

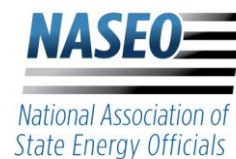


# ENERGY EFFICIENCY PATHWAY TEMPLATE:

## City of Boulder (Colorado) SmartRegs: Local Building Performance Program

### 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 an example of local-led building performance program based on the Boulder, CO SmartRegs Program requirements for residential rental units.*



## 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<sub>2</sub>) emissions.<sup>1</sup> 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.<sup>2, 3</sup> 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<sub>2</sub>.<sup>4</sup> 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.<sup>5</sup> 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.<sup>6</sup>

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 (NO<sub>x</sub>).<sup>7</sup> Maryland’s energy efficiency and renewable energy programs provide about 0.60 parts per billion

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<sup>1</sup> 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.

<sup>2</sup> Hoffman, Ian M., Gregory Rybka, Greg Leventis, Charles A. Goldman, Lisa Schwartz, 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>.

<sup>3</sup> 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/>.

<sup>4</sup> 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.  
<sup>5</sup> 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>

<sup>6</sup> U.S. DOE has assembled national and state-level energy savings potential estimates for several types of energy efficiency programs and has also cataloged state-level energy efficiency potential studies. U.S. Department of Energy, Energy Efficiency: Savings Opportunities and Benefits, <https://energy.gov/eere/slsc/energy-efficiency-savings-opportunities-and-benefits>

<sup>7</sup> 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>

reduction in ambient ozone levels.<sup>8</sup> Texas has included building energy codes, local government measures, and utility energy efficiency programs in its National Ambient Air Quality Standards (NAAQS) State Implementation Plans (SIPs) for ozone.<sup>9, 10</sup> Furthermore, DOE estimates 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.<sup>11</sup>

### 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 energy savings that translate into avoided emissions.<sup>12</sup> 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....”<sup>13</sup> 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.<sup>14</sup> EPA provides a roadmap for incorporating EE/RE into NAAQS SIPs.<sup>15</sup>

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<sup>8</sup> 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.

<sup>9</sup> 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>

<sup>10</sup> 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/>.

<sup>11</sup> 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](https://www.energycodes.gov/sites/default/files/documents/Codes_Energy_Savings_State_Primer.pdf)

<sup>12</sup> 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.

<sup>13</sup> <https://www.epa.gov/statelocalclimate/avoided-emissions-and-generation-tool-avert>.

<sup>14</sup> 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](https://www.epa.gov/sites/production/files/2016-03/documents/summary_paper_nox_allowance_6-6-2006.pdf).

<sup>15</sup> 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>.

The agency also pointed to energy efficiency as a key means to address CO<sub>2</sub> and greenhouse gas concerns.<sup>16, 17</sup> 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<sub>2</sub> and other greenhouse gases, including state-level standards and targets, are also pertinent.<sup>18</sup> 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 NO<sub>x</sub> allowances or emissions offsets in

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<sup>16</sup> 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.


<sup>17</sup> U.S. Environmental Protection Agency, 2016, "Energy Efficiency and Evaluation, Measurement and Verification in State Plans" ([https://www.epa.gov/sites/production/files/2016-01/documents/ee\\_and\\_emv\\_in\\_the\\_cpp\\_1-14-16\\_-\\_final\\_508.pdf](https://www.epa.gov/sites/production/files/2016-01/documents/ee_and_emv_in_the_cpp_1-14-16_-_final_508.pdf)).

<sup>18</sup> Some states have CO<sub>2</sub> 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.<sup>19</sup> Figure 1 summarizes the four pathways for incorporating EE/RE for NAAQS SIP purposes outlined in its EE/RE Roadmap Manual.<sup>20</sup> Table 1 provides more detail about the projects, characteristics of policies, and programs suitable for each pathway.<sup>21</sup>

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



## 4 Pathways

	Baseline 	Control Strategy 	Emerging/ Voluntary Measures		Weight of Evidence 
			Emerging 	Voluntary	
<b>Types of Projects</b>	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
<b>SIP Credit Limit</b>	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
<b>Enforcement</b>	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
<b>If SIP reductions do not materialize</b>	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
<b>Level of documentation</b>	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 lead 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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<sup>19</sup> 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>

<sup>20</sup> 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=0ahUKewiGrtrb\\_urDPAhWJyT4KHbDFAnQQFggsMAM&url=https%3A%2F%2Fwww3.epa.gov%2Fairnow%2F2014conference%2FCommunications%2FWednesday%2FShatas\\_final.pptx&usg=AFQjCNHTISnqs4u9aJn9-uc9pw44scLQbA&sig2=LpXOMA86FdAhldkvzwdWIA&bvm=bv.134052249,bs.2,d.dmo](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=0ahUKewiGrtrb_urDPAhWJyT4KHbDFAnQQFggsMAM&url=https%3A%2F%2Fwww3.epa.gov%2Fairnow%2F2014conference%2FCommunications%2FWednesday%2FShatas_final.pptx&usg=AFQjCNHTISnqs4u9aJn9-uc9pw44scLQbA&sig2=LpXOMA86FdAhldkvzwdWIA&bvm=bv.134052249,bs.2,d.dmo)

<sup>21</sup> 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](https://www.epa.gov/sites/production/files/2016-05/documents/eeremanual_0.pdf)



