Solutions for States
Energy, Economy & Environment

Navigating the Clean Power Plan: A Template for Including Building Energy Codes in State Compliance Plans

At a Glance

The Environmental Protection Agency's proposed Clean Power Plan establishes state-specific emissions targets for carbon dioxide emissions from existing power plants (EPA 2014b). The proposed plan allows states to use end-use energy efficiency as a primary means to comply with the emissions targets.

Adoption and implementation of building energy codes (referred to in this document by the single term, "adoption") could help states achieve significant emissions reductions from the electric power sector. Buildings consume roughly 70% of our nation's electricity (DOE 2011). ACEEE has estimated that, taken together, increased code stringency and improved building code compliance could result in 139–232 million megawatt-hours (MWh) of electricity savings in 2030 (Hayes, Ungar, and Herndon 2015). These reductions in electricity consumption have the potential to help states reduce greenhouse gas emissions by 102–169 million metric tons in 2030.[1]

This document is intended to help states document and claim emissions reductions resulting from building energy codes as a means of complying with their obligations under the Clean Power Plan. It includes

1. A discussion of the guidance, precedent, and major themes relied on to develop this template
2. A list of the elements states should address in order to claim emissions reduction credit for building energy codes
3. Specific recommendations on how to address these elements
4. A case study of a state that seeks to include adoption of a building energy code in its compliance plan[2]

[1] Range of greenhouse gas reductions possible from covered generation sources nationally between a low and high energy savings scenario, as modeled by ACEEE (Hayes, Ungar, and Herndon 2015).

[2] This work product is not intended to provide an exhaustive representation of what EPA or EPA regional offices will require for the inclusion of building energy codes in a Clean Power Plan Compliance Plan. Rather, it offers a conceptual framework on which to build. In drafting this document, we have relied on the provisions in the proposed rule as well as on guidance on and past precedent for the treatment of energy efficiency under other provisions of the Clean Air Act. The final rule could change and EPA could opt to develop different processes for the treatment of energy efficiency.

Guidance and Precedent Relied on to Develop this Document

At the time this document was developed, the Clean Power Plan was still a proposed rule offering limited guidance on what a state's compliance plan would need to include. In section VIII Part C of the Clean Power Plan (79 FR 34909), EPA outlines four general criteria it will use to evaluate state plans and emissions reduction measures:

1. The measures contained in the plan are enforceable.
2. The plan as a whole is projected to achieve the emissions standard.
3. The emissions reductions from measures are quantifiable and verifiable.
4. Each measure has a clear process of reporting on implementation.

Although these four criteria are similar to the elements required in state implementation plans (SIPs) for National Ambient Air Quality Standards (NAAQS), "approvability criteria for [Clean Air Act] section 111(d) plans need not be identical to approvability criteria for SIPs" (79 FR 34909). Nevertheless, the historical precedent of EPA's treatment of energy efficiency in SIPs may still be informative. EPA has issued specific guidance on how to ensure that end-use energy efficiency is enforceable, quantifiable, and verifiable, as well as on how to project the emissions impacts of an efficiency policy and report on the implementation of that policy in the context of a SIP submission.[3] Several approved SIPs have been reviewed to understand how states have successfully documented and obtained emissions credit for energy efficiency policies. Relying on the guidance in the proposed rule, existing EPA guidance on documenting and crediting energy efficiency in SIPs, and approved state plans, we have developed a recommended approach that states can use to include the adoption of building energy codes in their Clean Power Plan compliance plans.

The Clean Power Plan provides states with a great deal of flexibility, and the method outlined in this document is not the only one a state may use. We have followed EPA precedent to develop a conservative approach that may be more rigorous and complex than what is ultimately required for compliance. States may use much simpler options, and EPA will likely provide additional guidance on options for them to consider.[4]

In the remainder of this section, we apply the established approaches and existing guidance to the four criteria above. This high-level discussion touches on several of the major themes that contribute to the recommended elements (Section 2), specific recommendations (Section 3), and example language (Section 4).

[3] The previous guidance referred to here is for the incorporation of energy efficiency measures into SIPs for NAAQS found in the 2012 *Roadmap* (EPA 2012). EPA has suggested there may be some overlap between this guidance and what is applicable under the Clean Power Plan, and has requested comment on this issue.

