ENERGY EFFICIENCY PATHWAY TEMPLATE:

Illinois Building Energy Codes

Abstract

Energy efficiency (EE) programs can deliver air pollutant emission avoidance and reduction. Energy Efficiency Pathway Templates provide a format for summarizing EE program features and opportunities that can be shared with state environmental regulators for consideration in air quality planning. These templates can promote dialogue among State Energy Offices, environmental agencies and other pertinent bodies on potential roles for EE as air pollution management approaches. This template describes the Illinois Building Energy Codes pathway.

National Association of State Energy Officials

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Disclaimer

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Introduction

Energy Efficiency Benefits

Energy efficiency policies and programs are delivering growing benefits that save consumers money. They reduce or defer needs for costly electricity generation, transmission, and distribution investments, and can support energy security and reliability through reduced stresses to energy supply infrastructure. Further, by reducing the need for electricity generation and onsite fuel consumption, energy efficiency mitigates adverse environmental impacts, including emissions of air pollutants and their health effects.

For example, in 2014 U.S. electric utility energy efficiency programs reported saving about 26,000 gigawatt-hours (GWh) of electricity, equivalent to nearly 20 million tons of carbon dioxide (CO_2) emissions.[1] Such utility programs cost an average of 4.6¢ per kilowatt-hour (kWh), significantly less than average retail electricity price of 10.44¢ per kWh.[2, 3] As another example, the U.S. Department of Energy (DOE) estimated that in 2012 building energy codes saved American consumers $5 billion and 40,000 GWh of electricity, while avoiding nearly 40 million short tons of CO_2.[4] Lawrence Berkeley National Laboratory (LBNL) estimated that energy savings performance contract (ESPC) projects delivered by the energy service company (ESCO) industry delivered about 34,000 GWh of electricity savings and about 224 trillion British thermal units (Btu) of total energy savings (about 1% of total commercial building consumption) in 2012.[5] Other efforts, such as low-income weatherization, state "lead-by-example" policies, local-led building efficiency programs, industrial energy efficiency, and combined heat and power (CHP) programs also contribute to energy efficiency at various scales.

At an individual state level, Xcel Energy's efficiency programs in Minnesota avoided the need for 2,500 MW of new power plants since 1992 while preventing over 11,000 tons of nitrogen oxides (NOx).[6] Maryland's energy efficiency and renewable energy programs provide about 0.60 parts per billion reduction in ambient ozone levels.[7] Texas has included building energy codes, local government measures, and utility energy efficiency programs in its National Ambient Air Quality Standards (NAAQS)

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[1] Consortium for Energy Efficiency, 2016, "2015 State of the Efficiency Program Industry: Budgets, Expenditures, and Impacts." Savings are gross incremental savings; emissions avoided based on EPA eGRID.

[2] Hoffman, Ian M., Gregory Rybka, Greg Leventis, Charles A. Goldman. Lisa Schwatrz, Megan Billingsley, and Steven Schiller, 2015, "The Total Cost of Saving Electricity through Utility Customer-Funded Energy Efficiency Programs: Estimates at the National, Sector and Program Level," Lawrence Berkeley National Laboratory, http://emp.lbl.gov/sites/all/files/total-cost-of-saved-energy.pdf.

[3] U.S. EIA, State Electricity Profiles, United States Electricity Profile 2014, Table 1. 2014 Summary statistics (United States), http://www.eia.gov/electricity/state/unitedstates/.

[4] U.S. Department of Energy, 2014, "Building Energy Codes Program: National Benefits Assessment, 1992-2040," http://www.energycodes.gov/building-energy-codes-program-national-benefits-assessment-1992-2040-0 . Monetary savings are net present value and emissions avoided includes both electricity and non-electricity savings.

[5] Carvallo, Juan Pablo, Peter H. Larsen, and Charles A. Goldman, 2015, "Estimating Customer Electricity and Fuel Savings from projects installed by the U.S. ESCO Industry," Energy Efficiency, vol. 8, pp. 1251-1261. Information from abstract at https://emp.lbl.gov/publications/estimating-customer-electricity-and

[6] Xcel Energy, 2013, "Partnering for a Better Future," cited in State and Local Energy Efficiency (SEE) Action Network, "Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution, and Meet Energy Needs in the Power Sector," p. 12. https://www4.eere.energy.gov/seeaction/eepathways

[7] Aburn, T., 2013, "Building Energy Efficiency and Renewable Energy into the Clean Air Act Planning Process." Presentation at the ACEEE Market Transformation Conference, Washington, D.C., March 24-26, 2013.

State Implementation Plans (SIPs) for ozone.[8, 9] Furthermore, DOE projects that adoption and compliance with the latest model building energy codes (2015 International Energy Conservation Code (IECC) and ASHRAE Standard 90.1-2013) by 2017 would save Florida almost 5 million MWh of electricity and 20 trillion Btu total energy in 2030 along with concomitant avoided emissions.[10]

Status of Energy Efficiency for Air Quality Compliance

While air emission benefits of energy efficiency have been recognized for years, they have been included explicitly in state air quality management plans and strategies only infrequently. This is because air quality regulators are often unfamiliar with energy efficiency programs and their ability to achieve savings that translate into avoided emissions.[11] Air quality regulators may be unversed in methods used to reliably project and measure energy savings and their emissions impacts. And there can be concerns about the costs and complexity of rigorous evaluation, measurement, and verification (EM&V) when formal regulatory credit is sought under certain Clean Air Act programs. Perhaps because of these reasons, thus far only a few state air regulatory agencies have taken advantage of the guidance and tools that the Environmental Protection Agency (EPA) provides to help states to include savings from energy efficiency in air quality planning.

EPA has signaled support for states to include energy efficiency as an air quality management strategy for NAAQS and other purposes. It has offered "*… to help[] state air quality planners calculate the emissions benefits of EE/RE [energy efficiency/renewable energy] policies and programs so that these emission reductions can be incorporated in Clean Air Act plans….*"[12] As noted previously, there is precedent for recognizing and crediting NOx reductions from energy efficiency in NAAQS SIPs. Also, a few states have "set aside" modest numbers of NOx allowances for allocation to EE/RE projects under certain Clean Air Act programs.[13] EPA provides a roadmap for incorporating EE/RE into NAAQS SIPs.[14] The agency also pointed to energy efficiency as a key means to address CO_2 and greenhouse gas

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[8] The Texas Commission on Environmental Quality included NOx reductions from building codes as well as local government and utility energy efficiency programs in a 2005 Dallas-Ft. Worth area SIP revision. See https://www.tceq.texas.gov/airquality/stationary-rules/nox/eere.html

[9] The Texas A&M University Energy Systems Laboratory provides analytic support to the Texas Emissions Reduction Program (TERP), including quantification of emissions reduced by energy efficiency and renewable energy programs. It can serve as an exemplar for other states. See http://esl.tamu.edu/terp/.

[10] U.S. Department of Energy, 2015, "Achieving Energy Savings and Emission Reductions from Building Energy Codes: A Primer for State Planning." https://www.energycodes.gov/sites/default/files/documents/Codes_Energy_Savings_State_Primer.pdf

[11] An exception to this is that air quality agencies are familiar with transportation control measures used to reduce emissions from cars, trucks, and other mobile sources. The EPA and state agencies employ recognized models to estimate emission impacts from transportation measures. There is a good analogy between transportation and end-use energy efficiency.

[12] https://www.epa.gov/statelocalclimate/avoided-emissions-and-generation-tool-avert.

[13] U.S. EPA, 2006, "State Clean Energy-Environment Technical Forum Roundtable on State NOx Allowance EE/RE Set-Aside Programs, June 6, 2006, Call Summary." https://www.epa.gov/sites/production/files/2016-03/documents/summary_paper_nox_allowance_6-6-2006.pdf.

