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United States Environmental Protection Agency

Including Energy Efficiency and Renewable Energy Policies in Electricity Demand Projections

A resource for state & local air agencies preparing NAAQS SIPs

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INTRODUCTION

In July 2012, the U.S. Environmental Protection Agency (EPA) published the *Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs Into State and Tribal Implementation Plans* ("the Roadmap")[1] in recognition of the potential impact that energy efficiency and renewable energy (EE/RE) policies and programs can have on reducing air emissions, and in an effort to make it easier for states, local governments, and tribes to use EE/RE policies and programs in their state Implementation Plans (SIPs) and Tribal Implementation Plans (TIPs), particularly those under sections 110, 172, and 175A of the Clean Air Act.[2] The Roadmap lays out four pathways that states, local governments, and tribes can use in their SIP/TIP to account for the emissions impacts of EE/RE policies and programs: (1) *baseline*, (2) *control measure*, (3) *emerging/voluntary measures*, and (4) *weight of evidence*. This document provides additional information on incorporating EE/RE policies in the *baseline emissions projections pathway.*[3]

The baseline pathway adjusts the electricity demand forecast that state, local, and tribal agencies use in their SIPs/TIPs to reflect the impacts of on-the-books EE/RE policies and programs. The baseline pathway can eliminate the need to account for the changes from individual EE/RE policies and programs "after the fact" using a traditional control strategy pathway, an approach states have indicated can be onerous. It also can capture the impact of multiple statewide EE/RE policies, compared to counting individual programs or measures, which streamlines the process of accounting for EE/RE in a SIP/TIP. Finally, the results of applying this approach could provide an estimate of future baseline emissions that reflects the

[1] For details about the Roadmap, visit http://www.epa.gov/airquality/eere/manual.html.
[2] For more information on the types of SIPs that this approach is best suited for, see the Roadmap FAQs at http://www.epa.gov/airquality/eere/resources.html.
[3] State, tribal, and local agencies can include EE/RE policies that are currently on the books in a baseline emissions projection. This is also known as the baseline emissions projection pathway, as detailed in Appendix E of the Roadmap.

impact of EE/RE policies on power plants, which could lower the costs of attaining the National Ambient Air Quality Standards (NAAQS).

Projecting future emissions from the power sector normally requires information from an electricity demand forecast as a basis for predicting how future generation requirements will grow over time. There are a variety of demand forecasts available, including the U.S. Energy Information Administration's (EIA) Annual Energy Outlook (AEO) used for this illustrative analysis, and it is important to understand the assumptions, including which EE/RE programs are already incorporated in the forecast.

EPA has developed a methodology for estimating the energy impacts of key EE/RE on-the-books policies that are not explicitly reflected in the EIA's AEO 2013 electricity projections and including them in their baseline projections. These policies include Energy Efficiency Resource Standards (EERS), dedicated sources of energy efficiency program funding that are adopted in state law and/or codified in rule or order, and renewable portfolio standards. EPA solicited peer and public review of this methodology, and comments received have been addressed and incorporated into this document.

This discussion paper will help agencies understand options for:

- Identifying on-the-books EE/RE policies and estimating the incremental electricity savings of these policies;
- Developing a methodology for projecting a jurisdiction's energy demand both with and without the incremental electricity savings; and
- Estimating the change in power sector emissions attributable to the incremental electricity savings.

This methodology was developed to illustrate how EE/RE policies could be accounted for in the context of National Ambient Air Quality Standards (NAAQS) State Implementation Plans (SIPs), as required in Section 110 of the Clean Air Act. While elements of this analysis may inform issues that are shared between the existing NAAQS SIP requirements and the proposed Clean Power Plan (Section 111d), this analysis is not intended to offer guidance for complying with any requirements of the Clean Power Plan.

SECTION I: METHODS AND APPROACH

EPA is providing a methodology that states responsible for developing SIPs for ozone or other criteria air pollutants could use to estimate their own electricity impacts. Jurisdictions not currently preparing a SIP/TIP, but interested in better understanding the energy and emissions impacts of EE/RE policies, can likewise use EPA's methodology to identify strategies for staying in attainment with the NAAQS.