[4] See discussions of simpler approaches in recent publications from the Regulatory Assistance Project: http://www.raponline.org/document/download/id/7501 and http://www.raponline.org/document/download/id/7491.

Enforceability

The exact meaning of "enforceability" in the context of the Clean Power Plan is still uncertain.[5] In spite of this uncertainty, some general lessons are likely applicable. If a measure is ineffective and fails to achieve the emissions reductions it is supposed to, methods to establish that a measure is "enforceable" to EPA's satisfaction (79 FR 34909) might include authority to levy penalties or force corrective action, or obligating the state to make up any shortfall. Therefore, if a measure is to be federally enforceable, a state would likely need to commit to evaluating its effectiveness. Establishing enforceability has historically involved demonstrating that the measure is mandatory and that legal authority has been granted by legislation and/or regulations to the relevant governing body (EPA 2012).

In the case of building energy codes, states may adopt model codes through legislation or regulation. In some cases local governing bodies have jurisdiction over the adoption of building energy codes. A key to enforceability is having a responsible party that will face penalties or find additional emissions reductions to compensate for a shortfall. A measure may be federally enforceable when the state or affected power plants are directly obligated by law to implement it. However, it is possible that measures could be enforceable against other third parties, such as local governments or builders responsible for implementation of building energy codes. States may consider where they want this obligation to fall and should consult the final rule for additional guidance. One option we recommend is for states to shield builders and local governments from federal enforceability by agreeing to meet any shortfall in anticipated emissions reductions through other energy efficiency policies or measures as part of a larger portfolio.

Projected Achievement of Emissions Standard

State compliance plans must show that included measures will reduce the emissions rates of regulated power plants to the required standard of performance within the designated timeframe. One way to ensure this is to adopt measures that will have lasting effects on emissions. Building energy codes affect electricity consumption and the greenhouse-gas emissions associated with it. Benefits can last for the lifetime of a building, and emissions reductions could typically be credited for upwards of 20 years, well within the Clean Power Plan's timeframe (PNNL 2014). Additionally, in order to garner further energy savings for years to come, many states mandate that building energy codes be reviewed and updated periodically as new technologies become available and cost effective.

Because compliance plans are forward looking, each state will need to develop a reasonable estimate of the energy savings it expects to achieve by adopting new building energy codes (including any updates that would be required by law). These projections will vary by climate zone and rate of new construction. They are made available on a state-by-state basis by the U.S. Department of Energy (DOE) (DOE 2012). States may wish to adjust these estimates to allow for noncompliance of an assumed amount (based on past experience, a recent compliance study, or a conservative estimate). Later in this document, we provide a sample calculation for states'

[5] EPA sought comment on this issue in the Clean Power Plan (79 FR 34909).

consideration. These estimates would later be trued up with actual savings using a compliance verification study or other tools.[6]

The state is also required to ensure that the measure's forecasted emissions reductions actually occur. This means that the state should take action to ensure that no backsliding or reduction in code stringency or enforcement occurs over the compliance timeframe. One way to do this is by securing extended funding for code implementation and enforcement in order to ensure consistent compliance and effective implementation. Binding legislation or regulations can also ensure that the code stays in place and carries the force of law.

Quantifiable and Verifiable Emissions Reductions

State plans must detail how emissions reductions will be quantified and verified. According to SIP guidance, in order for a measure to be considered "quantifiable," it must have a measureable, replicable effect on emissions (EPA 2012). The Clean Power Plan contemplates methods for quantifying the impact of an efficiency policy by measuring energy savings and converting those savings into an emissions impact. In the case of building energy codes, we recommend that a state identify a protocol for quantifying the electricity savings and associated emissions reduction from the adoption of new codes that is best suited to the resources the state has available. An effective protocol for electricity savings quantification might engage stakeholders who already are involved in code enforcement and implementation at all levels, such as builders, local and municipal code officials, and state development boards.