[14] U.S. EPA, 2012, "Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans, https://www.epa.gov/energy-efficiency-and-renewable-energy-sips-and-tips.

concerns.[15, 16] However, federal and state air quality regulators' are often unfamiliar with energy efficiency and how it can reliably prevent and reduce emissions, and EPA guidance remains imprecise. The hope is that this energy efficiency pathway template along with other efforts will strengthen the opportunity for including energy efficiency in air quality management.

The scope of EPA rules and standards, coupled with the agency's increased recognition of energy efficiency as a clean air resource, creates an opportunity for states to tap into energy efficiency as a frequently least-cost compliance option that offers multiple co-benefits. Recent and prospective EPA actions that provide energy efficiency-related compliance opportunities include revision of various NAAQS, new criteria and hazardous air pollutant standards for power plants and other sources, and the upcoming second implementation period for the Regional Haze Rule. Concerns about CO_2 and other greenhouse gases, including state-level standards and targets, are also pertinent.[17] By reducing the amount of electricity needed to be generated as well as onsite heating fuel use, energy efficiency acts directly to avoid or reduce pollution.

Options for Quantification and Rigor

It is important to note that air quality regulators can consider energy efficiency at different levels for varied purposes under different regulatory programs. One distinction is between considering energy efficiency for broad planning and projection purposes as compared with formalized crediting of energy efficiency for enforceable regulatory purposes.

Broad quantification can be useful for air quality regulators to project likely impacts of programs to help achieve long-term emission and air quality objectives. Avoided energy use reduces emissions irrespective of whether formalized credit is given or whether savings can be ascribed to individual measures or projects. Air regulators can project the combined impacts of multiple programs and apply conservative discount factors to assure that, in aggregate, broad emissions goals can be met even if a particular program may underperform relative to its projection. Periodic program impact evaluations let energy officials and air quality regulators see if savings and emissions avoidance progress is "on track" and provide opportunities to adjust plans if warranted.

Formal regulatory crediting often requires more rigorous EM&V and can include considerations of legal enforceability—who is "on the hook" if required reductions are not achieved. As discussed below, EPA identifies several pathways for including energy efficiency in NAAQS SIPs. Formal crediting may involve attribution of energy savings and avoided emissions to individual program or project implementers for issuance of compliance instruments such as tradable NOx allowances or emissions offsets in

[15] U.S. EPA had included energy efficiency as a major option for compliance with the Clean Power Plan, a rule under a U.S. Supreme Court stay pending litigation at the time of this writing; U.S. EPA, "Fact Sheet: Energy Efficiency in the Clean Power Plan" (https://www.epa.gov/cleanpowerplan/fact-sheet-energy-efficiency-clean-power-plan) provides a summary.
[16] U.S. Environmental Protection Agency, 2016, "Draft Evaluation Measurement and Verification (EM&V) Guidance for Demand-Side Energy Efficiency" (https://blog.epa.gov/blog/wp-content/uploads/2016/12/EMV-Guidance-12192016.pdf).
[17] Some states have CO_2 and greenhouse gas goals and standards. As noted, the EPA Clean Power Plan rule is under a judicial stay pending resolution of litigation.

nonattainment areas. Formal crediting could also play a role under state, regional, or other greenhouse gas programs.

For NAAQS SIP purposes, EPA's EE/RE Roadmap Manual outlines four pathways; three of these offer EPA-recognized formal quantified crediting and the fourth ("weight-of-evidence") offers a less formal recognition of air quality benefit.[18] Figure 1 summarizes the four pathways for incorporating EE/RE for NAAQS SIP purposes outlined in its EE/RE Roadmap Manual.[19] Table 1 provides more detail about the projects, characteristics of policies, and programs suitable for each pathway.[20]

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[18] U.S. EPA, 2012, "Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans," https://www.epa.gov/energy-efficiency-and-renewable-energy-sips-and-tips

[19] Angie Shatas, 2014, "Energy Efficiency (EE) & Renewable Energy (RE) in SIPs – EPA's Roadmap and a Tour of Several States," National Air Quality Conference (February 12, 2014), slide 9. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=0ahUKEwiGrtb_urDPAhWJyT4KHbDFAnQQFggsMAM&url=https%3A%2F%2Fwww3.epa.gov%2Fairnow%2F2014conference%2FCommunications%2FWednesday%2FShatas_final.pptx&usg=AFQjCNHTlSnqs4u9aJn9-uc9pw44scLQbA&sig2=LpXOMA86FdAhIdkvzwdWIA&bvm=bv.134052249,bs.2,d.dmo

[20] U.S. EPA, 2012, "Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans," fig. 7, p. 30. https://www.epa.gov/sites/production/files/2016-05/documents/eeremanual_0.pdf

Figure 1. Pathways for Incorporating EE/RE in NAAQS SIPs

4 Pathways

	Baseline	Control Strategy	Emerging/ Voluntary Measures		Weight of Evidence
			Emerging	Voluntary	
Types of Projects	For "on the books" policies; Best on a state-wide or regional basis	For "on the way" policies	For locally-based activities; can be bundled	For locally-based activities; can be bundled	Any
SIP Credit Limit	None	None	6% of total required emission reductions (3% mobile + 6% other)	6% of total required emission reductions (3% mobile + 6% other)	No credit taken but do get emissions benefits
Enforcement	State enforceable ** but not Federally enforceable	Federally enforceable against the responsible party*	Enforceable against the source	Not enforceable against the source or implementing party	None
If SIP reductions do not materialize	Air agency required to make up for emission shortfall; CAA SIP call	Responsible party required to comply	State responsible for reductions	State responsible for reductions	SIP revision
Level of documentation	Significant analysis: show reductions in place for planning period; quantify impacts; ensure no double counting	Significant analysis: show reductions are permanent, enforceable, quantifiable, surplus	Moderate: show reductions are permanent, enforceable, quantifiable, surplus	Moderate: show reductions are permanent, enforceable, quantifiable, surplus	Range: depends on level of analysis

* May be the load serving entity required to implement EE/RE.

** If a municipality has initiated a measure, then the state may delegate responsibility to the municipality.

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Table 1. Characteristics of Policies and Programs Suitable for Each NAAQS SIP Pathway

Baseline Emission Pathway
• EE/RE policies that are "on the books," have not been accounted for elsewhere in the SIP, and are not emerging and/or voluntary programs • Can be state enforceable but is not federally enforceable • Revisions could be required through a Clean Air Act SIP call if reductions from the EE/RE policy are needed to attain the NAAQS and policy is not implemented as assumed in baseline projections • Electric generating unit (EGU) baseline projections are best done on a coordinated, regional basis • When available, agencies can utilize EPA's EGU baseline projections or develop their own projections model or approach • EGU baseline projections using energy models or similar methods reflect EGU operations as a whole system

Control Strategy Pathway
• "On the way" policies and programs that are not emerging and/or voluntary programs and that will produce emissions benefits in the planning timeframe of the SIP/TIP {Tribal Implementation Plan] • EE/RE policies and programs for which the state, tribal, or local agency wishes to seek SIP credit • Once approved into the SIP, federally enforceable (enforceable against an air pollution source or implementing party) • State, tribal, and local agencies will have emission reductions from a control strategy to help them attain the NAAQS • Documentation is needed to demonstrate that the EE/RE policy and/or program is permanent, enforceable, quantifiable, and surplus
Emerging/Voluntary Measures Pathway
• Good option for locally-based EE/RE activities • Voluntary EE/RE policies and programs that are not enforceable against an air pollution source or implementing party • Emerging EE/RE policies and programs for which it is difficult to quantify emission impacts • EE/RE policies and programs for which state, tribal, or local agency wishes to seek SIP credit • Emerging/voluntary measures can be "bundled" in a single SIP submission and considered as a whole • EPA will propose to approve through the SIP rulemaking process SIP/TOP credit up to six percent for EE/RE policies and programs, or more, if they can make a clear convincing case
Weight of Evidence Pathway
• EE/RE policies and programs for which state, tribal, or local agency does not wish to seek SIP credit and for which quantification of the air quality impacts of the emissions reduction is unavailable or infeasible • Can include unspecified emission reductions from any policy or program in weight of evidence that may impact a nonattainment area

States seeking formal crediting and inclusion of energy efficiency programs in SIPs are urged to consult closely with their EPA Regional Offices to understand detailed expectations and requirements for SIP-eligibility of programs and measures.