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

<b>Baseline Emission Pathway</b>
<ul style="list-style-type: none"> <li>• 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</li> <li>• Can be state enforceable but is not federally enforceable</li> <li>• 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</li> <li>• Electric generating unit (EGU) baseline projections are best done on a coordinated, regional basis</li> <li>• When available, agencies can utilize EPA’s EGU baseline projections or develop their own projections model or approach</li> <li>• EGU baseline projections using energy models or similar methods reflect EGU operations as a whole system</li> </ul>
<b>Control Strategy Pathway</b>
<ul style="list-style-type: none"> <li>• “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]</li> <li>• EE/RE policies and programs for which the state, tribal, or local agency wishes to seek SIP credit</li> <li>• Once approved into the SIP, federally enforceable (enforceable against an air pollution source or implementing party)</li> <li>• State, tribal, and local agencies will have emission reductions from a control strategy to help them attain the NAAQS</li> <li>• Documentation is needed to demonstrate that the EE/RE policy and/or program is permanent, enforceable, quantifiable, and surplus</li> </ul>
<b>Emerging/Voluntary Measures Pathway</b>
<ul style="list-style-type: none"> <li>• Good option for locally-based EE/RE activities</li> <li>• Voluntary EE/RE policies and programs that are not enforceable against an air pollution source or implementing party</li> <li>• Emerging EE/RE policies and programs for which it is difficult to quantify emission impacts</li> <li>• EE/RE policies and programs for which state, tribal, or local agency wishes to seek SIP credit</li> <li>• Emerging/voluntary measures can be “bundled” in a single SIP submission and considered as a whole</li> <li>• EPA will propose to approve through the SIP rulemaking process SIP/TIP credit up to six percent for EE/RE policies and programs, or more, if they can make a clear convincing case</li> </ul>
<b>Weight of Evidence Pathway</b>
<ul style="list-style-type: none"> <li>• 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</li> <li>• Can include unspecified emission reductions from any policy or program in weight of evidence that may impact a nonattainment area</li> </ul>



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 savings and air quality benefit 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 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 some of 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<sub>2</sub>, NO<sub>x</sub>, sulfur dioxide (SO<sub>2</sub>), methane, and nitrous oxide emissions.<sup>22</sup>
- **AVERT.** The EPA AVoided Emissions geneRation Tool (AVERT) allows for more detailed analyses of avoided emissions on a regional basis.<sup>23</sup> 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.<sup>24</sup> 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 electricity use and air pollution (CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>2</sub> 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-

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<sup>22</sup> See <https://www.epa.gov/energy/egrid>

<sup>23</sup> See <https://www.epa.gov/statelocalclimate/avoided-emissions-and-generation-tool-avert>

<sup>24</sup> See <http://aceee.org/research-report/e1601>

specified scenarios to provide emission avoidance projections of CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>2</sub> as well as several other criteria pollutants and greenhouse gases.<sup>25</sup>

Savings of on-site use of natural gas, fuel oil, propane, or other fuels can be translated into avoided emissions using equipment specifications, engineering estimates, and published emissions factors, such as EPA's AP-42.<sup>26</sup>

### Energy Efficiency for Supporting Greenhouse Gas Goals

*At the time of this writing, the EPA Clean Power Plan rule has been proposed for repeal by the EPA and remains under a U.S. Supreme Court stay. 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.<sup>27</sup> Nine Northeastern and Mid-Atlantic state members of the Regional Greenhouse Gas Initiative (RGGI) cap power sector CO<sub>2</sub> emissions.<sup>28</sup> California is mandating greenhouse gas reductions from its power sector and other sources.<sup>29</sup> These and other states as well as localities having or considering greenhouse gas standards or targets can find energy 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<sub>2</sub> 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.<sup>30</sup> 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<sub>2</sub> 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<sub>2</sub>) 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,

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<sup>25</sup> <http://energyefficientcodes.com/energy-codes-make-sense-with-or-without-the-clean-power-plan/>

<sup>26</sup> U.S. Environmental Protection Agency, AP-42: Compilation of Air Emission Factors, <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors>

<sup>27</sup> Center for Climate and Energy Solutions, Greenhouse Gas Emissions Targets, <https://www.c2es.org/us-states-regions/policy-maps/emissions-targets>

<sup>28</sup> Regional Greenhouse Gas Initiative <https://www.rggi.org/>

<sup>29</sup> Assembly Bill 32 Overview <https://www.arb.ca.gov/cc/ab32/ab32.htm>

<sup>30</sup> 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](https://www.epa.gov/sites/production/files/2015-08/documents/flow_chart_v6_aug5.pdf)

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), localities, and other entities, 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 or locality 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 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 and localities 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: Locally-Led Building Performance Programs

Ideally, the SEO and locality 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 or locality should complete the template and have a dialogue with its air quality regulatory agency to familiarize the agency with local-led building performance programs as an air quality management and compliance strategy and to familiarize the SEO and locality with air

regulatory requirements. The SEO, locality, 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 savings from local-led energy efficiency programs. They should identify any information gaps or concerns that air quality regulators may have about the reliability of building energy performance standards 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 and locality, 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: Local-Led Building Performance Programs

*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.*

There are numerous kinds of local-led building performance policies and programs. Table 2, derived from the State and Local Energy Efficiency Action Network, summarizes several common types but omits others, such as programs addressing minimum energy standards for existing residential rental housing. This document discusses in detail one such program, the City of Boulder's (Colorado) SmartRegs program.<sup>31</sup>