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EPA used this methodology to conduct a detailed policy review to produce national numeric estimates[4] of the electricity impacts of state EE/RE policies not accounted for in the AEO 2013 forecast. EPA is not, however, providing state-level estimates of EE/RE impacts, nor estimates of resulting emissions reductions. The time period covered by this analysis is 2013–2030.

For this analysis, EPA chose to include a core of high-impact, on-the-books policies that states have generally adopted and illustrate how savings could be estimated for inclusion in NAAQS SIPs. Because these policies are embodied in state legislation or regulation, there is a reasonable expectation that they will continue, and thus could be appropriate for inclusion in the SIPs. EPA recognizes that these assumptions are conservative and acknowledges that there are other types of programs and measures that could be included in SIPs, such as integrated resource plans and voluntary programs. EPA also acknowledges that the assumptions limiting the scope of this illustrative analysis effectively means that not all states with utilities and other entities reporting their EE/RE program impacts to EIA are reflected. The assumptions used for this analysis should not be construed as guidance for states to limit the types of on-the-books policies that may be included in their SIPs. States need to make their own determinations about what policy instruments to include in their SIPs in consultation with their regional EPA office.

For more information on the steps necessary for applying the results of this methodology to estimate baseline emissions impacts, see Section II, Applying Results to Estimate Emissions Reductions.

EPA's approach to estimating the electricity effects of EE/RE policies is described in six steps:

- **Step 1:** Choose a baseline forecast for electricity demand projections (e.g., AEO 2013 or newer).
- **Step 2:** Document EE/RE policies already included in baseline electricity demand projections.
- **Step 3:** Identify on-the-books EE/RE policies not included in AEO or the chosen baseline electricity demand forecast.
- **Step 4:** Estimate the incremental electricity savings of the on-the-books EE/RE policies not included in the chosen baseline electricity demand forecast.
- **Step 5:** Incorporate the incremental electricity impacts of EE/RE policies and lower projected electricity demand in the model.
- **Step 6:** Project the change in power sector emissions attributable to the incremental effects of on-the-books EE/RE policies for future attainment year(s).

Steps 1 through 5 are described in this section, and Step 6 is described in the next section, Applying Results to Estimate Emissions Reductions. The descriptions for each step include explanations for how states may conduct their own analysis, as well as the details of the example analysis that EPA conducted.

[4] For more information, go to http://www.epa.gov/statelocalclimate/state/statepolicies.html.

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Please note that throughout this discussion, EPA refers to *savings* resulting from EE/RE policies. EPA recognizes that renewable energy policies result in electricity generation; however, when compared against an existing forecast, this generation should be viewed as a reduction in the demand forecast. Therefore, incremental renewable energy generation will be treated the same as savings from energy efficiency policies and will be referred to jointly as *savings* for the purposes of this discussion.

Step 1: Choose a baseline forecast for electricity demand projections.

State, local, and tribal governments can choose from a number of information sources which provide electricity demand forecasts that can be used in a SIP.[5] These include the following:

- U.S. Department of Energy, Energy Information Administration, Annual Energy Outlook (AEO)
- North American Electric Reliability Corporation (NERC)
- Regional transmission organizations (RTOs)/independent system operators (ISOs) (e.g., PJM Interconnection, ISO-New England, NYISO)
- Vertically integrated utilities (e.g., a large power company that operates the electricity system for a specific region)
- State energy agencies (e.g., State Energy Office or Public Utility Commission [PUC])
- Regional councils that coordinate energy planning (e.g., Northwest Power and Conservation Council)

Each information source may already reflect different levels of on-the-books EE/RE policies, so it is important to research and document how each of the policies is incorporated. States can determine the most appropriate source for their electricity demand forecast (to be used for the emissions baseline projection) by reviewing the forecast's growth rates, policy assumptions, and economic conditions to ensure that they are aligned with their own assumptions. Keep in mind that if a group of states does their air quality modeling on a regional basis and uses electricity demand forecasts from different information sources, then any inconsistencies between the approaches and assumptions will need to be reconciled.