Tools & Resources to Assist with Quantifying Savings

Various freely available tools can be useful for developing energy and air quality savings estimates that might enable broad programmatic quantification or can lead to formal regulatory crediting for energy efficiency. Using these tools, energy savings can be projected *ex ante* or quantified *ex post*, based on broadly accepted evaluation, measurement, and verification (EM&V) protocols. Once energy savings are quantified they can be translated into avoided emissions.

The State and Local Energy Efficiency Action Network published *A Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution, and Meet Energy Needs in the Power Sector* (2016), which presents case studies of successful regional, state, and local approaches to energy efficiency with sources for more information, resources to understand the range of expected savings from energy efficiency, and common protocols for documenting savings. Appendix A in the guide provides a synopsis of energy efficiency and emission reduction planning tools for states.

Among the tools available, this template cites the ones summarized below. In addition, electric power dispatch models and other tools may also be applicable.

- **eGRID.** If electricity savings data are available, the EPA Emissions and Generation Resource Integrated Database (eGRID) provides regional average and average non-baseload emission factors for electric power-sector CO_2, NOx, sulfur dioxide (SO_2), methane, and nitrous oxide emissions.[21]
- **AVERT.** The EPA AVoided Emissions geneRation Tool (AVERT) allows for more detailed analyses of avoided emissions on a regional basis.[22] The AVERT tool allows entry of energy savings data on temporal scales from annual to hourly, which, if temporal savings data are available, can provide more precise emission impact estimates and can support air quality management focused on seasonal ozone levels.
- **ACEEE SUPR.** The State and Utility Pollution Reduction (SUPR) calculator provides a screening-level estimate of some of the costs and benefits of various policies and technologies that could help a state meet its air quality goals.[23] The tool allows the user to select up to nine energy efficiency policies. The results provide users with an idea of the magnitude of the costs and the impacts of selected options on energy use and air pollution (CO_2, NOx, and SO_2 emissions).
- The **Energy Efficient Codes Coalition Clean Power Plan Energy Code Emissions Calculator** offers conservative projections of the impact of building energy codes based on default and user-specified scenarios to provide emission avoidance projections of CO_2, NOx, and SO_2 as well as several other criteria pollutants and greenhouse gases.[24]

Energy Efficiency for Supporting Greenhouse Gas Goals

At the time of this writing, the CPP is under a stay issued by the U.S. Supreme Court, pending litigation. While disposition of the CPP is currently uncertain, this section may be useful for considering energy efficiency's potential role under state-level greenhouse gas policies and objectives as well as under local, regional, and voluntary initiatives.

Nineteen states have adopted state greenhouse gas emission targets.[25] Nine Northeastern and Mid-Atlantic state members of the Regional Greenhouse Gas Initiative (RGGI) cap power sector CO_2 emissions.[26] California is mandating greenhouse gas reductions from its power sector and other sources.[27] These and other states considering greenhouse gas standards or targets can find energy

[21] See https://www.epa.gov/energy/egrid
[22] See https://www.epa.gov/statelocalclimate/avoided-emissions-and-generation-tool-avert
[23] See http://aceee.org/research-report/e1601
[24] http://energyefficientcodes.com/energy-codes-make-sense-with-or-without-the-clean-power-plan/
[25] Center for Climate and Energy Solutions, Greenhouse Gas Emissions Targets, https://www.c2es.org/us-states-regions/policy-maps/emissions-targets
[26] Regional Greenhouse Gas Initiative https://www.rggi.org/
[27] Assembly Bill 32 Overview https://www.arb.ca.gov/cc/ab32/ab32.htm

efficiency to be a cost-effective approach for meeting greenhouse gas objectives while simultaneously delivering other economic, energy, and environmental benefits.

As with criteria air pollutants, energy efficiency programs can reduce CO_2 emissions from both electric power generation and from onsite fuel use. Both broad quantification for high level planning and more detailed quantification for formal regulatory crediting can be useful.

The EPA CPP had included options for states to follow either rate- or mass-based compliance approaches, which may be useful for state-level consideration.[28] Under the rate-based approach, a state's utility-scale electric generating units (EGUs) would on average need to meet a target emissions rate denominated in pounds of CO_2 emitted per MWh generated. The CPP would allow qualified and verified electricity savings (as well as low- and non-emitting generation) to earn emission rate credits (ERCs) that could be bought by electric generating units (EGUs) to help meet targets.

Under the mass-based approach, the state would have a total tonnage goal for its EGUs' emissions. Similar to the mechanism used by the RGGI states, EGUs would need to hold allowances (one for each ton of CO_2) to cover their emissions. Such allowances could be traded to help EGUs lower compliance costs. Under a mass-based system, energy efficiency would reduce power demand and, thus, emissions, so helping with compliance. Energy efficiency programs could be "complementary" to the emission allowance system (i.e., not directly involved in allowance issuance and trading) or a state could opt for an allowance distribution approach that further encourages cleaner power options, such as by allotting some allowances for low or non-carbon generation as well as for energy efficiency. Under this option, quantification of energy efficiency could be used as a basis for allocating allowances to energy efficiency project owners or providers.

Template Purpose and Use

The purpose of this template is to be a tool to help states recognize options and opportunities for energy efficiency programs to contribute to air quality management and compliance. It is organized around a series of questions about a specific energy efficiency pathway, which can help illuminate the potential and likelihood for particular programs and policies to help prevent air pollution.

This template is designed for State Energy Offices (SEOs), in collaboration with other relevant agencies and organizations, to fill in. They could use the completed template in discussions with their air quality agencies on opportunities for the energy efficiency pathway described in the template to be considered in air quality planning and management. Air quality regulators may have differing needs depending on a state's context, such as NAAQS attainment status, regional haze requirements, state greenhouse gas goals, and other matters. However, this template can serve as a starting point.

The template highlights specific actions a state can take to achieve, quantify, and verify savings from energy efficiency efforts, and identify gaps that may need to be filled, to give confidence to air quality

[28] U.S. EPA, Clean Power Plan for Existing Plant, https://www.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants; also see U.S. EPA, "Fact Sheet: Energy Efficiency in the Clean Power Plan" https://www.epa.gov/cleanpowerplan/fact-sheet-energy-efficiency-clean-power-plan for more on energy efficiency considerations and the State Plan Decision Tree https://www.epa.gov/sites/production/files/2015-08/documents/flow_chart_v6_aug5.pdf

regulators that a particular pathway can deliver reliable energy savings and emissions avoidance. The actions and guidelines outlined in the template can be helpful for broad projections and planning or for formal regulatory purposes. As noted previously, broadly quantified projections are useful for air quality regulators to project likely impacts of programs to help achieve long-term emission and air quality objectives while more rigorous quantification and EM&V may be needed for formal crediting in SIPs or for issuance and trading of emissions credits and allowances (e.g., NOx Trading Program).

