Department of Planning and Development

NOTES AND COMMENTARY

Chuck Perry spoke about NC's HERO code which is a stretch code and a great launching pad for high performance homes. Provisions include:

- Improve leakage to the outside added
- Band Insulation not treated like a wall
- Increased SHGC for passive solar
- Low E reflectivity
- Six year code cycle added for commercial and legislation is pending for residential cycle.
- Blower door is optional, but ~40% conduct testing anyway.

Duane Jonlin spoke about Seattle being the most energy efficient progressive city in the country; NYC is #2. (ACEEE scorecard report). Provisions include:

- Commissioning permit
- Actionable Graphic energy display for buildings 20,000 square feet or greater
- Source meters for full floor tenants, new buildings and tenant improvement permits
- Graphic tenants dashboards – tenants can monitor and manage their own energy
- 40% unobstructed roof area required for large PV systems in the future
- Small renewable energy required already 70 watt/1000 square feet
- EV ready in current code cycle
- 25% of commercial energy is for light and ½ is wasted
- Luminaire-level lighting control (LLLC) – wireless controls

Seattle has the first outcome based code in the country, but is now modifying this code based on results from initial pilot project results, revising EUI target settings, etc. New requirements within the 2015 code include:

- 40% cut in lighting power density (LPD)
- Dedicated outdoor air systems (DOAS), which require that ventilation air is supplied by equipment that is separate from the systems that heat and cool the space

LEARNING OBJECTIVES

- *Identify under-enforced provisions and methods to improve compliance*
- *Review technical details contained in progressive residential and commercial energy codes*
- *Learn about new compliance paths contained in progressive residential and commercial energy codes*
- *Discuss building stakeholder relationships and how it can lead to tangible benefits and improved compliance*

BEST PRACTICE SHARING:
STATE AND LOCAL APPROACHES TO IMPLEMENTATION

Model energy codes have begun to incorporate requirements for building performance, whole-building performance approaches have become an increasingly popular pathway to demonstrating code compliance. Session attendees learned about the best practices, resources, and certifications developed by state and local governments and code support organizations to assist in using performance metrics to demonstrate compliance.

PRESENTATIONS

Cosimina Panetti *(moderator)*, Building Codes Assistance Project (BCAP)

Evolution of WA State Energy Code- Aligning Efficiency Targets w/ Compliance
Lisa Rosenow, Northwest Energy Efficiency Council

Embracing Diagnostic-Based Compliance Assessment through a Diverse, Yet Integrated Training Program
Darren Myers, International Energy Code Consultants

Home Rule Implementation: Pima County's Two-Tier Approach to the Adoption of and Compliance with the Energy Codes
Rich Franz-Under, Pima County Development Services

GA Energy Code Update – A Step Ahead!
Ted Miltiades and Bill Towson, Georgia Department of Community Affairs

Tropical Design Everywhere
Howard Wiig, Hawaii Dept. of Business, Economic Development, and Tourism

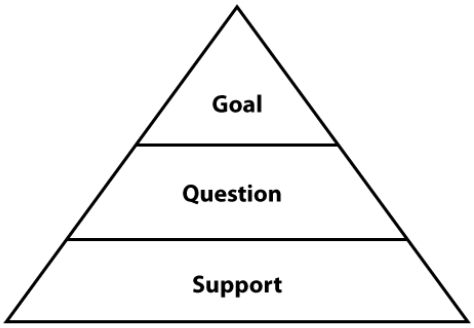
NOTES AND COMMENTARY

Energy code policy in Washington State - what can be done?

- Address code issues by using big picture process diagram at right
- Turn policy into results
- Identify under-enforced provisions
- Increase awareness
- Provide training and make visits to local jurisdictions; this is crucial in increasing awareness and enforcement effectiveness
- Host webinars, especially on certain commercial compliance forms
- Create diversity and integrated training formats for each state code.
  - › Visual guides of codes for code compliance can be very helpful.
- Establish strong partners; for example, Pima County, AZ partnered with Tucson Electric Power, Southwest Gas, the Southern Arizona Home Builders Association (SAHBA), Pepper Viner Construction, Alliance for Construction Trades, and Hamstra Heating and Cooling.
- Developing a house summary was a key to easy review of the Manual J.
- NEEDS: Visual guide along the lines of "Manual J for Dummies", more diverse CEU courses, info on multi-story building facade air filtration
- Hawaii's IECC amendments have created a unique code.
  - › State will also "leapfrog" from 2006 IECC to the 2015 IECC and add a Tropical Code
  - › The ideal tropical home will achieve a 48% energy use reduction over the 2006 IECC baseline