Organizations develop demand forecasts for a variety of reasons. The purpose of the specific demand forecast may influence which informational resource a state, local, or tribal government chooses. For example, NERC demand forecasts are developed from utility-level forecasts provided to NERC as part of annual, long-term reliability assessments. Available regional forecasts may be developed as part of regional transmission planning activities established by the Federal Energy Regulatory Commission, which may also include separate scenarios incorporating alternative assumptions about environmental regulations. State, tribal, and local governments should work closely with their EPA regional office if their demand

[5] For more detailed information on how to develop a baseline demand forecast, see EPA's Assessing the Multiple Benefits of Clean Energy: A Resource for States at http://epa.gov/statelocalclimate/resources/benefits.html.

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forecast information comes from one of these organizations to ensure that all environmental regulations are properly accounted for in the analysis.

Application of Step 1 in EPA's illustrative analysis

EPA and many states use data from the AEO electricity demand forecast when developing a forecast of emissions from the power sector. EPA relies on EIA's electricity demand forecasts and underlying EE/RE policy assumptions to project future growth in electricity demand for the electric power sector. EPA uses the Integrated Planning Model (IPM™)[6] electricity market model and updates its base case application of the platform with the new AEO forecasts as they become available.[7]

Step 2: Document EE/RE policies already included in baseline electricity demand projections.

When choosing a demand forecast, the state, local, and tribal governments should work with the source of the forecast to understand whether and how the following EE/RE policies are included in the electricity demand forecast:

- Energy efficiency policies or programs funded by utility ratepayers
- Existing Federal appliance and lighting efficiency standards that are already in effect
- New Federal appliance and lighting standards that are scheduled to take effect over the forecast period
- State appliance or lighting efficiency standards (if applicable)
- State building energy codes
- Other applicable policies/programs (e.g., codified local policies)

There are at least two ways that these EE/RE policies are captured in an existing demand forecast:

1. Explicitly modeled policies showing a direct connection between the EE/RE policy and its impacts on energy demand
2. Indirectly, and either fully or partially, through econometric or other assumptions in the model

[6] IPM was developed and is maintained by ICF Resources. It is used for EPA and other federal, state, and commercial clients for analysis of power market issues. It has been used by EPA to analyze the potential impacts of a broad range of air regulations, policies, and legislative initiatives.

[7] EPA typically uses AEO electricity demand projections as input assumptions in its IPM base case. IPM outputs provide estimates of future electric generating unit emissions. It is important to know which version of AEO that EPA is using as inputs for electricity demand projections in a given IPM run. There is typically a brief time lag between EPA's modeling platform updates and the most recent AEO forecast release. For more information, see http://www.eia.gov/forecasts/aeo.

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Application of Step 2 in EPA's illustrative analysis

To understand the EE/RE policy assumptions included in the AEO 2013 forecast, EPA reviewed EIA's documentation for the AEO 2013 reference case forecast and consulted with EIA staff.[8] From the review, it is clear that AEO 2013 explicitly includes the impacts of several existing EE/RE policies,[9] including the following:

- Federal appliance and equipment standards for residential and commercial categories[10]
- Lighting efficiency standards for various types of lighting technologies[11]
- Tax credits for energy-efficient appliances and equipment, and investment tax credits for EE/RE technologies[12]
- Federal energy efficiency programs and funding:
  - American Recovery and Reinvestment Act[13]
  - State Energy Program and Energy Efficiency and Conservation Block Grant
  - Weatherization Program
  - Green Schools
  - Smart Grid expenditures
- Building energy codes for residential and commercial new construction:[14]
  - For example, all states adopt and enforce International Energy Conservation Code (IECC) 2006 (Residential Building Code) by 2017
- State Renewable Portfolio Standards (RPS):[15]
  - 30 states and Washington, D.C., effective as of October 2012

Step 3: Identify on-the-books EE/RE policies not included in chosen baseline electricity demand projections.