States should use software capable of developing sophisticated estimates to model the effects of building energy codes on electricity consumption. Achievable savings can be determined using a representative group of the most common building types by assessing their energy consumption under the previous code, comparing that amount to the estimated consumption under the new building code, and then weighting the savings from each building type by the number of homes (for the residential sector) or square feet (for the commercial sector) of each building type built in a state each year. These steps are included in utility savings estimators created by the Pacific Northwest National Laboratory (PNNL) for DOE. Specific analyses are also available for many states from PNNL, although states should review their assumptions (DOE 2014).[7]

A variety of important variables need to be considered when devising methods for modeling emissions reductions from codes. Climate zone considerations will play a major role, and the rate of new construction and project square footage are also important factors in accurately calculating energy usage and the savings from codes.

[6] See a variety of resources to assist states here: https://www.energycodes.gov/compliance.

[7] A wealth of protocols is already in place in states where utilities are involved in code compliance improvement and development. For more information on quantifying the effects of building energy codes, see http://www.energycodes.gov/development/commercial/methodology and http://www.energycodes.gov/development/residential/methodology.

Process for Reporting On Plan Progress and Corrective Actions

For a measure to be deemed acceptable for inclusion in a state compliance plan, it must include a process for reporting its performance and implementation to EPA. One option is to set up a hierarchy of oversight under which building energy code enforcement and implementation practices are monitored at the local level and then reported to the state agency responsible for ensuring that the code is effectively implemented. To track emissions reductions attributable to codes, the state may want to set milestones specifying levels of savings to be achieved in particular years. States should monitor progress with compliance studies and report the results to EPA biennially (79 FR 34837).

Building Energy Code Elements to Include in State Plans

Here are the template elements that a state should consider addressing when incorporating building energy codes in a Clean Power Plan compliance plan. Although various levels of rigor may be required depending on the compliance plan approach adopted, ACEEE recommends that these elements be included to ensure the plan has the best chance of being accepted by EPA. In the following sections we provide (1) guidance on filling in the template elements, and (2) model language based on a hypothetical compliance plan scenario.

Brief Overview of Building Energy Code

- Description of new building energy code adoption process, including the roles of state agencies
- Timeline for code adoption, effective date, and obligated sectors (commercial, residential, public)
- The energy code's role in the state's overall plan approach

Discussion of Measure Technology

- History of building energy codes in the state
- Manner in which codes will yield emissions reductions at affected electric generating units (EGUs)
- Common assumptions surrounding new code adoption and compliance

Quantification of Emissions Benefits Potential

- Methodology for calculating the electricity savings attributable to new code adoption
- General equation for calculating electricity savings
- Description of data assumptions and sources
- Potential effects on emissions of new code adoption

Implementation

- Current status of code implementation in the state
- Existing structures of code implementation
- Entities involved in implementation

Monitoring and Reporting

- Process by which code implementation will be monitored and evaluated
- Entities responsible for monitoring code implementation progress (state/federal/local government, utilities, and so on)
- Sources of relevant data collected from monitoring (square footage, energy consumption, and so on)
- Process for overseeing and reporting on code implementation progress

Enforcement

- Entities legally culpable in the case of noncompliance, failure to implement, or emissions reduction shortfall
- Entities with the jurisdiction to enforce the building energy code
- Process for enforcing the building energy code
- Corrective actions available in case of emissions reduction shortfall, and shortfall remedies

Verification and Quantification

- Verification process for electricity savings attributable to new code adoption
- Entities responsible for verifying code has been complied with and electricity savings have occurred
- Process for reporting verified electricity savings
- Process to be used in quantifying energy savings and emissions reductions

Guidance, Recommendations, and Items to Consider When Compiling Building Energy Code Elements

This section contains detailed instructions and specific questions we recommend that states consider addressing in their compliance plans. Following this is a hypothetical where we provide example responses to these descriptions and questions for the state of Virginia.

Brief Overview of the Building Energy Code

Description of new building energy code adoption process, including the roles of state agencies. Briefly describe the building code being adopted, the process that led to the code taking effect, the entities involved in reviewing and updating codes, and how this process may have been amended in the present context.

The timeline for code adoption, effective date, and the obligated sectors (commercial, residential, public). Give the schedule for reviewing and regularly updating codes, if any. Discuss when the code will go into effect and electricity savings will begin to be counted. Include the building types the specific energy code applies to.