**Table 2. Sample of Building Performance Policies Established by Local Governments**

Type of Policy	Buildings Covered	Sectors Affected	Summary
Ongoing energy benchmarking and transparency	Buildings over a certain square footage (varies by jurisdiction)	Primarily commercial, large multifamily, municipal	Benchmarking involves compiling building energy consumption data and calculating summary metrics that can be compared to peer buildings or the same building's historical consumption. Building owners provide results, typically annually, to a designated government agency. Results are often disclosed to the public to make energy performance of buildings transparent, encourage steps to improve performance over time, and enable the real estate market to reward high-performing buildings.
Ongoing energy audits	Buildings over a certain square footage (varies by jurisdiction)	Primarily commercial, large multifamily, municipal	Audits are on-site evaluations of a building's major energy-consuming systems conducted by a certified professional. Audits identify opportunities to improve efficiency and reduce energy bills and provide a roadmap for property owners to improve performance. Some jurisdictions offer technical or financial support for audits.
Periodic retro-commissioning	Buildings over a certain square footage (varies by jurisdiction)	Primarily commercial, large multifamily, municipal	Retro-commissioning is a structured process, conducted by a certified professional, to systematically examine a building's major energy-consuming systems and identify and correct sub-optimal performance. Retro-commissioning can lead to improved building performance through low- or no-cost measures. Some jurisdictions require that large buildings periodically undergo retro-commissioning to ensure ongoing efficient performance.

<sup>31</sup> SmartRegs, City of Boulder <https://bouldercolorado.gov/plan-develop/smartregs>

Point of sale energy disclosure or upgrade	Commercial, owner-occupied residential (varies by jurisdiction)	All	Point of sale policies encourage or require sellers to: (1) provide potential buyers with information about the energy performance of the property for sale or (2) complete basic upgrades to demonstrate compliance with a local energy ordinance at the time of sale or major renovation.  Trained and certified property assessors ensure accuracy of the information.
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Source: State and Local Energy Efficiency Action Network.

### Summary of Key Facts: City of Boulder SmartRegs Program

*Following completion of sections 1-5, provide a high-level summary in this table. The first two columns may be derived from the 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 <sup>32</sup>	Specific Summary
FEASIBILITY: Can building performance policies help achieve GHG and criteria air pollutant reductions in the required time frame?	<ul style="list-style-type: none"> <li>• Yes. Whether residential, multifamily or commercial and industrial focused, these programs reduce the amount of electricity generated and fossil fuel consumed at power plants. Also, they can lower onsite combustion emissions from furnaces, boilers, and water heaters. Decreased energy demand yields emissions reductions.</li> </ul>	<b>Section 1</b> <ul style="list-style-type: none"> <li>• SmartRegs requires all licensed rental housing (about half of housing stock) permitted before 2001 to meet basic energy efficiency standards by the end of 2018.</li> </ul>
APPROACH: How can energy savings be achieved from local-led building performance policies and programs?	<ul style="list-style-type: none"> <li>• City or county legislators approve local ordinances to adopt policies.</li> <li>• City or county designates a lead organization or agency to administer the policy or program.</li> <li>• Lead agency provides guidelines, standards, and other requirements, and may offer technical tools and support; may also provide criteria for listing eligible service providers (e.g.,</li> </ul>	<b>Section 1</b> <ul style="list-style-type: none"> <li>• City Council passed ordinances updating the City Housing Code and Rental Licensing Code and establishing new baseline energy efficiency requirements for existing rental housing. The SmartRegs Guidebook was integrated into City's Rental Housing License Handbook.</li> <li>• SmartRegs compliance requires inspections and, if needed,</li> </ul>

<sup>32</sup> Derived in part from 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](#)

	<p>energy auditors, licensed inspectors, commissioning agents).</p> <ul style="list-style-type: none"> <li>• Lead agency or other entity evaluates and tracks performance and compliance with policy or program, including estimating energy savings and avoided emissions.</li> </ul>	<p>upgrades to property to meet prescriptive or performance-based (HERS rating) energy compliance.</p> <ul style="list-style-type: none"> <li>• Existing rental housing is required to comply by December 31, 2018.</li> </ul>
<p><b>IMPACT:</b> What energy savings and emission reductions can building performance policies achieve, and are the savings permanent?</p>	<ul style="list-style-type: none"> <li>• Potential energy savings from benchmarking and transparency policies may be as high as 2.5% annually.</li> <li>• More active policies, such as mandatory retrocommissioning, may yield electricity savings of 5%-15% per building.</li> <li>• Energy savings will be a function of the stringency of the building performance policy; upgrades or improvements implemented relative to the prior condition of the building; and operational practices.</li> <li>• Resulting emission reductions vary with the amount and timing of energy savings and power plant emission profiles. Values can be determined with simple estimates or detailed modeling.</li> <li>• Savings lifetimes range from a few years to decades, based on installed measure life, occupant behavior, and replacement rates.</li> </ul>	<p><b>Section 2</b></p> <p>As of June 30, 2017, 76% of rental units complied; upgrades undertaken through the program provide 1,631,736 kWh and 367,040 therms in annual savings.</p> <p>Using EPA eGRID 2014v2 (January 2017) nonbaseload emission factors for electricity in Colorado, the estimated electricity savings translate to emissions avoidance of:</p> <p>1480 short tons CO<sub>2</sub> (at 1814 lb/MWh)  2611 lbs NO<sub>x</sub> (at 1.6 lb/MWh)  1958 lbs SO<sub>2</sub> (at 1.2 lb/MWh)</p> <p>Using EPA AP-42 for small natural gas residential furnaces, 367,040 therms savings translates to avoidance of:<sup>33</sup></p> <p>2160 short tons CO<sub>2</sub>  3384 lbs NO<sub>x</sub>  1440 lbs carbon monoxide (CO)</p> <p>Savings from full compliance (2018) have not been estimated by the program.</p>
<p><b>RELIABILITY:</b> How can impacts of building energy performance policies be documented?</p>	<ul style="list-style-type: none"> <li>• Actual energy use should be collected, normalized, and evaluated following retrocommissioning, upgrades, or other actions taken and compared with the building's</li> </ul>	<p><b>Section 3</b></p> <p>All rental housing units built prior to 2001 are inspected through SmartRegs. The program tracks subsequent building upgrades undertaken for achieving compliance.</p>

<sup>33</sup> Propane, fuel oil, or other fuels have different emission factors from natural gas. More specific information on the population of furnaces, boilers, water heaters, and other equipment affected can provide more accurate emission avoidance estimates.