State, tribal, and local governments should review the EE/RE assumptions within the respective forecast or talk with the organization providing the demand forecast to determine which on-the-books state EE/RE policies are incorporated in their forecast, and what on-the-books EE/RE policies should be evaluated for incremental EE/RE savings. States will need to be aware of differences between current year (i.e., first year) and cumulative (those that persist and

[8] EIA documents their assumptions whenever they produce an updated AEO forecast. It is important to review the most current assumptions within the respective AEO forecast.

[9] This discussion highlights several of the most important policies, but it is not intended to be a comprehensive review of AEO assumptions. See http://www.eia.gov/forecasts/aeo/assumptions/pdf/appendix_a.pdf for additional information.

[10] U.S. EIA (2013c), Appendix A, pp. 187–204.

[11] Ibid.

[12] Ibid.

[13] U.S. EIA (2013c), pp. 32.

[14] Ibid.

[15] U.S. EIA (2013a), pp. 14–17.

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accumulate over a period of time) impacts associated with any chosen policies, and document them appropriately for use in calculations.

EE/RE policies represent just one of many assumptions made in electric generation baseline emissions forecasts. Any EE/RE policies that are explicitly included in an electric generation baseline projection should document the following:

1. Policy name
2. Whether the policy is codified in state or local rule
3. Year enacted
4. When the policy requirement sunsets
5. Policy requirements (e.g., targets in megawatt hours [MWh] or percentage)
6. Annual energy savings in the base year (MWh)
7. Annual and cumulative energy savings in the future attainment year (MWh)

Application of Step 3 in EPA's illustrative analysis

EPA identified on-the-books EE/RE policies not explicitly included in AEO for the illustrative example provided in this document.[16,17] These policies are as follows:

- Energy Efficiency Resource Standards
- Energy efficiency programs funded by public benefits funds
- Energy efficiency programs funded by the Regional Greenhouse Gas Initiative[18]
- Energy efficiency programs funded by Forward Capacity Market revenues[19]

When EPA performed this step to understand the EE/RE policy assumptions included in the AEO forecast, EPA reviewed EIA's documentation for the AEO reference case forecast and consulted with EIA staff; EPA recommends that states consider pursuing a similar approach when using a different forecast, or a newer version of the AEO forecast.

Step 4: Estimate the incremental electricity savings of the on-the-books EE/RE policies not included in chosen baseline electricity demand projections.

Whether using a version of the AEO forecast or a different forecast entirely, the same conceptual approach applies:

[16] Other EE programs, such as integrated resource plans (IRPs), are also important instruments that states may choose to include in their own analyses and SIPs; however, EPA chose to focus on these major policy types that were enforceable and would produce the greatest energy savings impacts across the states.

[17] EPA last checked for changes to state EE/RE policies on August 4, 2014.

[18] For more information, see http://www.rggi.org.

[19] For example, several states participating in ISO-NE's forward capacity market are using auction revenues to fund energy efficiency.

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1. Begin with the baseline electricity demand forecast for the selected jurisdiction. Ensure that the jurisdictional boundaries for this forecast are consistent with those of the policies evaluated.
2. Estimate the electricity savings associated with the on-the-books EE/RE policies already embedded in the baseline electricity demand forecast. This involves evaluating the historical savings for these policies and establishing an assumption for the share of savings that would carry forward in subsequent years through the forecast period.[20]
3. Estimate the electricity savings associated with the on-the-books EE/RE policies not included in the baseline electricity demand forecast.[21] This can be done by using EE/RE policy targets established in law, where applicable, and/or estimates of savings by EE/RE program dollars spent.[22]
4. Where a portion of the embedded electricity savings of the EE/RE policies is indirectly factored into the baseline forecast, that portion of embedded savings should be subtracted from the total program savings of these EE/RE policies to calculate the incremental electricity savings beyond the baseline electricity forecast.

