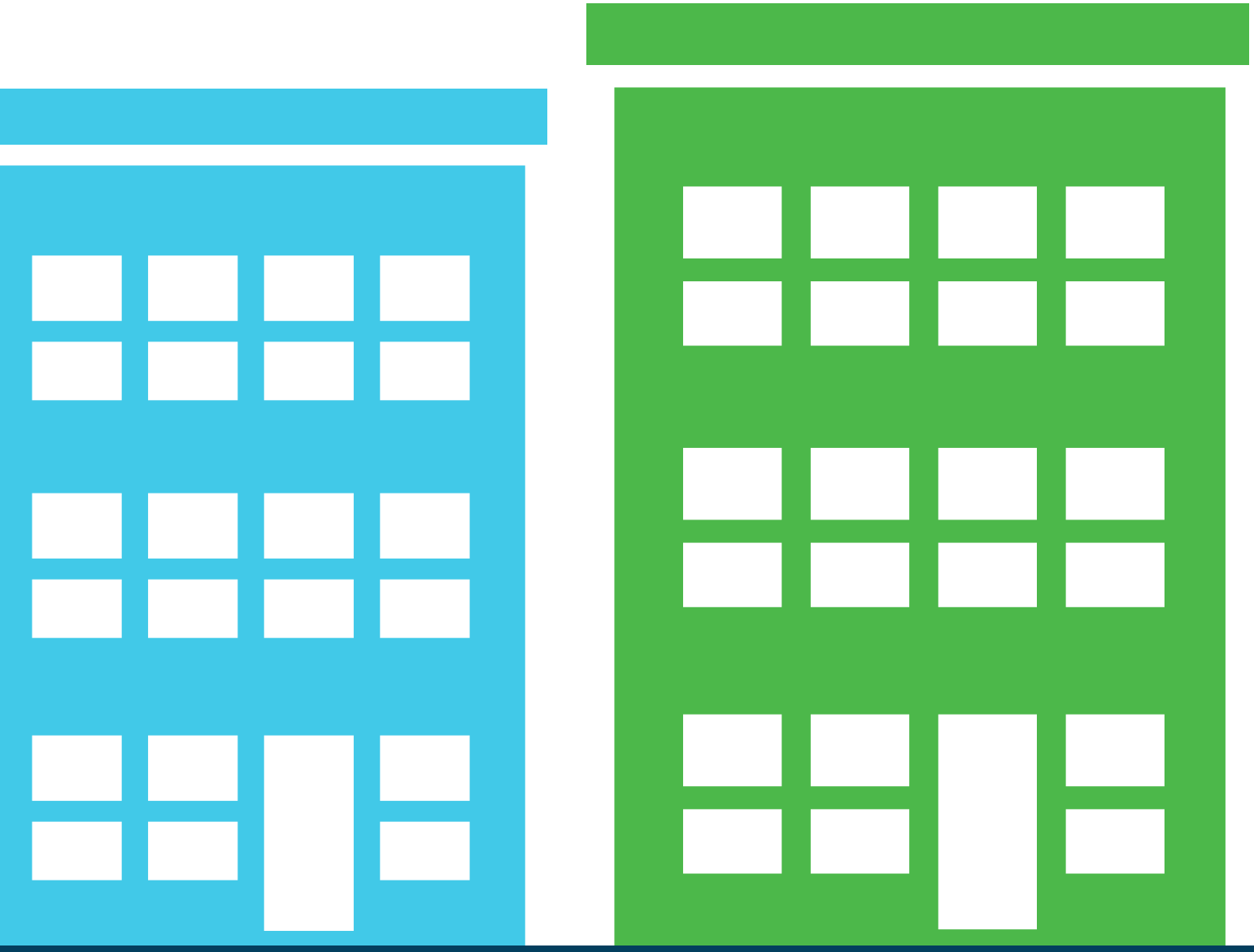

# How Energy Code Compliance Programs Can Generate More Savings Opportunities

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**ABSTRACT**

Energy code compliance programs offer an attractive opportunity for energy efficiency program administrators to capture additional cost-effective energy savings. These programs recognize the need to support design and construction professionals and code officials with training and technical assistance as they climb the learning curve on advanced energy codes. This paper explores code compliance savings attribution as a theory—and, more importantly, how to transform it into a viable program enhancement. We focus on National Grid's initiative in Rhode Island, featuring details about their methodology to claiming savings and applying combined wisdom and best practices to implementation strategies.