The energy code's role in the state's overall plan approach. Briefly describe the status of the measure in the overall plan. Include how the measure will be enforced relative to other measures, and the role the measure will have in achieving the overall required emissions reductions.

Questions to consider for this section:

- What is the current status of the state's building codes?
- What commitments have state or local governments made under the policy/program?
- How might code enforcement and administration need to change to ensure that the energy savings claimed are being achieved?[8]

Discussion of Measure Technology

The state's history on building energy codes. Include some description of the history of building energy codes in the state, such as energy codes or standards previously adopted and the existence of any prior studies detailing historic electricity savings or emissions reductions attributable to building energy codes.

The manner in which codes will yield emissions reductions at affected EGUs. Explain the measure and how emissions reductions are expected to occur. Discuss how building energy codes reduce electricity consumption and therefore emissions from electricity generation at affected EGUs.

The common assumptions surrounding the new code's adoption. Discuss the common assumptions the state may depend on for quantification purposes. These may include the measure life typically associated with building energy codes, as well as documentation of the typical energy savings seen with the adoption of new codes.

[8] Many of these questions are addressed above, but we list them here as well for purposes of completeness.

Questions to consider for this section:

- What sectors/buildings does this new code apply to?
- What, if any, code is being replaced?
- How will the newly adopted code reduce EGU emissions?
- Are there any reports or studies describing how building energy codes impact emissions in the state?

Quantification of Emissions Benefits Potential

The methodology used in calculating the electricity savings attributable to the new code's adoption. Describe any emissions benefits anticipated from the new code's implementation and the high-level methodology used to arrive at them.

The general equation used in calculating electricity savings. You may base the emissions benefits potential of building energy codes on an equation that takes into account forecasts of new construction, renovations, and additions, as well as a baseline of what electricity consumption would have been under previous code editions. A simple approach might be to rely on utility energy savings estimators or even on already published analysis results such as those created by PNNL for DOE (DOE 2014). If a state wishes to conduct its own calculation, we suggest the following equation as a potential basis for a codes quantification methodology:

> Incremental annual electricity savings by building type = (a)(b)(c)(d) + (a)(b)(c)(e)(f)
>
> Where
> a = Estimated square footage of new construction affected by code
> b = Average electric intensity at 2009 IECC/ASHRAE 90.1-2007 for climate zone
> c = Percent electricity savings from new code over 2009 IECC/ASHRAE 90.1-2007
> d = Percentage of new construction assumed to be fully compliant
> e = Percentage of new construction assumed to be noncompliant
> f = Percentage of electricity savings realized in noncompliant buildings[9]

This is just an example, and other equations are also possible. For example, another equation might be (a)(b)(c)(g) where g = the average percentage of electricity savings realized in all buildings.

Description of assumptions and sources. Include detailed assumptions, as well as any supporting documentation. Assumptions should address variables such as compliance rates, lost energy savings from noncompliance, and the effect of interstate electricity flows on the reduction of electricity generation from affected EGUs.[10]

[9] In this sample quantification approach, we use 2009 IECC/ASHRAE 90.1-2007 as the starting place or baseline against which savings from new codes are measured. EPA has not specified a single baseline that states should use. We believe our approach is a conservative one. Future EPA guidance may provide additional detail on the possibility of states' using a different baseline or earlier code as a starting place.

[10] We discuss this last issue later in this document.

The potential effects of the new code on emissions. Your calculations should result in an estimate of the impact of new building energy codes on electricity consumption and the associated EGU emissions. Document the level of reduced emissions expected from the measure.

Questions to consider for this section:

- How will the state treat lapses in code compliance?
- What baseline should be used to calculate electricity savings from the new code?
- What assumptions should be used concerning code compliance, rate of new construction, and percentage electricity savings?
- How will the effect of interstate electricity flows be compensated for?
- Where are data available to prepare an estimate?

Implementation

The current status of code implementation in the state. Explain the current processes used in code implementation in the state, as well as what is necessary for proper program administration.

The existing structures for code implementation. Describe the existing structures for code implementation, including who has authority over whom. Note whether it will be necessary to alter these structures in order to include the measure in the compliance plan submission.

The entities involved in implementation. List any federal, state, and local government agencies and private stakeholders involved in building code enforcement and compliance. Describe the level of responsibility that is assigned to each group.