See Appendix A of this document for a detailed examination of how EPA estimated the energy savings of the following policies not explicitly included in the AEO forecast:

- Energy Efficiency Resource Standards
- Energy efficiency programs funded by public benefits funds (PBFs)
- Energy efficiency programs funded by the Regional Greenhouse Gas Initiative (RGGI)
- Energy efficiency programs funded by Forward Capacity Market (FCM) revenues

Step 5: Incorporate the incremental electricity impacts of EE/RE policies and lower projected electricity demand in the model.

Using the incremental electricity savings resulting from Step 4, states can apply these savings as adjustments to the baseline electricity demand projections, thus creating a revised electricity demand projection. This may include lowering the demand growth rate, integrating savings from avoided transmission and distribution losses, or accounting for the timing (e.g., peak or non-peak demand periods) of the electricity savings from specific EE/RE policy types that affect determination of the marginal generating asset displaced. The form of savings data will depend on the quantification approach for calculating emissions in Step 6.

National Results

The results of EPA's analysis are presented here to illustrate the expected relationship among three main components of this analysis: (1) baseline electricity demand projections (AEO baseline), (2) projections adjusted to reflect a scenario absent embedded savings, and

[20] The specifics of this methodology are further detailed in Appendix A.
[21] It is important to avoid double counting of policies. For example, if a state has an EERS and a public benefits fund (PBF), then it may be assumed that the PBF spending goes toward meeting the EERS, so a state would only consider the EERS.
[22] The specifics of this methodology are further detailed in Appendix A.

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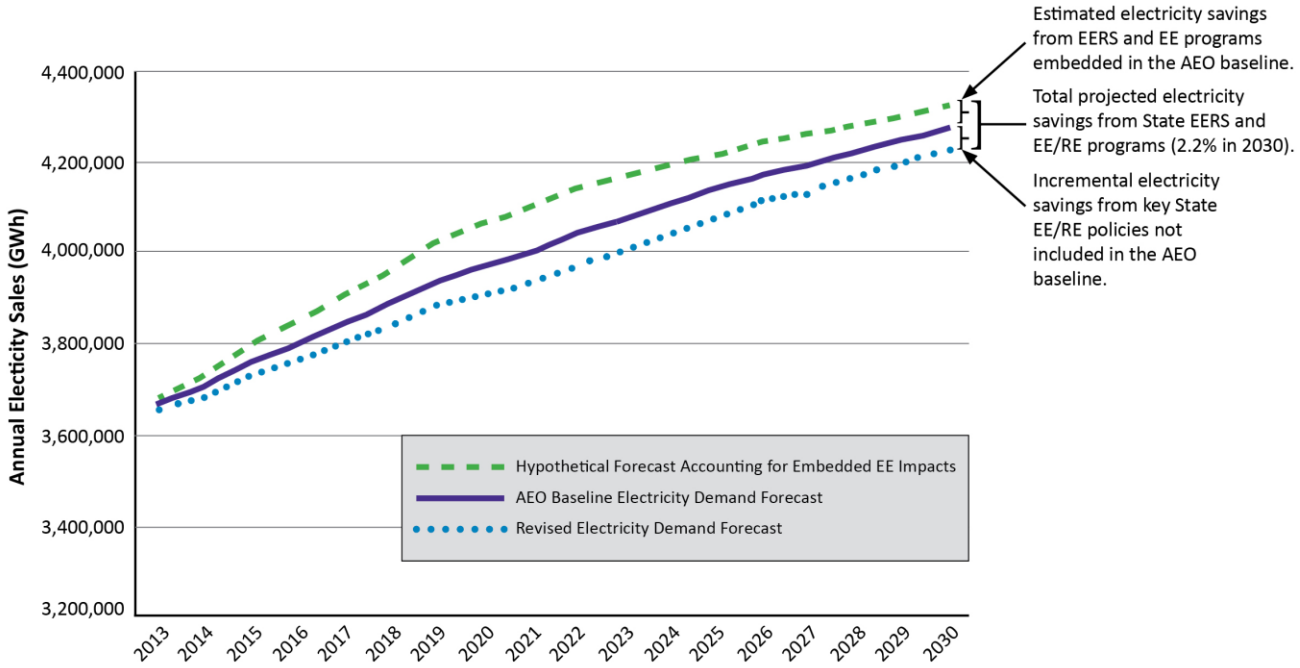
(3) revised electricity demand projections capturing both the embedded and incremental savings effects.