## The Current Problem

As energy codes become more stringent and energy efficiency baselines continue to rise, administrators of new construction energy efficiency programs[1] are finding it increasingly challenging to secure cost-effective savings in order to justify those programs. Much of the cost-effective savings potential has long ago been incorporated in recent generations of energy codes, leaving fewer easily accessible savings for programs to capture. Buildings and ducts are now tighter, insulation values are becoming optimized, windows have improved dramatically, efficient lighting is more prevalent, and HVAC equipment is nearing the top of its efficiency. An MMBtu or kWh of savings now costs program administrators (PAs) significantly more to secure than it did just ten years ago when buildings were less efficient and more savings opportunities were available at lower cost.

At the same time, if states are going to meet their climate, greenhouse gas and energy efficiency goals, and close the gap between energy code requirements and compliance rates, they need the PAs. PA new construction programs can help builders and contractors construct to more stringent energy codes and move the market along the path to "zero net energy" and "net energy positive" buildings. These challenges are actually good problems to have; they demonstrate that new construction market transformation is truly occurring. The problem is that conventional program designs and approaches are not keeping pace with market changes. With shrinking potential savings, increasing costs to achieve that next increment of savings and program cost-effectiveness rates that are moving toward—and sometimes under—a 1.0 benefit-to-cost ratio, what's a PA to do?

A handful of states have figured out how to step back in order to catapult ahead. Instead of focusing only on the program participants in new construction programs, some states and PAs are taking a broader perspective to address *all* new construction projects—participants *and* those outside of the program, as well as renovations, remodels and additions—finding tremendous opportunities to influence more savings. There are currently PAs in a few states that support code compliance programs (e.g., Arizona, Massachusetts, Oregon, Rhode Island) and other states in which PAs are actively engaged in advancing code adoption (e.g., Arizona, California and Oregon). Both code compliance support programs and code advancement efforts are presented

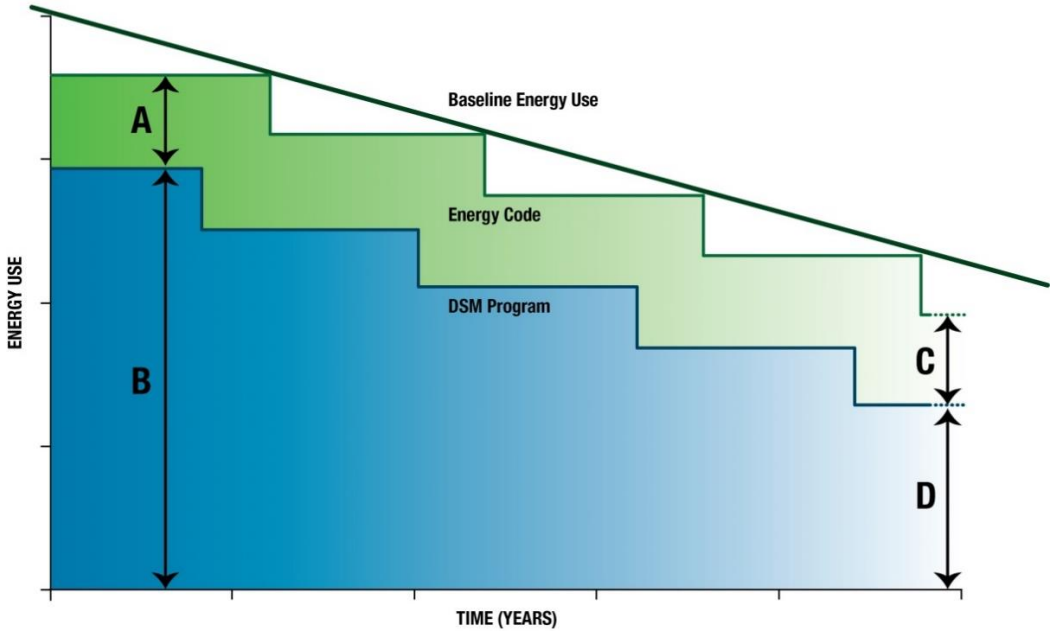
[1] This paper addresses both residential and commercial new construction throughout.