LEARNING OBJECTIVES

- *Identifying under-enforced provisions and methods to improve compliance, building technical support relationships with industry professionals;*
- *Identify a menu of affordable and successful and not-so-successful program options for training and technical support of the IECC;*
- *Understand the two tier approach of code compliance and beyond code programs; and*
- *Understand that building stakeholder relationships with tangible benefits is essential for improved compliance numbers.*



COMMERCIAL COMPLIANCE STUDIES

Residential code compliance studies have been done many times and are relatively straight-forward. But how do these studies work on the commercial side, with wildly varying building types, long construction times, complex HVAC systems and many levels of building official knowledge? This session covered accomplishments, lessons learned, and how stakeholders are moving forward on documenting commercial savings.

PRESENTATIONS

David Cohan *(moderator)*, U.S. Department of Energy

Commercial Code Compliance: A Literature Review
Rahul Athalye, Pacific Northwest National Laboratory (PNNL)

Commercial Baseline Study: Where Are We At?
Nigel Makela, Britt/Makela Group

Developing a Commercial Code Compliance Methodology
Ken Baker, Northwest Energy Efficiency Alliance (NEEA)

NOTES AND COMMENTARY

Evaluating Lost Energy Savings – What do we know so far?
Starting to do commercial studies, but first there is a need to evaluate lost energy savings.

- Buildings do not comply with all code requirements
- How much energy savings are lost?
- What requirements have the largest impact?
- How can we reduce the lost energy savings?
- Forget the question "does it comply?"

PNNL did a literature review of state studies (Colorado, DC, Florida, Idaho, Nebraska, Utah) going back to 1991, looking at:

- The definition of compliance... which of the following does it mean?
  - All requirements of code must be met
  - Compliance by system
  - Percentage of requirements met (BECP methodology)
  - Not defined (highest # of studies)
  - Through modeling
- Research methodology
- Sample size
  - Data source
  - Sampling method
  - Stratification – was there an adequate variety of size, climate, geography, building type, and new construction vs. renovation?
  - Sample size justification – most commonly, there was no justification
  - Confidence interval reported
- Building evaluation
  - most common problem was difficulty of accessing documentation
- Cost

LEARNING OBJECTIVES

- *Distinguish between the challenges found in commercial energy code compliance research versus those found in comparable and similar residential research*
- *Appreciate the current frontiers of commercial compliance research, including successes and shortcomings of completed studies*
- *Articulate the distinguishing features of compliance studies and energy savings studies*
- *Engage in an informed discussion on possible future directions for research in this field*

Summary – what did we learn?

- The good
  - › any states showed compliance rates above 80%
  - › single site visits occurring post-occupancy
  - › average cost of evaluating a single building was $4,000 total (though this may not be representative)
- The bad
  - › ample bias, compliance is not well-defined
  - › single site visit occurring post-occupancy
  - › focus on new construction
- The ugly
  - › sample size not sufficient
  - › requirements impacting energy use were ignored
  - › difficulty in accessing code compliance documentation

- Is a commercial compliance study feasible? If yes, then create a methodology with a focus on quantifying lost energy savings.

Building envelope

- In the field, insulation generally met/exceeded prescriptive requirements
- No NFRC certificates for site built windows
- Insulation values sometimes called out on plans

Lighting

- Lack of compliance with daylighting controls
- Bi-level switching was mostly fulfilled with occupancy sensors

Developing a Commercial Code Compliance Methodology

- Compliance and characterization has been happening in the Northwest for the past twenty years or so
- Type of occupancies – building types including K-12, office, retail, etc. all present their own issues with compliance
- What are the characteristics that should be evaluated in these different building types?
  - › Size of building
  - › Complexity of HVAC
- Northwest study goals:
  - › Identify major gaps in implementation and enforcement
  - › Inform program development and enforcement efforts
  - › Provide feedback on the efficacy of industry efforts
  - › Find better approach for estimating compliance & demonstrating value
- Compliance versus evaluation:

Compliance	**Evaluation**
Component or subset of evaluation; difficult to define	Energy use and savings or impact
Mix of measures that must be met for each building	Includes enforcement, education, compliance, etc.
Not an indicator of energy savings	Lets us know if market is transformed

- Expected outcomes
  - › Characterization of building factors
  - › Methodology for commercial energy code evaluations

DEMONSTRATING CODE COMPLIANCE WITH ERI

What does an ERI path to energy code compliance mean for building construction and code enforcement communities? Attendees learned more about the ERI and how it is calculated, which states across the country that are already using an ERI path for compliance, and software and other tools for determining the ERI score of a home.

PRESENTATIONS

Steve Baden *(moderator)*, Residential Energy Services Network (RESNET)

Benefit of the New ERI Compliance Tool in the International Energy Conservation Code (IECC)
Dominic Sims, International Code Council (ICC)

HERS Index in IECC Compliance - Comparing the New ERI Path to the Traditional Performance Path
Vrushali Mendon, Pacific Northwest National Laboratory (PNNL)

An In-the-field Perspective
Robby Schwartz, EnergyLogic

Implementing ERI as Building Code- 146 Case Studies from Massachusetts
Ian Finlayson, Massachusetts Department of Energy Resources

NOTES AND COMMENTARY

Benefit of the New ERI Compliance Tool in the International Energy Conservation Code (IECC)

- There are 57,000 members of the ICC
- Section R406 of the 2015 IECC authorizes code officials to accept third-party evaluations for code compliance – called the "ERI"
- The IECC performance path only analyzes the energy used by: Heating, cooling, lighting and hot water; ERI considers much more than that

HERS Index in IECC Compliance

- PNNL did a study to compare the new ERI path to the traditional performance path in 2012 IECC to determine: Do the 2015 IECC ERI thresholds consistently ensure reasonable compliance equivalency? *Answer:* Yes, they are sufficiently conservative to assure the home complies with the code.
- Study utilized 59,400 EnergyPlus home models; numerous building characteristics
- They analyzed 324 combinations of house characteristics, and HVAC
- They invented a "corresponding HERS index" (CHI) to assign a HERS score for what home would score if it had been HERS rated
- Variations in score included: High-efficiency appliances and HVAC, other
- Does the new ERI path set up any "free rider" or "path shopping" concerns? SEER 20 AC and 96 AFUE furnaces are the highest efficiency; in those cases, you may compromise the efficiency of the building shell
- In virtually every climate zone, house size, then appliances, then HVAC efficiency were the most impactful variables in the HERS score
- When no building characteristics were accounted for, HERS scores ranged from 56-79

LEARNING OBJECTIVES

- *Understand the new Energy Rating Index (ERI) compliance path in the IECC for residential construction*
- *Compare the ERI with traditional compliance paths in order to be able to provide technical assistance to jurisdictions as they adopt the 2015 IECC*
- *Participate in a new opportunity for broad industry collaboration to promote energy code compliance*
- *Learn how the ERI has been implemented and explore the lessons can be gained from these experiences*

An In-the-field Perspective

- RESNET Grade 1 is being adopted in at least one jurisdiction in Colorado
- 405.3 uses annual energy cost "less than or equal to" the prescriptive path, rather than the energy use
- Section R406.2 requires mandatory provisions identified in Sections R401.2 (but there were four corrections: SEE ERRATA)

Implementing ERI as Building Code - 146 Case Studies from Massachusetts

- Has allowed an ERI option for code compliance since 2009
- You can't get to Net Zero without a performance-based code
- In 2009: MA adopted the 2009 IECC with a HERS 75 compliance option
  - › Also offers optional "Stretch Code" for local adoptions, of HERS 65/70
  - › 146 local jurisdictions have adopted the stretch code; 136 of them are "Green Communities". There was a financial incentive to become a green community (which also requires a plan for community renewable energy and other requirements.)
  - › Over 50% of the population and over half the building permits covered by the green community and stretch code
- In 2014: MA adopted IECC 2012 with HERS 65 compliance option
- In 2016: MA will adopt the 2016 IECC 2015 with ERI 55 option

ENERGY CODE COMPLIANCE TO MEET UTILITY TARGETS

This session provided an overview of states where support for energy code adoption, training, and compliance can be used by utilities to claim savings toward meeting energy efficiency targets. Additionally, the session discussed the role code compliance may play in state plans to reduce greenhouse gas emissions.