Figure 1. National Results



Important Sources of Uncertainty

In conducting its analysis, EPA identified important sources of uncertainty that may be relevant to states' own analyses; these are discussed in detail in Appendix A. Generally, states should keep in mind the following when employing similar methods:

- The impacts of state EE/RE policies embedded in the baseline electricity demand projections: It is sometimes the case that sources of demand projections may not know with absolute certainty what policy impacts are embedded in their projections, often due to using source data collected from various sources. Therefore, it is important to recognize that even the best assumptions developed for embedded effects may have limitations.
- The approval of sufficient EE/RE program budgets necessary to meet the specified targets: Achievement of program targets is usually dependent upon approval of adequate energy efficiency program budgets, which may be affected by PUC approvals, varying levels of funding from legislatures, and other factors. Uncertainty related to these factors may need to be taken into account.

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SECTION II: APPLYING RESULTS TO ESTIMATE EMISSIONS REDUCTIONS

Section I focused on the electricity aspects of the EE/RE policies analyzed. In Section II, the resulting incremental electricity savings are used to estimate the emissions reductions associated with these electricity savings.

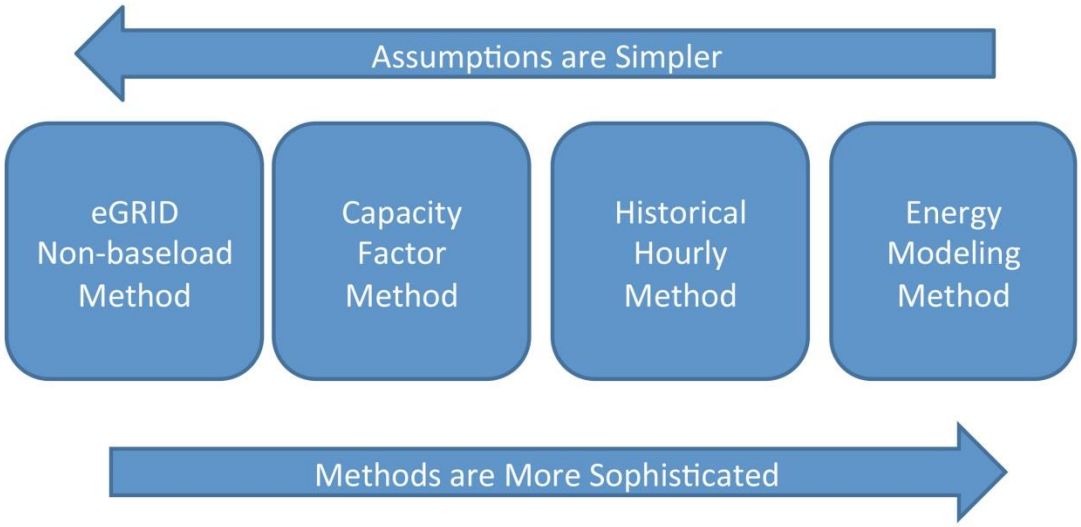
Step 6: Project the change in power sector emissions attributable to the incremental effects of on-the-books EE/RE policies for future attainment year(s).

State, tribal, and local governments have several methods available for quantifying the avoided or displaced emissions from fossil fuel generation as a result of electricity savings from EE/RE policy/program implementation. These methods range from basic to sophisticated, and vary in complexity, rigor, resource implications data requirements, and temporal and spatial scales of outputs.[23]

Appendix I of EPA's Roadmap suggests which emission quantification approaches would work in different situations, and include the following:

- Basic approach: eGRID sub-region "non-base load" emission rates
- Basic approach: Capacity factor emission rates
- Midrange approach: Historical hourly emission rates (e.g., EPA's AVERT[24])
- Sophisticated approach: Electricity market models (also referred to as energy models)

Figure 2. Emissions Quantification Approaches



[23] All are further detailed in the Roadmap, Appendix I.