	<p>prior performance to derive verified savings.</p> <ul style="list-style-type: none"> <li>• Verified electricity savings can be translated into avoided emissions using eGRID, AVERT, or dispatch modeling; standard emissions factors can be used to calculate avoided emissions from reduced onsite fuel use by furnaces, boilers, water heaters, and other combustion equipment, or from savings of purchased steam or chilled water from a district energy system.</li> </ul>	<p>Currently, deemed savings values, based on Xcel Energy utility program savings calculations, are used to estimate annual energy savings from upgrades undertaken.</p>
<p><b>RESPONSIBILITY:</b> Who is responsible for administering and implementing building performance policies?</p>	<ul style="list-style-type: none"> <li>• City or county governments implement and administer the program; localities may establish criteria for eligible service providers, such as energy auditors and commissioning agents.</li> <li>• Guidance and technical assistance can be provided to facility owners and operators; this may also include lists of qualified or eligible service providers.</li> <li>• Property owners are responsible for abiding by the policy, such as having energy assessments or audits performed, having retrocommissioning done, and implementing upgrades and improvements.</li> <li>• Actual building/facility performance should be monitored, tracked, and reported to allow comparison with expected energy savings and assess efficacy of the policy.</li> </ul>	<p><b>Section 4</b></p> <ul style="list-style-type: none"> <li>• The Rental Licensing Program of the City's Planning and Development Services administers the program with City's Climate and Sustainability Division overseeing policy.</li> <li>• Residential rental property owners are responsible to obtain a rental housing license and SmartRegs inspections performed, make any needed improvements, upgrades, and submit paperwork.</li> <li>• Inspections to determine compliance are performed by private-sector licensed inspectors that obtain the necessary credentials determined by the City.</li> <li>• City and Boulder County maintain an EnergySmart Service to support property owners, which provides energy efficiency advisor assistance, installs free efficiency measures, facilitates contacts with contractors and assists with rebate paperwork.</li> </ul>
<p><b>COST:</b> What is the cost structure of building performance standards program, and how much do they cost?</p>	<ul style="list-style-type: none"> <li>• Building owners bear the costs of complying with building performance policies, although localities or utilities may provide services and financial incentives.</li> </ul>	<p><b>Section 5</b></p> <ul style="list-style-type: none"> <li>• Property owners pay for costs of inspections and implementing needed upgrades to meet compliance.</li> </ul>

	<ul style="list-style-type: none"> <li>• Some jurisdictions may cap total compliance costs (e.g., less than 1% of property value) or include cost-effectiveness or payback criteria.</li> </ul>	<ul style="list-style-type: none"> <li>• The City and Boulder County offer EnergySmart services to assist property owners with compliance by providing energy advisors and certain “quick install” measures at no charge to property owners. These services have a funding stream that will continue through 2018.</li> <li>• Utility incentives may be available to property owners for installing certain energy saving measures.</li> </ul>
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## Summary of Findings

*If your state or local 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.*

*Optional—key facts are provided in the previous table.*

## Local-Led Building Performance Program Description

*Provide a brief description of the energy efficiency pathway and the state’s program(s) for implementing it. Succinctly describe how energy savings are achieved; for some approaches, such text may be derived from the SEE Action Guide for States.<sup>34</sup>*

SmartRegs was adopted by the Boulder City Council on September 21, 2010 (ordinance No. 7726). The ordinance updated the City of Boulder Housing Code and Rental Licensing Code to provide baseline energy efficiency requirements for existing rental housing in Boulder. All licensed rental housing, comprising about half of the city’s housing stock or approximately 20,000 units, is required to meet a basic energy efficiency standard by December 31, 2018 or be deemed compliant through exemption.

Exemptions include new units or buildings permitted after July 19, 2001 (which would have met applicable building energy code), manufactured housing, certain accessory dwelling units and attached owner accessory units, and units that have received free weatherization through the Longs Peak Energy Conservation.<sup>35</sup>

Owners of applicable licensed rental units must have their properties inspected by a contractor appearing on the city’s list of SmartRegs Rental Energy Efficiency Inspectors (City Class “G” license) to develop a baseline inspection report. Property owners may comply by meeting requirements through one of two paths—a prescriptive path requiring each unit to achieve at least 100 checklist points (plus two mandatory water conservation points) for each unit, or a performance path requiring a Home

<sup>34</sup> 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](#)

<sup>35</sup> Certain other exemptions, such as for historic buildings and cases of technical impracticality, allow owners to be deemed compliant based on achieving practicable upgrades.

Energy Rating System (HERS) rating of no higher than (i.e., no worse than) 120. If the baseline inspection identifies deficiencies, the property owner must have them rectified. Property owners may arrange for needed corrections or improvements on their own or can use the EnergySmart Service offered by the City and County of Boulder. The service provides EnergySmart Advisors to assist owners to develop a compliance path, provide energy advice, identify and schedule contractors, install certain free “quick install” measures, and help identify and apply for available incentives. A follow-up inspection verifies compliance with the SmartRegs requirements.

All applicable residential licensed rental properties are required to pass a SmartRegs Inspection before the end of 2018 or will be denied a rental license for 2019 and beyond.