in detail in a Northeast Energy Efficiency Partnerships (NEEP) study led by Cadmus[2] in January 2013. This paper borrows from that 147 page study and attempts to present the theory behind savings attribution for code compliance support at a much higher level. In addition, this paper provides a snapshot of National Grid's Code Compliance Enhancement Initiative in Rhode Island, an innovative program offering with a more detailed and Rhode Island-specific approach to savings and attribution[3].

## Shrinking Potential Savings

As energy codes become increasingly stringent over time, demand-side management (DSM) program participation criteria tend to advance at similar speed in order for programs to continue to secure savings. When energy codes are slated to become more stringent, the local new construction program will generally anticipate this move and will increase the program's standards at about the same time as the next version of the code is implemented. *Figure 1* shows how the energy code and DSM program move together over time.

*Figure 1. Shrinking Potential Savings in New Construction Programs*




At the same time, the available program savings as a percentage of total energy use in any building changes over time. As is shown in Figure 1, when the energy code is not very stringent, the typical energy efficiency program savings for a participant relative to code (A) is a reasonably small percentage of the building's total energy use (A+B). However, as the energy code becomes more stringent over time, the increment of savings available for a program home

[2] NEEP/Cadmus, "Attributing Building Energy Code Savings to Energy Efficiency Programs", February 2013. https://neep.org/Assets/uploads/files/emv/emv-products/NEEP_IMT_IEE_Codes%20Attribution%20FINAL%20Report%2002_16_2013.pdf

[3] Rhode Island Code Compliance Enhancement Initiative Savings and Attribution Logic Evaluation, NMR Group, Inc., December 11, 2013.

(C) represents a much larger percentage of the building's total energy use (C+D) and therefore becomes much harder and more expensive for a DSM program to obtain. We observed with the recent ENERGY STAR Homes v.3 certifications, that when the national program standards became more stringent, participation rates in 2012 fell to half[4] of 2006 certification levels. Programs have to expend more effort and, at the same time, increase incentives to lure participants. They end up pursuing a shrinking amount of savings while spending more budget, thereby impacting program cost-effectiveness. Consequently, PAs are looking for new ways of obtaining savings.

## Energy Code Savings Attribution Theory

By focusing on the *entire* new construction and renovation/remodel/additions markets, instead of just the 20% to 30% of the market that typically participate in new construction programs, more potential savings are available for PAs to capture. Baseline studies throughout the U.S. have found energy code compliance rates to be generally in the 50% to 70% range[5]. The theory follows that if the PA can help increase compliance from these baseline levels to 90% or more, then they should be able to claim a piece of the savings between baseline and code for all of the buildings that comply with code as a result of the PA's efforts.

PAs should continue to offer programs targeted to the leading builders and most efficient buildings. However, they may wish to consider supplementing this traditional effort with a new program that provides non-participant code compliance support to builders, design professionals and code officials in order to increase compliance rates. The primary activities offered may include training and technical assistance. It is important to examine how code compliance can be determined, quantify the savings that stem from increased compliance, and see how increased compliance should be attributed to PA efforts.