[24] Visit www.epa.gov/AVERT for further details on EPA's AVoided Emissions and geneRation Tool.

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Appendix I of the Roadmap also suggests that the quantification approaches that work for the baseline pathway described in this paper would include the following:[25]

- Energy model approach
- Historical hourly emission rate approach
- Alternative emissions projection tools or analysis

For more sophisticated analyses and/or if the projections for energy efficiency policies and programs extend out more than 5 years, a state, tribal, or local government should develop projections of how future generation may change over time. The jurisdiction should examine each nonattainment area and assign emission rates to new units expected to come online, or exclude planned retired plants in the jurisdiction's future emission rates. There are several organizations that project how electric generators will meet future demand and react to new environmental regulations. EPA recommends obtaining projections of future electric generation growth from EPA, EIA, electric grid operators, RTOs, ISOs, or NERC, if possible.

SECTION III: CONCLUSION

EPA believes that energy efficiency and renewable energy policies and programs have the potential to reduce multiple pollutants in a cost-effective manner, and can be one tool that states, local governments, and tribes can use to help meet the NAAQS. This paper provides analytical steps that can be used to incorporate EE/RE policies into SIP/TIP baseline electricity demand projections. EPA welcomes feedback and would like to hear from states, local governments, and tribes about what additional information might be useful to support their development of SIP/TIP baselines that incorporate energy efficiency and renewable energy.

[25] These quantification methods are only suggestions. Each state should consult with its EPA Regional Office on the type of alternative emission projection tools or analysis that they plan to use in a SIP/TIP submission.

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APPENDIX A: METHODOLOGY AND ANALYTICAL STEPS FOR ESTIMATING EE/RE POLICY IMPACTS

EPA developed the methodology described herein to conduct a detailed policy review to produce national numeric estimates of the electricity impacts of state EE/RE policies not accounted for in AEO 2013 forecast. The time period covered by this analysis is 2013–2030.

EPA applied the following analytical steps to estimate the projected annual energy savings of energy efficiency policies:

- **Step 1:** Generate a baseline (i.e., business as usual [BAU]) forecast of state electricity sales consistent with AEO 2013 regional forecasts.
- **Step 2:** Estimate the projected impacts of key state on-the-books energy efficiency policies already embedded in the AEO 2013 forecast of electricity sales.
- **Step 3:** Estimate projected total energy efficiency savings from key state on-the-books energy efficiency policies adopted or updated as of June 2013:
    - EERS (25 states)
    - Funding for energy efficiency programs in non-EERS states (e.g., dedicated funding from PBFs, RGGI, and FCM revenues)[26,27] (five states)
- **Step 4:** Generate a state-adjusted national energy forecast that reflects the energy savings not captured in (i.e., incremental to) the baseline forecast.

For renewable energy policies, EPA applied the following key analytical steps to estimate the projected annual energy impacts:

- **Step 1:** Estimate renewable energy generation from RPS policies adopted or revised between October 2012, when the AEO 2013 RPS assumptions were formulated, and June 2013, when this analysis was released for review (two states).
- **Step 2:** Generate a state-adjusted forecast reflecting policy changes.

Methodology for Generating a Baseline Forecast of State Electricity Sales to Represent AEO 2013 Regional Forecasts

State-level baseline sales[28] data were developed by first using 2012 historical state sales data from the EIA[29] and then applying the electricity sales growth rates from AEO 2013. AEO 2013-based annual average growth rates (AAGR) were calculated for each Electricity Market Module (EMM) region across the 2012–2040 forecast period. These regional growth rates were then applied to the 2012 historical sales for each state. For states whose boundaries cross EMM

[26] For more information, see http://www.rggi.org.
[27] For example, several states participating in ISO-NE's forward capacity market are using auction revenues to fund energy efficiency.
[28] Note that AEO 2013 does not include state-level forecasts, so incremental impacts are calculated against the BAU electricity sales forecast developed as described in Appendix A.
[29] U.S. EIA (2013b).