As of June 30, 2017, 18,459 units (92% of 2018 goal) were evaluated of which 15,150 units (76% of 2018 goal) complied.<sup>36</sup>

### Section 1: Local-Led Building Performance Program Implementation (Feasibility and Approach)

*Succinctly describe what activities are required to implement this pathway to achieve energy savings; the SEE Action Network Guide for States<sup>37</sup> can be a helpful resource. Then complete the worksheet tables with state, local, or program-specific information.*

The City of Boulder’s SmartRegs program is a local program for assuring that existing rental housing meet certain minimum energy efficiency standards. The approach is to require compliance with the standard by a certain date (December 31, 2018 in this case) as a prerequisite for rental housing license renewal.

The City established a point-based inspection form and lists qualified inspectors that owners must hire to inspect their units under a “prescriptive-based” compliance path. Owners can also opt for a “performance-based” pathway by having a qualified Home Energy Rating System (HERS) rater audit the units. Deficient units must be upgraded and pass re-inspection to meet the SmartRegs requirement.

The City integrated the SmartRegs Guidebook into its Rental Housing License Handbook. It also collaborates with Boulder County to provide an EnergySmart Services (which serves other energy efficiency programs as well as SmartRegs) to provide advice, offer technical support, help identify service providers, and access available incentives.

The City assured funding for the program by using portions of its Climate Action Plan (CAP) tax proceeds. In 2017 and 2018, the City implemented a fee on rental licenses for units not yet compliant with SmartRegs.

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<sup>36</sup> SmartRegs Progress Dashboard accessible from <https://bouldercolorado.gov/plan-develop/smartregs-progress>

<sup>37</sup> 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 1 Worksheet: Local-Led Building Performance Program

### What are the policy's or program's requirements?

All licensed housing, comprising about half of the city's housing stock or about 20,000 units, is required to meet a basic energy efficiency standard by December 31, 2018 or be deemed compliant through exemption. (Ordinance No. 7726)

Owners of applicable rental units must have their properties inspected by a contractor appearing on the city's list of SmartRegs Rental Energy Efficiency Inspectors (City Class "G" license) to complete a baseline inspection. Property owners may comply by meeting requirements through one of two paths—a prescriptive path requiring each unit to achieve at least 100 checklist points (plus two mandatory water conservation points) for each unit, or a performance path requiring a Home Energy Rating System (HERS) rating of no higher than (i.e., no worse than) 120. If the baseline inspection identifies deficiencies, the property owner must have them rectified, and have an inspector review and verify the measure was completed. A revised checklist must be submitted to the program administrator verifying improvements made.

### Are related activities occurring or contemplated that can contribute additional savings?

1. Boulder Building Performance Ordinance (ordinance No. 8071) requires most existing commercial and industrial buildings to undergo annual rating and reporting of energy use, perform energy assessments every ten years, undergo retrocommissioning (RCx) every ten years with implementation of cost-effective energy efficiency measures, and implement a one-time lighting upgrade. <https://bouldercolorado.gov/sustainability/boulder-building-performance-home>
2. Currently the 2017 City of Boulder Energy Conservation Code applies to new construction and major renovations. (Colorado does not have a mandatory statewide building energy code.) More information on the City of Boulder energy code is accessible at <https://bouldercolorado.gov/plan-develop/energy-conservation-codes>
3. The City of Boulder set a goal of reaching net zero energy (NZE) construction through building and energy codes by 2031.

## Section 1 Worksheet: Local-Led Building Performance Program – 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<sup>38</sup> can be a helpful resource. Then complete the worksheet tables with state-specific information.*

Bringing non-compliant buildings' rental residential units into compliance with SmartRegs energy efficiency requirements will save energy and, thus, energy-related pollutant emissions by reducing demand for electricity and onsite fuel (e.g., natural gas).

Once energy savings are quantified, they can be translated into avoided emissions. As discussed in the Introduction 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. For onsite combustion of natural gas and other fuels for space and water heating, there are established emissions factors from the EPA<sup>39</sup> as well as industry, manufacturer, and other sources to allow calculation of pollution avoidance.

The EnergySmart Service tracks upgrades (e.g., equipment installations) in rental housing units to achieve compliance through SmartRegs. Boulder currently estimates energy savings for these upgrades by using deemed factors based on Xcel Energy's utility energy efficiency deemed savings calculations that assume certain average savings for upgrades undertaken. Measurement and verification (M&V) based on bill analyses or field measurements could provide more accurate energy savings estimates.

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.

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 Worksheet: Energy Savings and Emissions Reductions

#### **Are there energy savings goals related to this pathway?**

The objective of the policy is for existing residential rental properties to meet at least certain minimal energy standards based on a checklist of property specifications (insulation, windows, air infiltration, duct condition, HVAC and refrigeration specifications, water/plumbing equipment) or HERS rating. The passing score of 100 checklist point or a HERS rating of 120 approximates compliance with the 1999 IECC model building energy code.

There are no specific Btu or kWh savings goals per unit, per square foot, or for the overall program.

<sup>38</sup> 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](#)

<sup>39</sup> U.S. EPA, AP-42: Compilation of Air Pollution Emission Factors. <https://www3.epa.gov/otaq/ap42.htm>

### Are there consequences of not meeting the targets?

Yes. Owners of applicable rental units that are noncompliant with SmartRegs on the December 31, 2018 deadline will have their rental license expire.

There are no specific targets for SmartRegs' energy savings by unit or for the overall program thus no consequent penalties for not achieving a particular level of energy savings.

### What are historical energy savings?

As of June 30, 2017, the program reports that 76% of units were deemed compliant and that upgrades undertaken by the program provide 1,631,736 kWh and 367,040 therms in annual savings. However, the energy savings estimates are based on deemed values for upgrades and quick install, rather than *ex post* measurement and verification (M&V).