Questions to consider for this section:

- What are the responsibilities of the parties involved?
- What structures for code implementation already exist?
- Will resources need to be allocated to improve code compliance and enforcement?

Monitoring and Reporting

The process by which code implementation will be monitored and evaluated. Provide specifics on the process the state will use to monitor whether electricity savings and emissions reductions are occurring. Include the means of code inspection and permitting. Set explicit deadlines and timeframes for reporting on code implementation.

The entities responsible for monitoring code implementation progress (state/federal/local government, utilities, and so on). Identify the parties responsible for code inspection and compiling relevant data on code implementation. Include the parties with the legal authority to administer the code.

Sources of data from monitoring (e.g., square footage, energy consumption). Identify where data necessary for quantifying energy code effects on greenhouse-gas emissions will come from. Identify the parties who currently have access to the necessary data, and describe how the state will access and compile these data.

Process for overseeing and reporting on code implementation progress. Identify process to ensure that code inspection is faithfully monitored. Include measures to ensure that affected EGUs regularly collect and report relevant data, and structures for regular reporting from local to state to federal entities.

Questions to consider for this section:

- What agencies will be charged with the task of monitoring energy code implementation and progress?
- Through what channels will reporting on implementation and enforcement take place?
- What agency relationships are necessary to ensure accurate and efficient monitoring and enforcement?

Enforcement

The entities against which the compliance plan will be federally enforceable in the case of noncompliance, failure to implement, or an emissions reduction shortfall. Identify who is responsible for any shortfall in actual versus anticipated emissions reductions. The entities responsible for implementing the code need not be the same as those responsible to EPA in the case of an emissions reduction shortfall. In order to shield third parties (e.g., builders) from federal enforceability, states may opt to take on the responsibility for assuring the federal government that the emissions reductions claimed from the enactment of the code have actually occurred.

The entities with the authority to enforce the building energy code. Identify the entities charged with code inspection and having the authority to issue building permits. Identify the regulations or legislation empowering code officials.

The process to be used in enforcing the building energy code. Identify the structures and processes set in place to ensure that the measure is implemented.

The corrective actions available in case of an emissions reduction shortfall, and shortfall remedies. Identify the measure that will be taken if the building energy code does not achieve the necessary emissions reduction. Explain how the overall plan will be reviewed and adjusted to correct the shortfall. Penalties for failure to correctly implement the code may include denial of permits, prohibition of occupancy, or alteration of the structure to meet the code.

Questions to consider for this section:

- Who has the jurisdiction to enforce the code?
- In states where local jurisdictions have enforcement authority, can a state agency be given an enforcement role?
- What will the process of code inspection and enforcement be?
- What corrective actions may be necessary in order to remedy any shortfall?

Verification and Quantification

The verification process for electricity savings attributable to new code adoption. Outline the process for verifying that the energy savings and emissions reductions potential previously quantified

actually occur. You should monitor new construction and may need to take samples of compliance in order to ensure that energy savings are occurring at the scale estimated through modeling. We recommend two options for incorporating the impact of code compliance into quantification of the energy savings from new codes. States could conduct a code compliance study of a sample of new construction to extrapolate the statewide compliance rate. Alternatively, a state may assume some reasonably conservative level of compliance and discount its credited energy savings appropriately. For more information on either of these approaches see Appendix B of *Comments of the American Council for an Energy-Efficient Economy (ACEEE) on the Environmental Protection Agency's Proposed Clean Power Plan* (ACEEE 2014).

The entities responsible for verifying that the code has been complied with and that the stated electricity savings have occurred. Identify which entities (either state agencies, EGUs, utilities, or third parties) have access to building energy code data and who will be responsible for measuring energy savings.

The process for reporting verified electricity savings. Describe the process to be used in reporting verified emissions reductions to both the state and EPA.

The process to be used in quantifying energy savings and emissions reductions. Describe the process for calculating the 2030 emissions reduction attributable to the adoption of building energy codes. Identify how electricity consumption reductions will be translated into emissions reductions.[11]

Questions to consider for this section:

- Who will be responsible for verifying code compliance and implementation?
- How often will emissions reductions be calculated?
- How often will emissions reductions and energy savings be reported?
- How will emissions reductions be quantified?