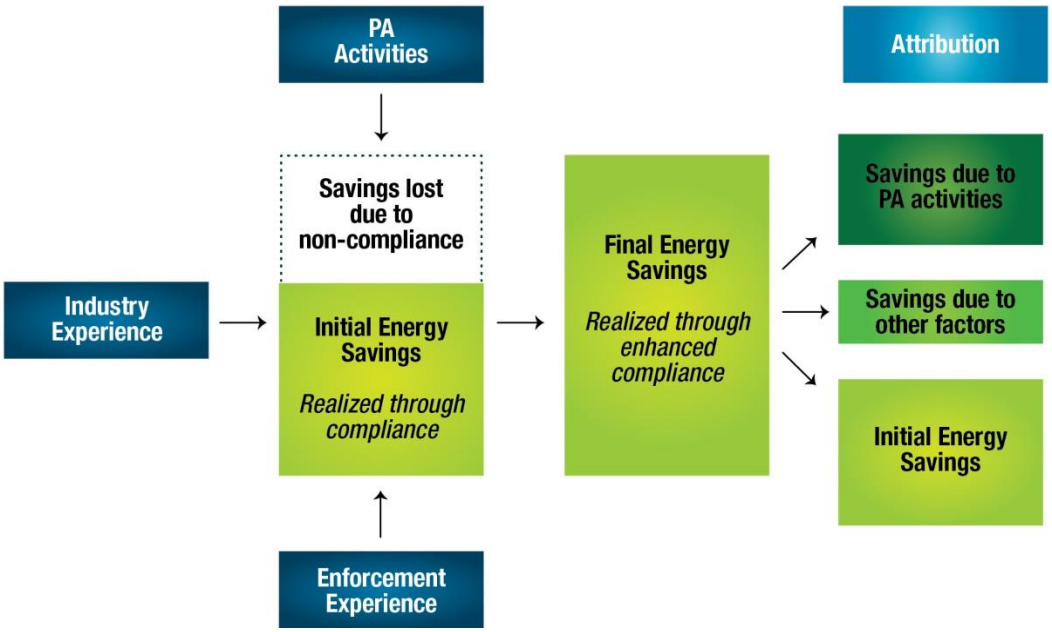
Figure 2[6] portrays the process of evaluating and attributing savings related to code compliance enhancement efforts. When a code goes into effect there is likely to be some level of non-compliance that results in less energy savings than would theoretically be attributable to the new code. The term "initial energy savings" is used here to indicate the savings that would occur without additional efforts from the PA— savings that can be increased through PA efforts focused on compliance enhancement. As industry and code officials gain more experience with the code, compliance is likely to increase. Other parties may also work with the industry and code officials to improve compliance. The combined effect of all these influences is an increase in code compliance and energy savings. Because several influences could contribute to an observed increase in compliance, an attribution analysis is required to determine the contribution of the PA activities.

The three critical analytical steps in the evaluation process are:

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

[4] http://www.energystar.gov/ia/partners/publications/pubdocs/2012_AnnualReport_Final.pdf?59f0-89ba
[5] http://www.imt.org/codes/code-compliance and communication with Dottie Conant, evaluator, 4/9/14.
[6] NEEP/Cadmus, Feb. 2013.

*Figure 2. General Model of Energy Code Compliance Enhancement Evaluation and Attribution to PAs*




**Determine Baseline Compliance Level and Energy Use**

Initial energy savings are determined by the baseline compliance level. This can be accomplished by referencing a recent market baseline study, if available, by conducting one (which can be expensive), or, by using expert judgment. Experts can be polled using a "Delphi process"[7] to estimate the compliance level prior to the PA's compliance enhancement efforts and estimate the energy usage.

**Determine Enhanced Compliance Level and Energy Use**

The most rigorous means of determining compliance levels would be through an in-field market assessment or baseline study a few years after the PA had offered its training and technical assistance. However, if budget or schedule is insufficient, a program could use expert judgment for this aspect, as well. The same experts could be asked to estimate the compliance level and energy use after the PA implements their compliance enhancement efforts. The experts should be informed fully about the type of compliance enhancement activities conducted. A Delphi panel process could be used to share feedback on the experts' views.