Past estimates of annual savings were provided in previous SmartRegs program-to-date progress reports.

EPA eGRID 2014v2 (January 2017) nonbaseload emission factor for electricity in the region covering Colorado translates the estimate electricity savings into annual emissions avoidance of:

1480 short tons CO<sub>2</sub> (at 1814 lb/MWh)

2611 lbs. NO<sub>x</sub> (at 1.6 lb/MWh)

1958 lbs. SO<sub>2</sub> (at 1.2 lb/MWh)

Ozone season NO<sub>x</sub> avoidance estimation would require information on seasonal energy savings.

EPA AP-42 compilation of air pollutant emission factor can be used to approximate avoided emissions from onsite heating fuels.<sup>40</sup> Neither fuel oil nor propane are used in the relevant properties, so therms savings are of natural gas. Using a simplifying assumption that all natural gas savings are from small residential furnaces, 367,040 therms savings translates to an annual avoidance of:<sup>41</sup>

2160 short tons CO<sub>2</sub>

3384 lbs. NO<sub>x</sub>

1440 lbs. carbon monoxide (CO)

### What future energy & emission savings estimates have been produced and using what assumptions?

Total program energy savings upon full compliance have not been projected.

However, if there is a linear relationship between number of compliant units and energy savings, then simple extrapolation could add about one-third to the most recent annual savings estimates:

2,175,104 kWh, 489,264 therms. But it is not clear that such extrapolation is valid.

<sup>40</sup> U.S. EPA, AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Vol. 1: Stationary Point and Area Sources, <https://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf>

<sup>41</sup> Propane, fuel oil, or other fuels have different emission factors from natural gas. More specific information on the population of furnaces, boilers, water heaters, and other equipment affected can provide more accurate emission avoidance estimates. Cooking appliances are not included in the SmartRegs checklist.

If such extrapolation is valid, then eGRID estimates (based on non-baseload electricity generation factors) annual emissions avoidance would be:

1973 short tons CO<sub>2</sub>

3480 lbs. NO<sub>x</sub>

2610 lbs. SO<sub>2</sub>

Using similar extrapolation and assumptions, AP-42 factors estimates onsite combustion emission avoidance would be:

2880 short tons CO<sub>2</sub>

4511 lbs. NO<sub>x</sub>

1920 lbs. carbon monoxide (CO)

#### Are other environmental impacts estimated?

The SmartRegs prescriptive pathway checklist requires that at least two points come from among nine possible water conservation points regarding low flow showerheads, faucets, faucet valves, toilets, and ENERGY STAR washing machines and dishwashers.

The SmartRegs program-to-date progress report does not provide any estimate of water savings.

#### Are other non-energy benefits estimated?

Not at this time.

#### 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<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, methane, and nitrous oxide emissions.<sup>42</sup> The EPA AVOIDed Emissions geneRation Tool (AVERT) allows for more detailed analyses of avoided emissions on a regional basis.<sup>43</sup> 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.*

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

#### Information gaps:

Energy savings are estimated based on deemed savings values. In principle, actual M&V, such as sampling utility bill data and comparing pre- and post-upgrade usage, with adjustments for weather and occupancy, would provide more accurate energy savings data and, hence, emission avoidance estimation. However, this would be difficult due to frequent tenant turnover and differing behavior among tenants,

<sup>42</sup> See <https://www.epa.gov/energy/egrid>

<sup>43</sup> See <https://www.epa.gov/statelocalclimate/avoided-emissions-and-generation-tool-avert>



Information on equipment used for space and water heating could improve estimation on emissions avoided from onsite combustion.

Ozone season NOx avoidance estimation would require information on seasonal energy savings.

**Critical questions to answer:**

**Other:**

### 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<sup>44</sup> can be a helpful resource. Then complete the worksheet tables with state-specific information.*

The program tracks measures installed to bring non-compliant units into compliance. The program uses a spreadsheet with deemed savings values and formulae based on Xcel Energy's Colorado utility energy efficiency programs to estimate electricity and natural gas savings from installed measures.

M&V approaches such as utility bill analyses or field analyses from samples of upgraded units could provide more accurate energy savings data.

The program imputes avoided CO<sub>2</sub> emissions using factors for both avoided electricity and natural gas use and does not estimate avoided criteria pollutant emissions (such as NO<sub>x</sub> and SO<sub>2</sub>). More accurate estimates of emission impacts (criteria and CO<sub>2</sub>) from electricity savings are possible using EPA's eGRID non-baseload emissions factors (presented in this document) or EPA's AVERT tool. Utility dispatch models can also be used if available. EPA's AP-42 provides emissions factors for residential and commercial natural gas furnaces. Equipment specifications and engineering estimates can also be used.

Avoided pollutant emissions can be used by air quality officials.

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

<b>Are energy savings (electricity and other fuels) regularly estimated or measured?</b>
Inspection based on prescriptive (checklist of features, e.g., insulation levels, equipment installed) and performance (HERS) ratings allow estimation of savings that can be realized if properties not meeting the standard are upgraded to comply.
The program keeps track of measures/upgrades undertaken to achieve compliance. An unpublished spreadsheet with deemed savings values based on those used by Xcel Energy in its utility energy efficiency programs is used to estimate annual energy savings.
<b>Is there currently an evaluation, monitoring, and verification (EM&amp;V) process to confirm energy savings estimates?</b>
Energy savings are estimated using a spreadsheet containing deemed savings values and assumptions based on those used by Xcel Energy for its Colorado utility energy efficiency programs.
<b>Are additional efforts needed to verify energy savings?</b>
M&V approaches, such as sampling utility bill data and comparing pre- and post-upgrade energy usage, with adjustments for weather and occupancy, would provide more accurate energy savings

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<sup>44</sup> 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](#)

data and, hence, emission avoidance estimation. However, tenant turnover and changing occupant behavior can make this difficult.