A Note on Compliance Improvement Activities

Although the potential for energy savings and emissions reductions from improved code compliance may be less than the potential savings from the adoption of new, more stringent building energy codes, compliance improvement may still play a large role in reducing emissions. A 2013 analysis completed by the Institute for Market Transformation (IMT) estimates that improved code compliance alone could account for 2.8–8.5 trillion Btus of energy savings in 2030 (Stellberg 2013).

States may be able to claim credit in their Clean Power Plan compliance plan submissions for emissions reductions attributable to the adoption of new codes, improvement of compliance rates with existing codes, or a mixture of new code adoption and improved compliance. In order to claim emissions reductions from improved code compliance rates, states may need to

[11] This latter question could be the subject of an entire paper. Many approaches are possible, ranging from dispatch modeling at the most complex to a simple rate-based approach provided in the draft Clean Power Plan. In this approach only kWh savings need be calculated, and these savings are factored into an emissions rate with no further emissions calculations needed.

present documentation to EPA that shows verifiable increases, over time, in the rate of code compliance, as well as calculations supporting the effect of increased compliance on the overall energy savings from codes. These increases in code compliance may be attributable to policies or programs instituted by the state, utilities, or other third parties. Many states have already engaged their utilities in code compliance improvement activities. Several states allow utilities to claim energy savings credit under statewide energy savings goals for such activities.[12]

[12] Arizona, California, Massachusetts, Minnesota, and Rhode Island. See Misuriello et al. 2012.

Sample Building Energy Code Submission

For the purpose of demonstration, we have developed the following hypothetical scenario, based in the real code processes and institutions of the Commonwealth of Virginia. In this scenario, Virginia has just recently adopted the latest versions of building energy codes for both its residential and commercial sectors and is seeking credit for the adoption and implementation of these new codes in its Clean Power Plan compliance plan submission.

Adoption and Implementation of the 2015 International Energy Conservation Code for Residential and Commercial New Construction, Renovations, and Additions

The following represents a hypothetical submission by the Virginia Department of Environmental Quality to the United States Environmental Protection Agency (EPA) Region 3 for the crediting of newly adopted building energy codes in reducing greenhouse-gas emissions from electric generating units (EGUs) commensurate with the provisions enumerated in the Clean Power Plan.[13]

Brief Overview of Building Energy Code

Building energy codes reduce the electricity consumption of both residential and commercial buildings through the imposition of efficiency standards on various building components, such as insulation, water heating, lighting, and air conditioning. The Commonwealth of Virginia requires all new construction, as well as major renovations and additions, to comply with Virginia's Uniform Statewide Building Code (USBC) as adopted by the Virginia Board of Housing and Community Development ("the Board"). The USBC is reviewed and updated every three years, with the next scheduled update set for 2017. However, in recognition of the potential for building energy codes to be included in Virginia's Clean Power Plan compliance plan submission, due June 2016, the Board has deemed it prudent to expedite the code update process. Working in conjunction with the Virginia Department of Mines, Minerals, and Energy, the Virginia State Corporation Commissions, and the Virginia Department of Environmental Quality, the Board has reviewed and adopted the 2015 International Energy Conservation Code (IECC), with amendments, as the new mandatory, statewide building energy code for both residential and commercial buildings, as of June 1, 2016, effective July 15, 2016.

The statewide implementation of the 2015 IECC, with amendments, has been included by the Commonwealth of Virginia in its Clean Power Plan compliance plan submission as a state commitment. The enforcement of the 2015 IECC, as well as all other provisions of the USBS, will remain the sole authority of the Commonwealth. Any shortfalls in forecasted emissions reductions shall be enforced against the Commonwealth, should EPA see fit to do so. If necessary, the Commonwealth will enact other measures as appropriate to rectify any lapse in emissions reductions herein attributed to the statewide adoption and implementation of the 2015 IECC. The localities in the Commonwealth shall retain the authority and autonomy to issue building permits, inspect new construction and renovations for code compliance, and perform all tasks otherwise associated with the administration of the USBC.