**Estimate Energy Savings Due to Enhanced Compliance**

Savings would be based on the difference between baseline energy use and the reduced energy use due to enhanced compliance in all cases. Estimates by building or building type

[7] The Delphi method is a structured information-gathering technique, which relies on a panel of experts to convey their collective knowledge and judgment.

would need to be extrapolated to the estimated population of buildings affected by the code and program.

**Determine Savings Attributable to PA's Compliance Enhancement Activities**

The final step would be determining what proportion of savings was attributable to the PA's efforts. In all cases, expert judgment would be required. One option would be for the experts to estimate in advance what the attribution would be and deem the value. A more stringent approach would assess attribution *ex post* based on which activities the PA had completed using a scoring type system. In the more rigorous scenario, an evidentiary approach would be employed with a group of impartial experts who would judge information provided by the PA documenting their activities and how they theorized the activities affected code compliance changes. Regardless of methodology, it is essential to avoid any double-counting between code compliance savings and new construction program savings.

## Regulatory Challenges

While the theory behind code savings attribution seems sensible, it may be a challenge to convince regulators of its merit. Unlike most DSM programs that engage participants in a program and count savings directly based on the number and type of measures installed by participants, code savings attribution efforts involve either expensive baseline evaluation or a Delphi panel of experts. In either case, there is potentially a significant amount of savings determined from indirect sources. Representatives of Public Utilities Commissions (PUCs) have remained skeptical that real and measurable savings will result from these programs. As a result, some jurisdictions (e.g., Massachusetts[8]) have taken years to move forward, while others (e.g., Vermont) have so far denied claiming savings through code compliance support altogether.

It is important to remind regulators and others involved in the PA DSM programs what might happen to the actual level of efficiency in new construction if a new implementation approach—such as the code savings attribution model—is not put into place. With shrinking available savings and programs headed toward becoming non-cost-effective, states risk losing their new construction programs at the time they will need them most: as codes ramp up and become increasingly challenging to comply with. It is conceivable that the absence of new construction programs and the support and assistance they provide to builders could lead to *lower* levels of efficiency even with more stringent codes—exactly the opposite of the effect that the more stringent codes are intended to have.

Proponents of code support programs should prepare for a multi-year process to inform, and then work with, PUC staff to design, develop, launch and test a compliance savings attribution program. It is recommended in states with multiple PAs that code compliance programs be crafted and delivered in unison across the PAs – presenting one statewide approach to both implementation and evaluation.

[8] Although efforts in Massachusetts have taken years to develop, all Program Administrators are in 2014 moving forward with a code compliance enhancement initiative similar to that in Rhode Island. The initiative will run as a pilot through 2015 with no captured savings. Efforts will then be re-evaluated to determine applicability for the PAs' next 3-Year Plan (2016-2018).

PAs may want to share with regulators the detailed plans and evaluation model that Rhode Island has developed as an example of what has worked in one state. This model has been scrutinized by many parties, was approved in 2012, and officially launched in 2013. A summary of these efforts along with their potential savings is outlined below.

## Applying the Theory – Rhode Island Case Study

As part of its 2013 Energy Efficiency Program Plan, National Grid in Rhode Island, with the support of the Energy Efficiency Resource Management Council (EERMC), proposed and received approval from the Rhode Island Public Utilities Commission for development and deployment of an energy code savings attribution program in December 2012. The Rhode Island effort is a combined residential and commercial initiative spanning both new construction and retrofit buildings. It is part of a long-term strategic plan of coordinating resources to maximize impact of the statewide codes and standards efforts over the next three to five years. As part of this long-term plan, National Grid is pursuing four specific paths:

1. Code compliance support: The Code Compliance Enhancement Initiative (CCEI) is designed to increase the ability and desire of both the design community (architects and engineers) and the construction community (contractors and construction managers) to comply with the locally mandated building energy code and improve the ability of the local building departments to enforce the code.
2. Appliance standards development and advocacy: This will entail the selection of three to four appliances to pursue as higher efficiency products, to develop technical specifications for, and to promote more stringent standards at the state, regional, or the federal level.
3. Development of voluntary "stretch" code[9]: A stretch code initiative will save energy by assisting the State in developing the next generation of a voluntary energy code – saving approximately 15% more energy than buildings constructed to current energy codes.
4. Base energy code (IECC) advocacy: This includes targeted advocacy initiatives to improve building energy efficiency regulations specific to Rhode Island code amendments.

The CCEI is the first priority for National Grid, having begun in the second quarter of 2013. Associated energy savings will be attributable to National Grid for improving Rhode Island buildings' code compliance levels until 2017 at the least. Groundwork for the development of appliance standards and voluntary stretch codes began in 2013, although savings for these activities will not be realized until 2015 or later. While annual savings derived from code compliance support will not serve as a major contributor to annual portfolio savings, National Grid believes that code compliance support is the correct first step toward their aforementioned broader codes and standards effort. As savings from all four activities are aggregated annually, the importance of the effort to the entire savings portfolio will escalate.

### Code Compliance Enhancement Initiative

The CCEI, branded as "Energy Code Technical Support", provides support for both residential and commercial buildings that are required to comply with the applicable energy code

[9] A "stretch" code is a second energy code set at a more stringent level.

(for new construction, major renovations, and retrofits/additions). The state of Rhode Island adopted the 2012 International Energy Conservation Code (IECC) with amendments in October 2013 and began enforcement at that time. Code trainings offered to the building industry are an important component during the start of any code cycle. National Grid began code trainings in October 2013, and will continue through 2014 and beyond. The goal of this effort is to increase compliance above the current 57% energy code compliance rate for residential and 70% rate for commercial buildings (determined through 2012 code compliance baseline studies).

In the first quarter of 2013, Conservation Services Group (CSG) was selected as the lead vendor, in partnership with Energy & Resource Solutions (ERS), to implement Energy Code Technical Support. Based upon a collaborative effort of National Grid, the Rhode Island Building Code Commission, NEEP and the CSG/ERS team, the following tasks commenced in 2013:

1. Trainings: CSG and ERS are delivering code trainings around Rhode Island, including geographically dispersed classroom, location-based, and web-based trainings. Sessions focus on the building envelope, HVAC, and electrical sections of the code, and also the use of compliance software and tools. Training and outreach efforts developed in 2013 will continue throughout 2014 targeted to both residential and commercial markets, as modified based on participant feedback. On-site demonstration trainings (as a bridge between the code requirements), classroom lessons and on-the-job-site realities may be scheduled periodically throughout 2014. CSG and ERS also conducted focus groups to learn from builders, contractors and code officials whether additional information should be included in future trainings and support materials.
2. Technical Assistance Energy Code Circuit Riders: The Energy Code Circuit Riders provide technical assistance for Rhode Island building professionals on energy codes and energy efficient building design and best practices. They interpret and explain code administrative requirements and serve as liaisons between designers, builders and contractors and Rhode Island's code officials. Circuit Riders assist in clarifying any confusion or misunderstanding that building design and construction professionals may have about energy codes, and ultimately support their efforts to better understand and execute code compliant building designs. The Circuit Riders serve the entire state, providing technical assistance to project teams as the need arises, including direct assistance to building departments.
3. Support for third-party inspections: Once Rhode Island establishes the legislative provision for optional/voluntary third-party inspections of the building energy code (currently pending legislative action), training will be developed based on the rules created, and will be delivered to those professionals approved to perform this work. While third-party specialists will be encouraged to attend the technical trainings delivered through Energy Code Technical Support, the trainings designed for these individuals will be separate and distinct from the trainings described above. They will focus on how to best apply their technical expertise in a code compliance environment -- and on administrative and procedural issues rather than on technical aspects of the code and its enforcement mechanisms.
4. Documentation Tools: A focus of Energy Code Technical Support is to reduce confusion regarding code compliance due to lack of standardized documentation at the time of permitting. In 2014 CSG is continuing to refine documentation tools created in 2013, such as checklists and code check protocols, based on feedback from code officials and other