PRESENTATIONS

Isaac Elnecave *(moderator)*, Midwest Energy Efficiency Alliance

The Arizona Experience: 2012 IECC
Sharon Bonesteel, Salt River Project (SRP)

National Grid's Code Compliance Enhancement Initiative in Rhode Island
Eric Beaton, National Grid

Energy Codes and Utility Support in the Southeast
Kristi Matthews, Advanced Energy

Energy Codes and the Clean Power Plan
Rodney Sobin, National Association of State Energy Officials (NASEO)

NOTES AND COMMENTARY

- Starting the conversation by understanding…
  - Utility concerns
  - Public service/utility commission concerns
  - Best practices and considerations
  - Potential for real saving and benefits
- How does energy code support effect utilities' above code programs?
  - Public service/utility commission concerns include:
    - How much savings and how will they be proved?
    - Why get involved when other government agencies are supposed to be ensuring code compliance?
    - What is the impact on above-code programs?
    - How are you going to prove you are not double-counting?
- Benefits of a codes and standards program:
  - Reduce lost opportunities from non-participants
  - Better understand code comparison rate to inform resource planning decisions
  - Help utilities support new codes
- Utility needs to be the facilitator that helps translate the codes into specific construction details and process for buildings and contractors
- Work with the local ICC code officials and help them understand the life, safety element of the energy code
- Understand that a different location structures programs differently and treat attribution differently
- What we need from working with utilities: durability, practical solutions
- Utility is the enabler, not the enforcer
- If new construction projects don't meet the base code, there are "lost" energy savings: this is where there is an opportunity for an organization such as National Grid to address code compliance

LEARNING OBJECTIVES

- *Understand the relationship between utility programs and code compliance*
- *Understand the types of programs that can improve code compliance*
- *Understand the ways to measure the energy savings coming from improved code compliance*
- *Understand the relationship between energy savings from implementation of energy codes and the reduction of greenhouse gas emissions*

- Meanwhile in **Rhode Island**, there are two working groups:
  - Implementation Group that is made up of Rhode Island commissioning groups, National Grid, NEEP, lead vendors.
  - Evaluation Group that is made up of National Grid, consultants, and lead vendors.
  - National Grid offers financial incentives, engineering analysis, and education to retrofit projects and new construction projects that exceed the base code.
  - Core of Initiative:
    - Proactive outreach to important stakeholders for input and review
    - Trainings for code officials, builders, architects, etc.
    - Energy code circuit rider tech support - people can call in or have an expert accompany them out into the field, e.g. going out to architecture firms to review plans or visiting someone's built home
    - Code compliance tools – field guides and technical bulletins
    - Process trainings for 3rd party energy specialists
- Lessons learned from the working groups after a year of collaborating:
  - Trainings have been successful.
  - There is a lack of circuit rider activity, and questions for the lack of activity include:
    - Is there not enough construction activity?
    - Does presence of inspectors at construction sites worry builders?
    - Do we need to be more proactive in outreach?
    - There are no continuing education credits required for builders; hampers potential for maximum participation.
    - Initial high spending with little immediate proof of savings—no one will know exact impact of the energy code until next baseline study comes out in 2016
- **Building Energy Code and Clean Power Plan**
  - Clean Power Plan proposed rule: State-specific interim and final rate goals (lb CO2/MWh)
    - Projected to reduce sector CO2 emissions of 30% by 2030 (v. 2005)
    - Each state's goal is based on four "building blocks":
      1. Improve heat rate
      2. Increase natural gas (NGCC) dispatch
      3. Certain renewable and nuclear
      4. Energy efficiency savings ramped up to 1.5%/year
  - Schedule as follows:
    - Proposed June 2014 (comment period ended Dec. 2014)
    - Final rule expected Summer 2015
    - State compliance plans due 2016-20108 (some flexibility)
    - Compliance: 2020 interim target, 2030 final target
  - State compliance plans: 12 components
    - Affected entities, approach, compliance obligations, performance standards, milestones, corrective actions for shortfalls, monitoring/record-keeping/reporting
    - Measures need to be quantifiable, non-duplicative, permanent, verifiable, and enforceable
  - There are still many complicated issues including a lack of awareness of the new air regulation and too much state flexibility stemming from providing too many compliance options
  - Enforceability considerations could have multiple compliance entities which can lead to more complex quantification issues