Some gaps that impede consideration of energy efficiency programs for air quality management may be bridgeable with existing data, tools, and technical assistance resources. Other gaps may be addressed through programmatic changes, such as implementing certain EM&V and related quantification practices or enhancing program and project reporting and tracking processes. Still others may illuminate the need for new or enhanced data, tools, and other resources to assure confidence in savings.

States can work with the National Association of State Energy Officials (NASEO), U.S. DOE, EPA, and others to identify gap-filling resources or, if those are lacking, inform the need for research, tool development, and technical assistance.

Next Steps: Building Energy Codes

Ideally, the SEO should partner with air quality regulators early to discuss each agency's areas of responsibility, topics of mutual interest, and collaborative opportunities, including recognizing energy efficiency benefits. The SEO should complete the template and have a dialogue with its air quality regulatory agency to familiarize the agency with building energy codes as an air quality management and compliance strategy and to familiarize the SEO with air regulatory requirements. The SEO and air quality regulators should bring in other pertinent agencies and stakeholders as appropriate.

The agencies should discuss available data and tools showing past and projected future energy savings from building energy codes. They should identify any information gaps or concerns that air quality regulators may have about the quantification and reliability of building energy codes as an emissions avoidance tool. The state can consult with NASEO as well as with the U.S. DOE and EPA to help identify options for filling such gaps.

The state air quality agency, in partnership with the SEO, should also consult with the pertinent EPA Regional Office if formal inclusion and crediting in SIPs is sought to understand EPA expectations and requirements.

Energy Efficiency Pathway: Building Energy Codes

Note: Red, italicized text provides instructions to complete the template. Blue text describes the template fields that need to be completed. Black text represents model or example responses, as they might be filled in by a state.

Summary of Key Facts: Illinois Building Energy Codes

Following completion of sections 1-5, provide a high-level summary in the final column of this table. The first two columns can be drawn from the February 2016 State and Local Energy Efficiency Action Network document "Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution and Meet Energy Needs in the Power Sector".

Key Issues	General Summary[29]	State-Specific Summary
FEASIBILITY: Can building energy code adoption and compliance help achieve GHG and criteria air pollutant reductions in the required time frame?	• Yes. They reduce the amount of electricity generated, and fossil fuel consumed, at EGUs. Reduced energy demand yields emissions reductions. They also reduce use of onsite heating fuels.	**Section 1** The Illinois Energy Conservation Code is based on the 2015 IECC and ASHRAE Standard 90.1-2013. State programs exist to support code adoption and compliance.
APPROACH: How can a state achieve energy savings from codes?	• Adopting current versions of foundational model building energy codes. • Adequate funding for code compliance activities. • Measuring compliance rates every 3 to 5 years. • Education and training for the building industry and codes officials.	**Section 1** The Energy Efficient Buildings Act requires adoption of new codes, subject to amendment, within 12 months of new model code publication. New code comes into effect six months from adoption by the Board. Department of Commerce and Economic Opportunity (DCOE houses the State Energy Office) and utilities support code compliance, education, and training and could be expanded.
IMPACT: What energy savings and emission reductions can building energy codes achieve, and are the savings permanent?	• Compliance with robust energy codes permanently decreases a building's energy consumption for the life of the measures. • Resulting emissions reductions vary with amount and timing of energy savings	**Section 2** Baseline year: 2016 Completion year: continuous; projections to 2030 Data source: ACEEE SUPR 2.0 calculator

[29] State and Local Energy Efficiency Action Network. February 2016. *Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution and Meet Energy Needs in the Power Sector*

	and EGU emission profiles. Values can be determined with simple estimates or detailed modeling.	Electricity savings est. (low – current model code): Annual (2030) 3,637,000 MWh; Cumulative 26,503,000 MWh Electricity-related CO_2 reductions est. (low): Annual (2030) 3,047,000 short tons; Cumulative 22,202,000 short tons Electricity savings est. (high – projected new codes): Annual (2030) 6,341,000 MWh; Cumulative 42,400,900 MWh Electricity-related CO_2 reductions est. (high): Annual (2030) 5,312,000 short tons; Cumulative 35,521,000 short tons
RELIABILITY: How are the energy impacts of building energy codes documented?	• Independent evaluators assess savings through surveys of construction activity, inspections, review of energy bills, and computer simulations.	**Section 3** The state has not historically conducted independent evaluations of savings, but has estimated savings based on ACEEE SUPR 2.0 calculator (see above). Independent evaluations of savings, conforming with DOE's forthcoming methodology, will need to be conducted.
RESPONSIBILITY: Who is responsible for administering and implementing energy codes?	• The designated state agency, local government agencies, or both are responsible for code development, adoption, and enforcement. • Building designers, builders, and building owners are responsible for implementing the code requirements.	**Section 4** The Capital Development Board adopts code based on national model codes with advice of the Illinois Energy Code Advisory Council. Localities (counties and cities) enforce code. Builders and contractors are responsible for meeting code in construction and major renovation projects.
COST: What is the cost structure of energy code	• Building developers or owners pay for energy	**Section 5**

programs, and how much do they cost?	efficiency upgrades required by the code. • Fees for building plan reviews and inspections pay for code enforcement. • Utilities may provide incentives for certain code measures and help fund education and training	Building permit fees fully support code compliance activities. Last triennium (2014-16), additional education, training, and technical assistance was provided from $2 million annually by utility programs and $900,000 annually by DCOE. If additional funding were available, energy savings would be projected to increase.

Summary of Findings

If your state partners would like a text summary of findings, it can be placed here or at the end of the document. This can be a helpful way to offer conclusions after completing all worksheets.

Illinois has a well-established building energy code policy and program. Law requires regular updates of the codes based on national model codes. The Illinois Energy Conservation Code is mandatory for new construction and major renovations of buildings. Related policies include utility ratepayer program and DCOE support of training, technical assistance, and enhanced compliance. Localities have some options for adoption of more stringent stretch codes and there are some beyond-code programs.

Periodic state compliance baseline studies indicate good overall code compliance at least for low-rise residences but are limited and do not provide aggregate energy savings. Implementation and compliance with code are the responsibility of builders so implementation of energy efficiency under this path is not subject to state budget decisions. Compliance is the responsibility of local code officials and is funded through building permit fees. DCOE and utility training and technical assistance are supplemental activities that have been funded through stable utility ratepayer sources.

The state had not previously estimated or projected energy savings from codes nor calculated imputed emissions avoidance. Projections are offered here, indicating significant energy and electricity savings and avoided CO_2 and criteria pollutant emissions opportunities if the state continues with its policy of prompt adoption and implementation of updated building energy codes.

While the fate of the EPA CPP is uncertain, its draft CPP EM&V Guidance may be useful. The draft guidance has a section that discusses modeling and indirect estimation approaches for evaluating building energy code savings. These approaches can vet building code-related energy savings and be used to confirm efficacy of building energy standards as an energy efficiency and emission avoidance strategy, whether for criteria air pollutants or for state CO_2 and greenhouse gas goals. EPA has previously recognized building energy codes as a NOx emission reduction measure in a SIP for the ozone NAAQS.[30]

Building energy codes offer good potential for recognition and inclusion in state energy planning and in air quality management and planning.

Building Energy Codes Description

Provide a brief description of the energy efficiency pathway in broad terms.

New and renovated residential and commercial buildings are required to meet statewide building energy codes. The codes are intended to assure that certain minimum levels of building energy efficiency are met. Building energy codes govern various building features such as insulation levels, building tightness, duct leakage, windows, and lighting, among others.

Residential (IECC) and commercial (ASHRAE Standard 90.1) model building energy codes are typically developed on a three-year cycle at the national level. These codes must then be adopted by states and localities to take effect. The next model code versions expected will be the 2018 IECC (expected publication June 2017) and ASHRAE Standard 90.1-2016 (published October 2016).