stakeholders. The ultimate goal is making permit submittals by building and design teams—as well as plan reviews by building department staff—simpler and more streamlined. Other documentation tools such as builder manuals, FAQs and periodic technical bulletins are being developed and distributed in 2014.

In addition, National Grid established a "Codes & Standards Working Group" that includes representatives from the EERMC, the Rhode Island Building Code Commission, National Grid contractors (CSG and ERS), and NEEP. The mission of this group is to:

- Provide oversight to the Codes/Standards Initiative at large;
- Create a list of tracking and performance metrics for each code compliance activity;
- Review and provide feedback to National Grid on energy savings estimates and attribution to National Grid for its code compliance effort; and
- Establish a methodology for attribution rate for subsequent years.

National Grid recognizes the challenges that accompany such an initiative. As one builder from an early focus group stated "we build to the code that is enforced, not what is written in the code books", it is clear that any compliance enhancement strategy must demonstrate the value of code compliant buildings to *both* the compliance and enforcement communities. National Grid and its support team believes that these activities will assist code officials in enforcing the energy code, and will help builders and contractors in understanding what the code requires, how to incorporate it in their buildings, and what elements are necessary to ensure compliance.

## Claiming Savings

National Grid, their evaluation consultants and the Codes & Standards Working Group have developed a robust methodology for claiming savings that result from these activities.[10] Highlights are outlined below.

### Projected Energy Savings

CCEI has two distinct energy savings estimates, one each for commercial and residential buildings. Estimates currently being analyzed are based on projected savings for the entire state over five years (a time range estimated to bring about a compliance rate of 90% for the Rhode Island building stock, in line with ARRA [American Recovery and Reinvestment Act of 2009] commitments), with cumulative savings every year starting in 2014. The expectation is that projected savings for the 2012 IECC code cycle will be realized from 2014 to 2018, as projects seek building permits under the current code. Even if Rhode Island adopts an updated energy code during this period, commercial buildings will still be pulling permits under 2012 IECC and building to those permits for years to come, so this will continue to be the basis for commercial savings through this period.

[10] Rhode Island Code Compliance Enhancement Initiative Savings and Attribution Logic Evaluation, NMR Group, Inc., December 11, 2013.

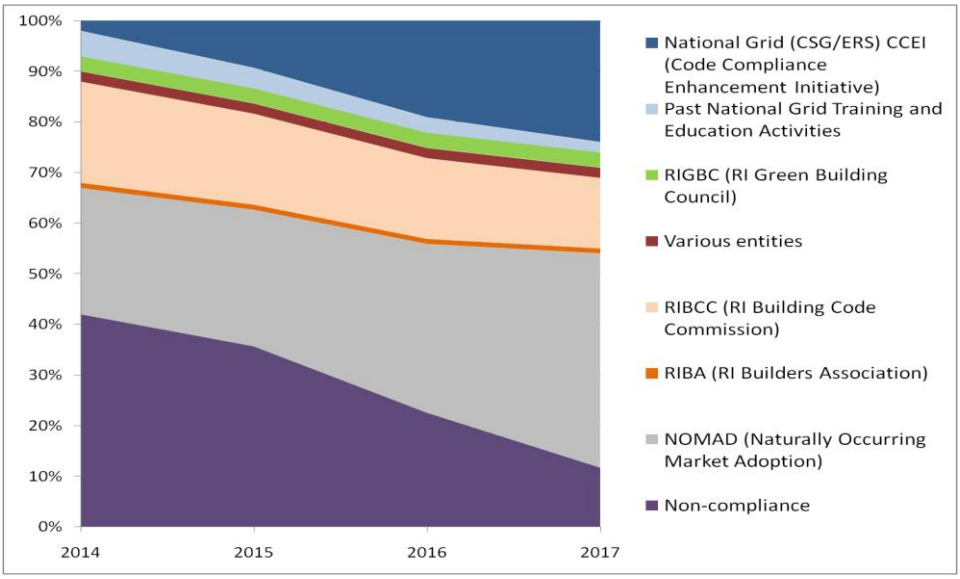
For this particular initiative, the gross technical potential savings are defined as the savings realized from an expected increase in the compliance rate with appropriate building code requirements—resulting in more energy efficient buildings. The baseline is set utilizing the results of Rhode Island code compliance baseline studies (residential and commercial separately). The potential gross savings are, therefore, the gap between the energy consumption at the baseline compliance rate and consumption at the maximum compliance rate (100%).. (The initiative also assumes that the compliance rate will increase over the designated time period of the initiative.