**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)**

General estimate of benefits

### 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:**

M&V approaches, such as sampling utility bill data and comparing pre- and post-upgrade energy usage, with adjustments for weather and occupancy, would provide more accurate energy savings data and, hence, emission avoidance estimation. However, tenant turnover and changing occupant behavior can make this difficult.

More detailed characterization of natural gas equipment upgrades (sizes and types of equipment) can allow more accurate estimations of avoided criteria air pollutant emissions.

**Critical questions to answer:**

**Other:**

**TIP**

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

**TIP**

*Tip: 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 programs which are analogous to state or local building performance standards. It also offers guidance on “project based M&V” for M&V of individual project savings which is also applicable to state lead-by-example building performance standards. The IPMVP, FEMP M&V Guidance, ASHRAE Guideline 12-2002, and U.S. DOE Uniform Methods Project are recognized as best practice guidelines and protocols and well-established deemed savings databases and Technical Reference Manuals can also be used.*

## Section 4: Policy Implementation (Responsibility)

*Succinctly describe who in the state or locality is responsible for implementing the pathway and ensuring energy savings are achieved; the SEE Action Guide<sup>45</sup> can be a helpful resource. Then complete the worksheet tables with state-specific information.*

The Rental Licensing program within the City's Planning and Development Services is responsible for rental licensing and administers the program.

Residential rental property owners are responsible to have rental housing and SmartRegs inspections performed, make any needed upgrades, and submit paperwork to the city. Inspections are performed by private-sector licensed inspectors that obtain the necessary credentials determined by the City.

Boulder County and the City provide the EnergySmart Service that provides energy efficiency advisor assistance, installs certain free energy efficiency measures, and facilitates contacts with contractors. The EnergySmart Service also supports other energy efficiency programs beyond SmartRegs in the City and County.

### Section 4 State Worksheet: Implementation

#### **What legal authority governs (statute, regulation, executive order, other) this pathway?**

- SmartRegs was adopted by the Boulder City Council on September 21, 2010 (ordinance No. 7726). The ordinance updated the City of Boulder Housing Code and Rental Licensing Code to provide baseline energy efficiency requirements for existing rental housing in Boulder.
- The Rental Licensing Program of the City's Planning and Development Services administers the program.
- Residential rental property owners are responsible to meet have inspections performed, make any needed upgrades, and submit paperwork.
- Inspections are performed by private sector licensed inspectors.
- City and Boulder County maintain the EnergySmart Service to provide advice, technical assistance, install free measures, facilitate contacts with contractors and incentive programs.

#### **Who is responsible for achieving savings? What happens if they are not achieved?**

Applicable rental property owners who do not pass SmartRegs requirements must make upgrades and have their properties re-inspected to show compliance with SmartRegs criteria in order to renew their rental housing license. They are not required to show or achieve specific energy savings levels but must pass a re-inspection to receive their full four-year rental license.

#### **Who monitors and verifies savings?**

The city tracks upgrades installed to achieve compliance. Currently energy savings are deemed based on the measures installed or performed.

<sup>45</sup> 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](#)

<b>What more is needed to monitor and verify savings?</b>
In principle, actual M&V, such as through utility bill analysis (post- versus pre-upgrade energy consumption with adjustments for weather and occupancy) or field sampling, can provide more accurate energy savings information, and can be used to verify or modify (as warranted) deemed savings assumptions but tenant turnover makes this difficult.

Section 4 State Worksheet: Implementation -- Follow Up Items

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

<b>Information gaps:</b>
<b>Critical questions to answer:</b>
<b>Other:</b>

## 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<sup>46</sup> can be a helpful resource. Then complete the worksheet tables with state-specific information.*

Property owners pay for inspections and most energy efficiency measures upgrades implemented to comply with SmartRegs requirements. The City covers the administrative costs of the program, partially from a local Climate Action Plan tax and in part from a fee on rental license renewals for non-compliant units. Boulder City and County both fund an EnergySmart Service that offers advice, technical assistance, and related services for SmartRegs as well as other energy efficiency programs in both the City and County. Some low-cost measures have been installed at no charge to property owners through the EnergySmart Service. Also, some measures are eligible for utility incentives.

### Section 5 State Worksheet: Costs and Funding Mechanisms

#### How are implementation costs funded?

- Property owners are responsible for costs of inspections and implementing needed upgrades.
- Rental residential units not SmartRegs compliant by April 1, 2017 are assessed a \$50 SmartRegs services fee; the City has proposed a \$100 fee in addition to the 2017 \$50 fee for units not compliant by December 31, 2017 to cover administrative costs.
- The City's Climate Action Plan (CAP) tax is authorized through 2020, providing about \$1.8 million annually in support of this and other programs; the CAP tax covered SmartRegs administration until 2017; in 2017 the CAP tax covers 40% and \$50 fee covers 60%; the City anticipates this ratio will be maintained with a new \$100 fee and the city's General Fund contributing in the last year of program compliance. Utility incentives may be available to property owners for installing certain energy saving measures.
- Boulder County with additional City funding collaboratively offer EnergySmart Service for energy efficiency programs in both the City and County, including SmartRegs.
- Some energy efficiency measures are eligible for utility incentives.

#### How have costs / funding varied over time?

The SmartRegs program has been sufficiently funded throughout its tenure. Boulder's CAP tax covered all program costs until 2017. As noted above, a fee imposed during 2017 with a proposed increase in 2018, in addition to the City's General Fund for the last year.