U.S. DOE projects that in 2030, building energy codes could save the United States 140-170 million MWh and avoid emission of 80-97 million short tons of CO_2 based on assumed trends in IECC and ASHRAE Standard 90.1 stringency, state adoption, and compliance rates.[31]

[30] See https://www.tceq.texas.gov/airquality/stationary-rules/nox/eere.html; the Texas A&M University Energy Systems Laboratory provides analytic support, including quantification of energy savings and emissions avoidance, see http://esl.tamu.edu/terp/.

[31] U.S. DOE, 2016, "How Building Energy Codes Can Support State Climate and Energy Planning," http://energy.gov/eere/slsc/downloads/how-building-energy-codes-can-support-state-climate-and-energy-planning

Section 1: Adopted Codes, Compliance, and Enforcement (Feasibility and Approach)

Succinctly describe what activities are required to implement this pathway to achieve energy savings; SEE Action Network Guide for States[32] can be a helpful resource. Then complete the worksheet tables with state-specific information.

Two main steps are needed to successfully implement building energy codes that achieve energy savings:

• Code adoption. Code adoption is the process of formally putting codes in place in a legal and regulatory framework and updating them over time. To achieve the most energy savings, states can adopt the most current model code (the current version of the IECC and ASHRAE Standard 90.1) and amend model codes to make them stronger.

• Code enforcement and compliance. Code enforcement is generally carried out by local governments who send inspectors to check building construction sites and review building plans. Code compliance refers to meeting the requirements specified by the code and demonstrating that the requirements have been met. It is through code compliance that actual energy savings are achieved.

- Code compliance rates measure how well building projects conform to code obligations. Some states and utilities provide training and education on updated codes and code compliance. Some also offer financial incentives to cover a portion of project costs as a way to encourage better compliance. Although code compliance activities have high energy-savings potential, they are often underfunded.

Energy savings can be projected *ex ante* for planning purposes by modeling energy savings between code versions (new code as compared to previous code) and code compliance levels (new compliance as compared to previous baseline compliance) per residential unit or per square foot of built space times estimated future construction and renovation activity (such as modeled by Pacific Northwest National Laboratory [PNNL]). States should model and project both electricity and onsite heating fuel use (natural gas and others) to maximize the value of the analysis for both state energy planning and for air quality management purposes.

Energy savings achieved can be quantified *ex post* by conducting EM&V. Achieved energy savings should be determined by independent evaluators who assess savings through surveys of construction activity, inspections, review of energy bills, and computer simulations. In general, savings can be quantified based on the following generalized and simplified formula or a similar approach:[33]

Annual energy (or electricity) savings = (affected construction and retrofit area per year) x (savings per unit area) x (compliance rate) = (square feet per year) x (savings per square foot) x (percentage)

[32] State and Local Energy Efficiency Action Network. February 2016. *Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution and Meet Energy Needs in the Power Sector*

[33] Based on U.S. Environmental Protection Agency, 2015, "Evaluation Measurement and Verification (EM&V) Guidance for Demand-Side Energy Efficiency: Draft for Public Comment, August 3, 2015." pp. 37-40 most pertinent to building energy codes. https://www.epa.gov/cleanpowerplantoolbox/evaluation-measurement-and-verification-emv-guidance-demand-side-energy

The formula is simplified; building types, climate zones, and other factors may also need consideration.

While the fate of the CPP is uncertain, EPA's draft EM&V Guidance for that rule discusses approaches for building energy code savings EM&V that can be useful for evaluating building energy code energy savings and deriving pertinent impacts on criteria air pollutant as well as CO_2 emissions. The draft guidance notes *direct empirical* approaches (based on collecting data from representative buildings but can include modeling and simulation) and *indirect estimation* (based on secondary information such as building department filings, building audits, and code official surveys). Readers should consult the draft EPA Guidance.[34]

Section 1 State Worksheet: Code Adoption

What is the state's current code? Include key amendments.
Residential: The low-rise residential portion of the current Illinois Energy Conservation Code is based on the 2015 International Energy Conservation Code (IECC).
Commercial: The commercial portion (covering institutional, industrial, and high-rise residential buildings) of the Illinois Energy Conservation Code is based on ASHRAE Standard 90.1-2013.
What is the state's process for code updates? The Energy Efficient Building Act requires adoption of an updated Illinois Energy Conservation Code by the state's Capital Development Board with advice from the Illinois Energy Code Advisory Council based on latest model codes (but subject to state-level modification) within 12 months of publication The new code comes into effect six months after adoption by the Capital Development Board. (20 ILCS 3125)
Is there a code update in process now? No. However, at the national level, the next model code versions expected will be the 2018 IECC (expected publication June 2017) and ASHRAE Standard 90.1-2016 (published October 2016). As noted, state law requires update of the Illinois Energy Conservation Code based on model code.
Are related activities occurring that can contribute additional savings? *[Optional: information on beyond-code programs, adoption of stretch codes, and other pertinent activities can be included if consideration for air quality management purposes is desired.]* "Beyond code" programs in the state resulted in construction of 1,300 ENERGY STAR homes in 2015. Local government can adopt "stretch" codes more stringent than the Illinois Energy Conservation Code for commercial construction. Only localities with a population greater than one million can adopt stretch residential code.

[34] U.S. Environmental Protection Agency. Draft EM&V Guidance for Demand-Side Energy Efficiency. December 19, 2016. https://blog.epa.gov/blog/wp-content/uploads/2016/12/EMV-Guidance-12192016.pdf

Section 1 State Worksheet: Code Enforcement and Compliance

How does the state enforce building codes? Counties and cities administer and enforce code. Local code officials have responsibilities for issuing building permits and performing reviews and inspections of buildings for compliance.
How does the state determine code compliance rates? The SEO performed baseline compliance studies for residential and non-residential buildings against the 2012 Illinois Energy Conservation Code (published June 2014).
What is the state's code compliance rate? A 2014 field study found 81.3 percent overall compliance with the 2012 Illinois Energy Conservation Code in the residential sector. A non-residential compliance rate was not determined, due to limited data.
What are the state's code compliance training and education programs and resources? Subject to Illinois Corporation Commission approval, a portion of a utility's ratepayer-funded energy efficiency expenditures can support activities meant to enhance building energy code compliance such as training, education, and technical assistance.
Who provides support for codes? Do they receive "credit" for this support? Utilities and DCOE both provide education, training, and technical assistance to support local code enforcement.

TIP

US DOE's "Achieving Energy Savings and Emissions Reductions from Building Energy Codes: A Primer for State Planning," provides information on best practices in code enforcement and compliance https://www.energycodes.gov/sites/default/files/documents/Codes_Energy_Savings_State_Primer.pdf

Section 1 State worksheet: Code Adoption and Compliance Follow Up Items

Information gaps and questions that arise can be entered for consideration and follow up attention.

Information gaps:
Critical questions to answer:
Other:

Section 2: Energy Savings and Emissions Reductions (Impact)

Succinctly describe how energy savings and emission reductions are achieved through this pathway; the SEE Action Guide for States[35] can be a helpful resource. Then complete the worksheet tables with state-specific information.

Compliance with robust energy codes permanently decreases a building's energy consumption for the life of the measures. At the highest level, energy savings result from adoption of a newer energy code[36] and compliance with the newly adopted code. Substantial energy savings and emission avoidance are feasible if the state continues its policy of prompt adoption and implementation of new building energy codes based on national model codes.

As previously noted, building energy saving achieved can evaluated and future savings projected. EPA's draft EM&V guidance for the CPP, with its section on building energy code energy savings evaluation, can be useful for estimating savings for criteria air pollutant management as well as for state CO_2 and greenhouse gas objectives.