**Attribution to the PA's Efforts**

Upon the calculation of the gross technical potential savings, the next step is to determine how much of the savings achieved through the initiative can be attributed to the actions and efforts of National Grid (i.e., excluding other factors such as normally occurring market transformation, non-compliance, and efforts carried out by the state of Rhode Island independent of National Grid's support). Agreeing to a reasonable pre-determined attribution factor provides National Grid with an indication of how much value its code compliance efforts will yield. For the five year period 2014 through 2018, National Grid projects electric savings of 105 GWh, representing 66% of their entire 2013 energy efficiency portfolio goal. On the gas side, they project 275,000 MMBtu of savings, which is 95% of their 2013 goal. For 2014, the working group is working toward re-calibrating and adjusting current savings and attribution rates, supported by analysis and refined methodology.

For a visual representation, Figure 3 shows residential energy savings attribution for National Grid through 2017 in the top blue slice. For more detail on the other elements of this figure, see the report referenced in the footnote. Savings attribution for the commercial sector is similar.

*Figure 3. Residential Code Compliance and Attribution (without the influence of New Construction and Retrofit programs)*[11]




[11]NMR Group, Inc., December, 2013.

### Future Evaluation

Although National Grid has developed initial estimates of the potential energy savings as indicated above, future evaluation is required to properly determine the true effect of CCEI. National Grid will, in time, augment the initial energy code compliance baseline studies from 2012 by seeking to conduct additional studies. By ensuring that the methodology, inputs, and assumptions all remain consistent across the two sets of baseline studies, the true effect on compliance of National Grid's trainings, technical assistance, and documentation tools will rise to the surface, all else being equal. In addition, subsequent qualitative studies may be conducted in order to better assess the attribution rate of various parties, similar to those described above.

## Conclusion

As new construction programs find it increasingly difficult and expensive to mine savings from projects, embarking upon a market-wide new construction effort is a sensible path forward for PAs to ensure the cost-effectiveness of new construction programs. Instead of supporting only program participants, in most states PAs can take advantage of a vast potentially untapped savings opportunity by working with the new construction, renovation and remodeling market in support of increased code compliance. Rhode Island's National Grid has taken this theory and applied it in a way that quantifies savings from their support of training, circuit riders, outreach, and tool development which results in increased energy code compliance. The savings that will result over the five year program period represent a significant proportion of their overall portfolio savings; two-thirds of their 2013 program goal for electric and 95% for gas. There is no reason not to believe that such potential additional savings also resides with other states. As a result of these efforts, Rhode Island's residential and commercial new construction programs have identified a cost-effective means of leveraging more savings, the State will realize their 90% code compliance goals, and builders and designers will benefit from the existence of a PA-supported program that will help them along their path toward net zero energy and net positive energy buildings in the future.