[13] To condense this demonstration, we have omitted certain elements that may be required. Specifically, we have not included the calculations, modeling, technical support documents, and other supporting materials that may accompany a formal compliance plan submission.

Discussion of Measure Technology

In 1973 Virginia adopted the first version of the USBC. Prior to the adoption of this mandatory statewide code, local jurisdictions adopted their own codes. Previous editions of the USBC have included reference to the 2000 IECC, ASHRAE Standard 90.1–2004, 2006 IECC, and 2009 IECC. The most recent USBC in effect prior to the adoption of the 2015 IECC was adopted in June of 2014 and referenced the 2012 IECC, with amendments, as the statewide mandatory energy code.

Nationally, building energy code adoption and implementation has provided cost-effective energy savings for decades. Through the reduction of electricity consumption in both residential and commercial buildings, a corresponding amount of electricity generation is avoided from fossil-fuel-fired EGUs. A 2013 assessment of the DOE Building Energy Code Program (BECP) found program activities to have contributed to 2 quads of cumulative energy savings over the 1992–2012 time period. These energy savings were calculated to have resulted in 344 trillion tons of avoided CO_2 emissions from the electric power sector over that same time period (PNNL 2014). Specific to Virginia, a 2012 DOE analysis estimated energy cost savings of 27% when moving from the 2009 IECC to the 2012 IECC.[14] These code improvements maintain an average simple payback of 5.2 years. A final determination on the 2015 IECC, completed by DOE, found on average a 5% reduction in electricity consumption in climate zone 4 with the adoption of the 2015 IECC over the 2012 IECC for both residential and commercial buildings.[15] It is assumed that these electricity savings will accrue over the lifetime of a building, typically 30 years.

Quantification of Emissions Benefits Potential

In order to develop a preliminary estimate of the potential emissions benefits attributable to the adoption of the 2015 IECC, the Commonwealth of Virginia has elected to use the following base equation:

Incremental annual electricity savings by building type = (a)(b)(c)(d) + (a)(b)(c)(e)(f)

Where
a = Estimated square footage of new construction[16]
b = Average electric intensity at 2009 IECC[17]
c = Percent electricity savings from 2015 IECC over 2009 IECC[18]
d = Percentage of new construction assumed to be fully compliant
e = Percentage of new construction assumed to be noncompliant
f = Percentage of electricity savings realized in noncompliant buildings

[14] http://www.energycodes.gov/sites/default/files/documents/VirginiaResidentialCostEffectiveness.pdf

[15] Hypothetical number as example of type of backing analysis states should mention

[16] Including major renovations and additions

[17] As estimated by DOE in the relevant Final Determination for Climate Zone 4

[18] As estimated by DOE in the relevant Final Determination for Climate Zone 4

A 2015 study completed by the Virginia State Corporation Commission found compliance with the 2012 IECC (pass/fail) to be 42–80% for new residential construction and 30–66% for new commercial and large multifamily buildings, depending on jurisdiction. The report found averages of 62% and 44% compliance (pass/fail) for the residential and commercial sectors, respectively. Noncompliant residential structures experienced on average a 15% loss in potential energy savings. Noncompliant commercial structures experienced on average a 22% loss in potential energy savings.[19] For the purposes of this preliminary calculation it has been assumed that compliance will remain at the levels specified in this study for the duration of the projected period. Thus, (d) in the above equation has been assumed to equal 62% for the residential sector and 44% for the commercial sector; (e) is assumed to equal 38% for the residential sector and 56% for the commercial sector; (f) is assumed to be 85% for the residential sector and 78% for the commercial sector. The Commonwealth relies on common practice, citing multiple DOE studies, and assumes that savings persist for 30 years. Additionally, the Commonwealth has assumed that 50% of the electricity savings attributable to the implementation of the 2015 IECC will occur at EGUs out of state. Therefore, the Commonwealth will only be taking credit for half of the potential emissions reductions. Detailed assumptions, as well as modeling spreadsheets, can be found in Appendix A of this submission.