Once energy savings are quantified, they can be translated into avoided emissions. As discussed previously under "Options for Quantification and Rigor" and "Tools and Resources to Assist with Quantifying Savings," there are a variety of tools and approaches for doing this. Such tools as eGRID and AVERT can translate electricity savings into estimated emissions avoidance. The ACEEE SUPR tool can project electricity savings and avoided emissions for selected energy efficiency program types.

For onsite combustion of natural gas and other fuels for space and water heating and industrial processes, there are established emissions factors from the EPA[37] as well as industry, manufacturer, and other sources to allow calculation of pollution avoidance.

For example, DCEO or Illinois EPA can take achieved or projected MWh electricity savings and multiply it by the relevant eGRID non-baseload average emissions factor to provide estimated avoidance of CO_2, NOx, and SO_2. MWh savings entered into the AVERT tool can provide a more precise estimate based on historic marginal emissions rates. If monthly, daily, or up to hourly savings data are entered in AVERT (which require more precise understanding of power demand patterns), more precise and temporally relevant avoided emissions (such as for considering ozone season impacts) can result. Likewise, natural gas savings in therms or Btus evaluated or modeled can be translated using standard emission factors.

Avoided emissions can be broadly estimated and projected for broad air quality management planning purposes even if no formalized "credit" under air quality rules is sought. Or more rigorous quantification may provide emissions reductions that can be formally credited under SIPs, state emission goals, or other programs. State air quality regulators should consult EPA on requirements for formalized recognition and crediting under Clean Air Act regulations.

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[35] State and Local Energy Efficiency Action Network. February 2016. *Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution and Meet Energy Needs in the Power Sector*

[36] Newer codes are statutorily required to save more energy than previous versions.

[37] U.S. EPA, AP-42: Compilation of Air Pollution Emission Factors. https://www3.epa.gov/otaq/ap42.htm

While currently beyond the focus of this template, states could consider energy savings benefits to water resources (water savings, water quality), avoided waste, land, and other resource impacts.

Section 2 State Worksheet: Energy Savings and Emissions Reductions – Policy and Goals

Does the state have energy savings goals related to this pathway?

There are no individual project/building level or aggregate state energy savings goals specific to building energy codes.

However, Illinois is currently developing a roadmap for energy efficiency and renewable energy with U.S. DOE support. Building energy codes are expected to be a recommended component of the plan.

Are there consequences of not meeting the targets?

N/A.

However, while there are not specific energy savings targets, conformance with the Illinois Energy Conservation Code is a legal requirement.

Section 2 State Worksheet: Energy Savings and Emissions Reductions Estimates

Has a building energy code compliance study been performed? Have potential additional energy savings from improved code compliance been estimated?

The state performed a Baseline Compliance Study[38] based on the 2012 Illinois Energy Conservation Code using Pacific Northwest National Laboratory methodology. The most recent estimation of energy savings from building energy codes based on the 2012 Illinois Energy Conservation Code indicated that the average home in climate zone 4 consumed 128.06 MMBtu/yr or 2.2% (2.87 MMBtu) greater than a 100% compliant prototypical home in the same climate zone. The same study showed that the typical home in climate zone 5 consumed 137.23 MMBtu or 2.2% (3.08 MMBtu) *less* than a 100% compliant prototypical home in that climate zone. Broken out between electricity and natural gas, the results are:

Climate Zone 4 Residential Energy Consumption

	Illinois Energy Conservation Code 2012	Prototypical Baseline	Difference Above Code
Electricity Annual Usage (kWh/yr)	13,772	13,642	-130
Natural Gas Annual Usage (Therms/yr)	810.65	843.72	33.07

Climate Zone 5 Residential Energy Consumption

	Illinois Energy Conservation Code 2012	Prototypical Baseline	Difference Above Code

[38] ADM Associates, Inc., 2014, "Evaluation of Illinois Baseline Building Code Compliance," prepared for the Illinois Department of Commerce and Economic Opportunity.

Electricity Annual Usage (kWh/yr)	12,215	12,278	63
Natural Gas Annual Usage (Therms/yr)	986.30	953.36	-32.94

The study did not evaluate commercial building compliance nor did it determine savings relative to previous versions of building energy code.

What are historical energy savings?

Historical energy savings from building energy codes have not been calculated specifically for this state.

However, the U.S. DOE determines energy and energy cost savings for different model building codes. For residential codes, the 2015 IECC (on which the 2015 Illinois Energy Conservation Code is based) was determined to save approximately 1% relative to the 2012 IECC.[39] This is in addition to historical savings from adoption of new code, with the 2012 IECC providing average energy cost savings of 32.1% over a 2006 IECC baseline.[40]

U.S. DOE determination of savings between ASHRAE Standard 90.1-2010 and 90.1-2013 (on which the 2015 Illinois Energy Conservation Code is based) found significant variation by building type but, weighted by building type floor space nationally, averaged 7.6% on a site energy use intensity (EUI; i.e., Btu per square foot) basis and 8.5% on a source EUI basis.[41]

What future energy savings and emissions reductions estimates have been produced and using what methods and assumptions?

The American Council for an Energy-Efficient Economy's (ACEEE) State and Utility Pollution Reduction Calculator (SUPR) is designed to provide high-level estimates of energy and emission impacts of several energy efficiency pathways for screening purposes, including building energy codes.[42] Projections below are based on activities between baseline year 2016 and 2030 for two scenarios, a "low" and "high" case.

The ACEEE SUPR calculator projects that the 2015 IECC and ASHRAE 90.1-2013 (which are the bases of the existing SECC) will provide as much as 3.6 million MWh in electricity savings in 2030 relative to prior code versions.

SUPR projects for Illinois that in 2030 building energy codes can provide 3 million to 5.3 million short tons of CO_2 avoided from the "low" and "high" scenarios described. Projected NOx reductions for 2030 are 18,000 to 28,700 short tons and 69,000 to 110,500 tons of SO_2.

[39] Mendon, V.V, et al., 2014, "2015 IECC Determination of Energy Savings: Preliminary Technical Analysis." https://www.energycodes.gov/sites/default/files/documents/2015_IECC_preliminaryDeterminationAnalysis.pdf

[40] U.S. DOE, "National Energy and Cost Savings for New Single- and Multifamily Homes: A Comparison of 2006, 2009, and 2012 Editions of the IECC." https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf

[41] Halverson, M., et al., 2014, "ANSI/ASHRAE/IES Standard 90.1-2013 Preliminary Determination: Quantitative Analysis." http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-23236.pdf

[42] The ACEEE SUPR Calculator and user manual is available via http://aceee.org/research-report/e1601

Scenario 1: The "low" scenario is based on adoption of 2015 IECC and ASHRAE Standard 90.1-2013, the current model codes on which the current SECC is already based. Compliance rates are assumed to correspond to average energy use in homes to be 12% above 2015 IECC and in commercial buildings 10% above ASHRAE Standard 90.1-2013. See Table 1 for detailed results. Electricity savings estimate (low – current model code): Annual (2030) 3,637,000 MWh; Cumulative 26,503,000 MWh Electricity-related CO_2 reductions estimate (low): Annual (2030) 3,047,000 short tons; Cumulative 22,202,000 short tons
Scenario 2: The "high" scenario assumes additional savings (5% per code cycle) from adoption of future, improved model codes every three years through 2030 along with high compliance rates, corresponding to achieving homes and commercial buildings using just 2% more energy than would be consumed with 100% code compliance. See Table 2 for detailed results. Electricity savings estimate (high – projected new codes): Annual (2030) 6,341,000 MWh; Cumulative 42,400,900 MWh Electricity-related CO_2 reductions estimate (high): Annual (2030) 5,312,000 short tons; Cumulative 35,521,000 short tons
Are other environmental impacts estimated? The State does not officially estimate or project emissions impacts from building energy codes. SUPR projects that in 2030 building energy codes can provide 3 million to 5.3 million short tons of CO_2 avoided from the "low" and "high" scenarios described. Projected NOx reductions for 2030 are 18,000 to 28,700 short tons and 69,000 to 110,500 tons of SO_2.
Are other non-energy benefits estimated? Water, waste, and other non-energy benefits and impacts of code-related energy savings have not been estimated in this state yet.