FORUM ON EXISTING BUILDINGS:
COMPLIANCE AND RESILIENCE

Increased demand for working and living spaces in urban and developed areas is leading to significant repurposing of commercial buildings. This is an opportunity to improve the performance of existing buildings. Realizing this opportunity depends on judicious and enforceable building code requirements and actionable best practice guidance for building owners and professionals. This session highlighted the recent evolution in code language for existing buildings, offered a test-case for an additional code change to the IECC's change-of-occupancy requirements, and presented a life-cycle approach to investing in commercial building energy efficiency.

PRESENTATIONS

Jennifer Senick *(moderator)*, Center for Green Building

Compliance Guidance for the Energy Code's Change of Occupancy Requirement Based on the Smart Rehab Code Approach
David Hattis, Building Technology, Inc.

Codes, Codes, and More Codes for Existing Buildings!
David Collins, Preview Group

Redefining the Rules: Driving Deep Efficiency in Existing Buildings
Zachary Hart, American Institute of Architects (AIA)

NOTES AND COMMENTARY

- **International Existing Building Code (IEBC) alteration scenarios:**
  - Level 1: No energy code requirements
  - Level 2 & 3: involve a movement of wall or rearrangement of a space require energy code
  - Change of occupation: repair and alteration
  - Addition (as if new)
  - Relocation (repair, alteration, change of use)
- **Rutgers Center for Green Building's** project objective is:
  - To develop regulator guidance for better code compliance with IECC change-of occupancy provisions through proof-of-concept testing.
  - WHY:
    - Policy objective of the IECC is energy conservation
    - Principal use is main determinant of energy consumption
    - Change-of-occupancy provision is hard to enforce in its current form
    - Project designed to help improve opportunities to optimize energy efficiency in existing buildings through code compliance
    - IECC is currently not accompanied with clear methods for evaluation and measurement
  - HOW:
    - Develop data on municipalities/commercial building inventory/rate of reuse
    - Work with target municipalities to gather information that informs the development of compliance guidance
    - Field test compliance guidance and disseminate to stakeholders
    - Propose IECC code change (in 2016); scale up nationally

LEARNING OBJECTIVES

- *Learn from the regulation of existing buildings to improve compliance with the IECC*
- *Leverage energy intensity as a metric for energy demand*
- *Learn about approaches, tools, and policies that address the energy efficiency gap in existing buildings*
- *Understand how certain triggers in a building's life cycle enable cost-effective deep energy retrofits*

- Building codes and the impact of “smart codes” on rehabilitation – some historical precedents:
  - International Existing Building Code (IEBC)
  - Nationally Applicable Recommended Rehabilitation Provisions (NARRP)
  - NJ Rehabilitation Code
  - Massachusetts Article 22

- Consider the relationship between predictability and proportionality
- Deep Energy Retrofit: a design-based, comprehensive approach of evaluating and improving the whole building performance
- Improve benefit/cost ratio:
  - [Deeper Energy Savings + Incentive + Value Triggers + Energy Financing + Value beyond Energy Savings] / [Cost]
- Components that require considerations on both energy use and intensity:
  - Space conditioning
  - Lighting
  - Water heating
- We need to understand the relationship between the maximum energy use and number of buildings to be regulated

APPENDIX OF ADDITIONAL CONFERENCE SESSIONS

TECH TRACK: Achieving and Evaluating Residential Compliance of Tight Envelopes
Demonstrating Compliance: The Evolving Role of Software
TECH TRACK: HVAC and the Energy Code: Comfort, Savings, and Fewer Call-Backs
Commissioning Requirements for Commercial Energy Codes
TECH TRACK: Increasing Role of Controls in Commercial Energy Codes
Forum on Messaging: The Value Proposition for Codes
Two Experiences: A Deep Dive into Energy Codes East and West
TECH TRACK: Daylighting Controls for Commercial Buildings
TECH TRACK: Successful Home Ventilation Strategies for Code Compliance
Multifamily Buildings Forum
TECH TRACK: Insulation Requirements in the IECC