Using the above quantification methodology, the Commonwealth of Virginia estimates the potential total annual electricity savings attributable to the adoption and implementation of the 2015 IECC to be 3,100 gigawatt-hours in 2030. These energy savings were added to the denominator of the Commonwealth's current emissions rate for affected EGUs (1,438 lbs/MWh) as zero-emissions generation (0 lbs/MWh) in order to estimate the potential effect on the attainment of the state's 2030 standard of performance target. This calculation found a potential 108 lbs/MWh reduction in emissions rate attributable to the adoption and implementation of the 2015 IECC.

Implementation

As is typical of building codes in general, measure implementation will be the responsibility of builders, developers, homeowners, and any other groups or entities involved in either commercial or residential construction or renovation. To ensure that those charged with implementation of the 2015 IECC do so at a level that adequately satisfies all provisions of the code, the Virginia Board of Housing and Development has determined it prudent to allocate $200,000 of its annual budget to builder/developer education and building energy code advancement for FY 2017. The Board commits to continuing this allocation for the foreseeable future.[20]

Monitoring and Reporting

The implementation of the 2015 IECC will be monitored by local code officials, as well as local building offices. The number of building permits issued, square footage, and compliance rates,

[19] This is based on a hypothetical study illustrating the type of data that may be necessary to calculate the potential energy savings and emissions reductions attributable to new building energy code adoption.

[20] This is a hypothetical allocation. In order to assure the effective implementation of the building energy code, states may wish to empower builders and developers through education and training.

as well as energy consumption, will be tracked and monitored by each jurisdiction, with oversight by the Virginia Board of Housing and Development on monitoring and reporting practices. Plan review and onsite inspection will be performed for each building. Localities will report these data annually to the Board no later than February 15 of each year. The Board will then compile and report the annual totals to the Virginia Department of Environmental Quality no later than March 15. The Virginia Department of Environmental Quality will track the progress of all measures contained in this plan submission, as well as the emissions rates of all affected EGUs, and compile and submit a report on the previous year's progress to the General Assembly, the Governor's Office, and EPA Region 3 headquarters no later than July 1 of each calendar year.[21]

Enforcement

Local and municipal code officials and building offices will maintain the authority to enforce the 2015 IECC, as well as all provisions of the USBC. Building plans will be scrutinized to ensure all provisions of the code are addressed. Should a building fail to meet the 2015 IECC upon final inspection by a state-certified code official, 90 days will be given to bring the structure into compliance. Should the structure fail to reach compliance after 90 days, occupancy of the structure will be prohibited until that time that the builder can show that the structure meets all provisions contained in the USBS. The Virginia Board of Housing and Community Development will maintain oversight over code enforcement, issuing a biennial report on the status of code enforcement at the local level beginning in 2017.

Should the pace of new construction fail to meet that which was assumed in the calculation of potential emissions benefits contained herein, or any other lapses in implementation occur that cause the electricity savings and emissions reductions attributable to the 2015 IECC to fall short of those claimed in this compliance plan, the Virginia Department of Environment, working with the Board of Housing and Community Development, as well as the State Corporation Commissions, will reevaluate the provisions contained in this submission and enact the necessary measures to make up the shortfall.

Verification and Quantification

In order to verify that the electricity savings estimated from the adoption of the 2015 IECC occur, local building offices will perform site visits upon completion of construction to ensure that the structure is in compliance. A sample of newly constructed buildings will be monitored each year for site electricity consumption, which will then be compared to that of a similarly constructed building at the 2009 IECC. The results of complex modeling, based on actual new construction rates across the Commonwealth, will be used to extrapolate based upon the results of the monitored sample. All electricity savings found using these methods will be discounted by 50% in order to account for the effects of interstate electricity flows.[22] The Board of Housing

[21] This process does not reflect current practices. It is a suggestion of what EPA may require to show that a state is faithfully executing plan progress monitoring.

[22] The 50% is an illustrative number and is not based on actual data for Virginia. In the draft Clean Power Plan, energy efficiency savings are discounted by a factor to account for electricity imports from out of state. ACEEE commented to EPA that such a discount should not be applied, but we do not yet know if the agency will agree with our argument.

and Community Development will be responsible for conducting regular oversight of local verification practices.

Working with the Board, the Virginia Department of Environmental Quality will report to the Virginia General Assembly, the Governor's Office, and EPA Region 3 headquarters on the level of verified electricity savings biennially, no later than July 1 of the calendar year, beginning in 2017.

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