TIP

Tip: If electricity savings data are available, the EPA Emissions and Generation Resource Integrated Database (eGRID) provides regional average and average non-baseload emission factors for electric power-sector CO_2, NOx, SO_2, methane, and nitrous oxide emissions.[43] The EPA AVoided Emissions geneRation Tool (AVERT) allows for more detailed analyses of avoided emissions on a regional basis.[44] The AVERT tool allows entry of energy savings data on temporal scales from annual to hourly, which, if temporal savings data are available, can provide more precise emission impact estimates and can support air quality management focused on seasonal ozone levels.

[43] See https://www.epa.gov/energy/egrid

[44] See https://www.epa.gov/statelocalclimate/avoided-emissions-and-generation-tool-avert

TIP

Tip (Codes): Various analyses, including from the U.S. DOE and Pacific Northwest National Laboratory (PNNL), provide average (by climate zone) and national energy savings estimates for meeting new model code as compared to previous model code (e.g., between ASHRAE Standard 90.1-2013 and -2010; 2015 IECC and 2012 IECC).

TIP

Tip (Codes): The ACEEE SUPR calculator allows rough, screening level projection of CO_2, nitrogen oxides (NOx), and sulfur dioxide (SO_2) from building energy codes. The Energy Efficient Codes Coalition Clean Power Plan Energy Code Emissions Calculator offers more conservative projections based on default and user-specified scenarios to provide emission avoidance projections of CO_2, NOx, and SO_2 as well as several other criteria pollutants and greenhouse gases.

Table 2. Illinois summary of estimated energy savings and air emissions reductions from building energy codes (low scenario), SUPR

Summary results

	2020	2025	2030
Cumulative NOx reductions (short tons)	1,500	7,400	18,000
Cumulative SO_2 reductions (short tons)	5,700	28,600	69,000
Cumulative CO_2 reductions (short tons)	1,818,000	9,198,000	22,202,000
Annual CO_2 reductions (short tons)	798,000	1,928,000	3,047,000
Cummulative net cost (million 2011$)	455	133	(1,207)
Cumulative energy saved (MWh)	2,169,500	10,980,100	26,503,000
Annual energy saved (MWh)	953,000	2,301,000	3,637,000

* Results are for all selected measures combined (see *Helpful definitions*).

What does this mean for EPA's Clean Power Plan?

Reduction in emissions required by EPA in 2030 (short tons of CO_2 as % of adjusted 2012 baseline)	35%
Reduction in emissions achieved by selected measures in 2030 (short tons of CO_2 as % of adjusted 2012 baseline)	3%
EPA 2030 emission rate goal (lbs of CO_2/MWh)	1,245
Emission rate achieved by selected measures in 2030 (lbs of CO_2/MWh)	2,070
Cumulative utility bill savings through 2030 (million 2011$)	$ 3,817

Table 3. Illinois summary of estimated energy savings and air emissions reductions from building energy codes (high scenario), SUPR

Summary results

	2020	2025	2030
Cumulative NOx reductions (short tons)	1,900	11,000	28,700
Cumulative SO_2 reductions (short tons)	7,300	42,200	110,500
Cumulative CO_2 reductions (short tons)	2,351,000	13,555,000	35,521,000
Annual CO_2 reductions (short tons)	1,060,000	3,060,000	5,312,000
Cummulative net cost (million 2011$)	659	570	(989)
Cumulative energy saved (MWh)	2,806,600	16,180,400	42,400,900
Annual energy saved (MWh)	1,265,000	3,653,000	6,341,000

* Results are for all selected measures combined (see *Helpful definitions*).

What does this mean for EPA's Clean Power Plan?

Reduction in emissions required by EPA in 2030 (short tons of CO_2 as % of adjusted 2012 baseline)	35%
Reduction in emissions achieved by selected measures in 2030 (short tons of CO_2 as % of adjusted 2012 baseline)	5%
EPA 2030 emission rate goal (lbs of CO_2/MWh)	1,245
Emission rate achieved by selected measures in 2030 (lbs of CO_2/MWh)	2,015
Cumulative utility bill savings through 2030 (million 2011$)	$ 5,891

Section 2 State Worksheet: Energy Savings and Emissions Reductions Estimates – Follow Up Items

Information gaps and questions that arise can be entered for consideration and follow up attention.

Information gaps: (also applies to section 2 below)
It would be useful to have estimates and projections of savings that differentiate between electricity and onsite combustion of natural gas or other fuels (propane, fuel oil).

What, if any, code-related energy savings are claimed by utilities through their support of codes programs?

Critical questions to answer:
Can U.S. DOE and PNNL assist in developing more precise state-specific savings estimates for 2015 Illinois Energy Conservation Code over previous code? Can they provide more precise state-specific projections of future savings?

Can the SEO or environmental agency or other trusted party develop emissions avoidance estimates based on estimated energy savings from 2015 SECC? From projected future savings?

Other:
These also apply to section 2 below.

Section 3: Approach to Energy Savings and Emissions Reductions Documentation (Reliability)

Succinctly describe how energy savings and emissions reduction values are determined for this pathway; the SEE Action Guide[45]can be a helpful resource. Then complete the worksheet tables with state-specific information.

Energy code adoption and enforcement provide a solid framework for achieving energy savings, but documentation of construction and compliance activity is necessary to affirm actual savings being realized. Independent evaluators assess savings through surveys of construction activity, inspections, review of energy bills, and computer simulations.

The state has not historically conducted independent evaluations of savings, but has estimated savings based on ACEEE's calculator (see above). Independent evaluations of savings, conforming with DOE's forthcoming methodology, will need to be conducted in the future if savings will be relied upon beyond providing a general estimate of benefits.

Section 3 State Worksheet: Approach to Estimation and EM&V

Are energy savings (electricity and other fuels) regularly estimated or measured? Savings have historically been estimated based on limited, periodic field studies of compliance rates in the state and a DOE-funded PNNL building energy codes estimation model. Savings estimates have been developed for total energy savings, including electricity and other fuels combined.
Is there currently an evaluation, monitoring, and verification (EM&V) process to confirm energy savings estimates? There is currently no EM&V performed for overall code-related energy savings in this state. Periodic baseline code compliance studies have been performed but allow very limited conclusions, and attribution of savings for utility programs require further inquiry. Codes energy savings attribution methods for utility ratepayer-funded programs have been published and could be implemented by the utilities or DCOE.[46]
Are additional efforts needed to verify energy savings? If savings were to be used for formal crediting purposes, additional EM&V would be necessary. DCOE could implement an EM&V process that aligns with DOE's forthcoming methodology for determining energy savings from building energy codes. This effort will require a new effort and associated funding.
To what extent can energy and emissions estimates be relied upon for planning and decision making? (e.g., general estimate of benefits, verified and attributed, other) Current estimates are likely sufficient for general estimation of benefits to contribute to planning. Additional efforts will be needed (and could be undertaken) to develop verified savings estimates that would be useable for formal crediting of savings.

[45] State and Local Energy Efficiency Action Network. February 2016. *Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution and Meet Energy Needs in the Power Sector*

[46] NEEP and IMT, "Attributing Building Energy Code Savings to Energy Efficiency Programs." http://www.imt.org/resources/detail/attributing-building-energy-code-savings-to-energy-efficiency-programs

Section 3 State Worksheet: Approach to Estimation and EM&V – Follow Up Items

Information gaps and questions that arise can be entered for consideration and follow up attention.