#### How certain is future funding?

Program requires compliance by December 31, 2018. Funding is highly certain through this period.

<sup>46</sup> 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](#)

The City's CAP tax is authorized through 2020 and supported the program from 2011–2017. Fee imposed on property owners for noncompliant units as of April 1, 2017 with planned additional fee of \$100 for units not compliant by December 31, 2017 would cover 60% of program administration costs with CAP and now the City's General Fund covering 40% in the last year.

**What funding would be needed to fully implement the pathway and document energy savings?**

Enhanced M&V, such as utility bill analyses and adjustment for changed occupancy, would require additional effort and, thus, funding.

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:**

**Critical questions to answer:**

**Other:**

Next Steps: Local-Led Building Performance Program Standard

The City of Boulder's SmartRegs program is in its last two years of implementation as full compliance by rental property owners is required by December 31, 2018. As the City continues implementation of SmartRegs and other energy efficiency policies and programs, it can consider discussing with the Colorado Energy Office (CEO) and Air Pollution Control Division of the Colorado Department of Public Health & Environment how these programs support and can be counted in state energy and air quality planning and objectives.

The City can continue to track measures undertaken and estimated energy savings due to SmartRegs. Currently energy savings figures are based on deemed savings values used for Xcel Energy utility energy efficiency programs.<sup>47</sup> The City and State could consider potential enhancements to the deemed savings values used and could better quantify energy savings through use of M&V approaches such as bill analyses and field sampling of data, though consideration of tenant turnover would be needed. Estimation of seasonal energy savings would allow more accurate estimation of avoided air pollutant emissions and could allow air quality managers to better consider "ozone season" impacts and benefits.

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<sup>47</sup> The City of Boulder utilizes an unpublished deemed savings spreadsheet.



Discussions with the Air Pollution Control Division could consider how SmartRegs energy savings can be translated into avoided emissions of Clean Air Act criteria air pollutants to support Colorado and local pursuit of National Ambient Air Quality Standards (NAAQS) and Regional Haze Program compliance. Carbon dioxide (CO<sub>2</sub>) emission avoidance calculations can support State and City greenhouse gas objectives.

This EE Pathway Template used EPA's eGRID tool to estimate avoided emissions from electricity savings. The EPA AVERT tool may provide more accurate results, including seasonal impacts (if seasonal or other time differentiated energy savings are available) and fine particulate emission impacts (PM-2.5). State- or utility-specific tools may be able to provide more accurate estimates of avoided electricity generation emissions.

This Template also used EPA's AP-42 emissions factors document to estimate emissions avoidance from onsite combustion, using a simplifying assumption that all such savings were from small natural gas-fueled residential furnaces. Differentiating among equipment types (furnaces, boilers, water heaters) may also provide ways to improve emission impact analyses. Neither fuel oil nor propane are used in the relevant properties.

The City may also consider discussing with the Department of Public Health & Environment and other pertinent state and local agencies, possible water savings accruing from the policy. These can include possible onsite savings at large apartment buildings with chillers as well as indirect impacts from reduced or avoided electricity generation at thermal power plants (coal, natural gas, nuclear units).

With SmartRegs nearing the end of its implementation phase, the City should consider discussions with CEO and the Air Pollution Control Division on ways to consider and count energy savings from the City's other ongoing (e.g., Boulder Building Performance Ordinance, building energy codes) and prospective programs and policies in state energy planning and for meeting state air quality requirements.

## Appendix: Local-Led Building Performance Program

*To include any relevant Helpful Resources, Detailed Calculations, Additional Questions*

### Helpful Resources

National Association of Clean Air Agencies, “Implementing EPA’s Clean Power Plan: Model State Plans.”

[http://www.4cleanair.org/sites/default/files/Documents/5\\_30\\_2016\\_NACAA\\_State\\_Models\\_FINAL.pdf](http://www.4cleanair.org/sites/default/files/Documents/5_30_2016_NACAA_State_Models_FINAL.pdf)

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.” <https://www4.eere.energy.gov/seeaction/eepathways>

U.S. Department of Energy, Energy Efficiency: Savings Opportunities and Benefits, <https://energy.gov/eere/slsc/energy-efficiency-savings-opportunities-and-benefits>

U.S. Department of Energy, State and Local Solution Center, <http://energy.gov/eere/slsc/state-and-local-solution-center>

U.S. Environmental Protection Agency, AP-42: Compilation of Air Emission Factors, <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors>

U.S. Environmental Protection Agency, AVOIDed Emissions and generation Tool (AVERT), <https://www.epa.gov/statelocalclimate/avoided-emissions-and-generation-tool-avert>

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>

U.S. Environmental Protection Agency, “Including Energy Efficiency and Renewable Energy Policies in Electricity Demand Projections: A Resource for State & Local Air Agencies Preparing NAAQS SIPs.” [https://www.epa.gov/sites/production/files/2015-08/documents/including\\_ee\\_and\\_re\\_policies\\_in\\_ed\\_projections\\_03302015\\_final\\_508.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/including_ee_and_re_policies_in_ed_projections_03302015_final_508.pdf)

U.S. Environmental Protection Agency, Incorporating Energy Efficiency and Renewable Energy into State and Tribal Implementation Plans. <https://www.epa.gov/energy-efficiency-and-renewable-energy-sips-and-tips>

U.S. Environmental Protection Agency, “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/energy-efficiencyrenewable-energy-roadmap>

U.S. Environmental Protection Agency, “Technical Support Document – DRAFT Demonstrating NOx Emission Reduction Benefits of State-Level Renewable Energy and Energy Efficiency Policies.” <https://www.regulations.gov/document?D=EPA-HQ-OAR-2016-0202-0035>