Information gaps: See section 2 entries.
Critical questions to answer:
Other:

TIP

Tip: For various Clean Air Act programs, the state can disaggregate electricity from non-electricity residential consumption using utility, National Laboratory, or Energy Information Administration data as may be available.

TIP

Tip (Codes): EPA published draft EM&V Guidance for demand-side energy efficiency under the Clean Power Plan in 2015 that may still be useful in the absence of a CPP for supporting other state energy and emission objectives. The document discusses EM&V of building energy code and compliance programs. It notes direct empirical approaches where data collected from a representative sample of buildings can be modelled or subjected to billing or energy data analysis to estimate energy or electricity savings. It also discusses indirect estimation approach to assess code compliance rates based on secondary information from building audits, code official surveys, or analysis of building department documents.

Section 4: Policy Implementation (Responsibility)

Succinctly describe who in the state is responsible for implementing the pathway and ensuring energy savings are achieved; the SEE Action Network Guide for States[47] can be a helpful resource. Then complete the worksheet tables with state-specific information.

A designated state agency, local government agencies, or both are responsible for code development, adoption, and enforcement. Building designers, builders, and building owners are responsible for implementing code requirements.

Section 4 State Worksheet: Implementation

What legal authority governs (statute, regulation, executive order, other) this pathway? The Energy Efficient Building Act requires the State to adopt the most current IECC and ASHRAE Standard 90.1 within one year of publication, subject to amendment, to become the SECC. The Capital Development Board adopts code with the advice of the Illinois Energy Code Advisory Council. Newly adopted code comes into force six months from adoption. Counties and cities administer and enforce code.
Who is responsible for achieving savings? What happens if they are not achieved? Builders and contractors are legally required to comply with building energy codes. Non-compliance is subject to civil penalty or denial of occupancy permit. Particular energy savings or performance are not required nor enforceable. Counties and cities administer and enforce code. Local code officials have responsibilities for issuing building permits and performing reviews and inspections of buildings for compliance. As a supplement, DCOE administers code training and technical assistance activities. Code compliance enhancement activities are also included as parts of utility ratepayer-supported energy efficiency programs. It should be emphasized that these activities are supportive adjuncts intended to improve compliance.
Who monitors and verifies savings? Currently, local enforcement of compliance is all that is monitored. Savings are not verified.
What more is needed to monitor and verify savings? The SEO could assemble data on construction activities and compliance levels and use existing tools and resources to estimate and project energy savings and emission benefits. DCOE could oversee code compliance studies, as well. To get verified savings data, investment in a field study every 3 to 5 years would be needed. DOE has developed and is verifying a methodology to conduct such studies to determine energy savings impacts of building energy codes. The methodology will be available in 2018 and could be implemented within one year.

[47] State and Local Energy Efficiency Action Network. February 2016. *Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution and Meet Energy Needs in the Power Sector*

Section 4 State Worksheet: Implementation -- Follow Up Items

Information gaps and questions that arise can be entered for consideration and follow up attention.

Information gaps:
Critical questions to answer:
Other:

Section 5: Costs and Funding Mechanisms

Succinctly describe how what costs are needed to implement this pathway and where funding comes from – or could come from. The SEE Action Guide for States[48]can be a helpful resource. Then complete the worksheet tables with state-specific information.

Building developers or owners pay for energy efficiency upgrades required by the current building energy code as part of construction costs. Local government fees for building plan reviews and inspections typically pay for code compliance enforcement. In some cases, utilities and/or state energy offices may provide incentives for certain code measures and help fund education and training to increase compliance.

Section 5 State Worksheet: Costs and Funding Mechanisms

How are implementation costs funded? The costs of meeting code (i.e., design, material and equipment procurement, and construction and installation to meet code) are incorporated in construction costs. Thus there is no public or utility funding or budget required to build and install energy efficiency measures required by code or for achieving the energy savings that result, to the extent that compliance occurs naturally in the market. Local government administration and enforcement of compliance is funded via construction permit fees. Building energy codes are part of a family of codes (e.g., structural, fire protection, electrical, plumbing) that are administered by local buildings officials. There is no budget for building energy code compliance and enforcement separate from other building code components. DCOE and utilities provide supplemental compliance assistance including training, education, and technical assistance to boost compliance of energy codes and ensure energy savings. For the current triennium, utility ratepayer funding supported code-related utility energy efficiency programs at about $2 million per year and DCOE code assistance activities at $900,000 per year.
How have costs / funding varied over time? Funding levels for supplemental training, education, and technical assistance have been relatively consistent for the past two trienniums (six years). These levels are expected to continue in the next triennium starting June 1, 2017, subject to Illinois Corporation Commission decision expected in January 2017.
How certain is future funding? Funds to build in compliance to code, and for local governments to enforce compliance are self-funded and certain. Funds for supplemental training, education, and technical assistance are considered by the SCC every three years and are solid for each approved cycle. Based on recent trends, it is reasonable to expect such funds to continue to be available.

[48] State and Local Energy Efficiency Action Network. February 2016. *Guide for States: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution and Meet Energy Needs in the Power Sector*

What funding would be needed to fully implement the pathway and document energy savings? Additional funding will be needed to develop code compliance and energy savings field surveys to verify savings. The U.S. DOE is currently funding a residential energy code compliance study for several states with a budget of $115,000 per state for the field study evaluation components. PNNL has been made available to provide analytical support to these states and a state (Michigan) that has a parallel utility-funded study underway.

Section 5 State Worksheet: Cost and Funding -- Follow Up Items

Information gaps and questions that arise can be entered for consideration and follow up attention.

Information gaps: Add information on ICC-approved budget for utility ratepayer program code support activities.
Critical questions to answer: Can funding be found to support state specific code compliance studies that generate electricity and on-site fuel use and savings data for both residential and commercial codes? Can findings from the U.S. DOE-funded and other residential compliance studies be applied in this state?
Other:

Next Steps: Illinois Building Energy Codes

DCOE, in collaboration with Illinois EPA and other pertinent bodies, should try to better quantify and track energy savings and avoided emissions accruing from building energy code adoption and implementation, including compliance. Energy savings should distinguish electricity savings from that of onsite fuels such as natural gas as well as any applicable district energy system savings. This will be important for estimating emissions impacts and for applicability as an air quality regulatory compliance approach. For example, some Clean Air Act rules can only "count" electricity system related energy savings (or renewable power generation) whereas consideration for National Ambient Air Quality Standards (NAAQS) purposes could consider both avoided fossil fuel electric power generation and reduced onsite combustion.

Projections of future building energy code-related energy savings and avoided emissions should be developed using several scenarios of future code stringency and compliance levels as well as modeling of anticipated construction activity. The U.S. DOE and PNNL may be able to provide pertinent technical assistance.

DCOE should continue its interactions with the Illinois EPA on energy efficiency as an opportunity and strategy for pollution reduction.

The agencies should discuss available data and tools showing past and projected savings. They should identify any information gaps or concerns that air regulators may have about building energy codes as an emissions avoidance tool. The state can consult with NASEO as well as with the U.S. DOE and EPA to help identify options for filling such gaps.

Appendix: Illinois Building Energy Codes

To include any relevant Helpful Resources, Detailed Calculations, Models & Tools, Additional Questions

Helpful Resources

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U.S. Environmental Protection Agency, "Draft Evaluation Measurement and Verification (EM&V) Guidance for Demand-Side Energy Efficiency" https://blog.epa.gov/blog/wp-content/uploads/2016/12/EMV-Guidance-12192016.pdf

U.S. Environmental Protection Agency, Emissions and Generation Resource Integrated Database (eGRID). https://www.epa.gov/energy/egrid

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