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regions, state-specific growth rates were derived by using a historical sales weighted average of EMM region growth rates.[30] The 2012–2040 AAGR was used to forecast sales for 2013–2040. Table 1 shows the EMM regions and the AAGRs used to forecast sales for each state.

Table 1. Electricity Market Module Regions and AEO 2013 Sales Growth Rates by States

State/Jurisdiction	Electricity Market Module Region	Average Annual Growth Rates (2012–2040)
Arizona	AZNM, NWPP	1.30%
Arkansas	SPNO, SPSO, SRDA	0.87%
California	AZNM, CAMX, NWPP	0.90%
Colorado	AZNM, NWPP, RMPA, SPNO, SPSO	1.22%
Connecticut	NEWE	0.22%
Delaware	RFCE	0.51%
District of Columbia	RFCE	0.51%
Florida	FRCC, SRSE	1.18%
Hawaii	HI[31]	0.78%
Illinois	MROW, RFCW, SRGW	0.43%
Indiana	RFCW	0.41%
Iowa	MROW, SRGW	0.54%
Maine	NEWE	0.22%
Maryland	RFCE, RFCW	0.50%
Massachusetts	NEWE	0.22%
Michigan	MROE, MROW, RFCM, RFCW	0.33%
Minnesota	MROW	0.54%
Montana	MROW, NWPP, RMPA	0.94%
Nebraska	MROW, RMPA	0.55%
Nevada	AZNM, NWPP	1.20%
New Hampshire	NEWE	0.22%
New Jersey	NYUP, RFCE	0.50%

[30] Each state was first mapped to one or more EMM regions, depending on the geographical overlap. The share of each state's electricity sales (from EIA-861) in a given EMM region was calculated as a percentage of total sales for that state. These shares represent the contribution of each EMM region's growth rate to the state's growth rate. The growth rate of each EMM region overlapping a state was then weighted by the share of each state's sales within that EMM region.

[31] Because AEO 2013 includes the contiguous lower 48 states only, the U.S. Average Annual Growth Rate was applied for Hawaii. Alaska is not included in this analysis because the state has no on-the-books state EE/RE policies meeting the definition for inclusion in this analysis.

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State/Jurisdiction	Electricity Market Module Region	Average Annual Growth Rates (2012–2040)
New Mexico	AZNM, NWPP, RMPA, SPSO	1.18%
New York	NEWE, NYCW, NYLI, NYUP, RFCE	0.20%
North Carolina	SRCE, SRVC	1.10%
Ohio	RFCW	0.41%
Oregon	NWPP	0.97%
Pennsylvania	NYUP, RFCE, RFCW	0.48%
Rhode Island	NEWE	0.22%
Texas	AZNM, ERCT, SRDA, SPSO	0.89%
Vermont	NEWE	0.22%
Washington	NWPP	0.97%
Wisconsin	MROE, MROW, RFCW	0.41%

Methodology for Estimating Energy Savings of State Energy Efficiency Policies Embedded in AEO 2013

The goal of this analysis was to produce numeric estimates of the energy impacts of state EE/RE policies not accounted for in AEO 2013 forecast that inform a national estimate. In order to estimate the impacts *not accounted for* in the baseline electricity sales forecast, the analysis necessarily must define the impacts *already accounted for* in the baseline. Therefore, we define *embedded* savings in this analysis as those impacts already accounted for in the AEO 2013 reference case forecast. EPA estimated the embedded savings and subtracted them from estimates of total state EE/RE policy impacts to yield the incremental savings effects on the baseline, thus avoiding potential double counting.

AEO 2013 does not *explicitly* include the impacts of state energy efficiency policies such as EERS and dedicated sources of energy efficiency program funding. However, we understand the AEO forecasts to *implicitly* represent the impacts of those energy efficiency policies addressed in this analysis. This implicit representation of energy efficiency occurs in two key ways:

1. The AEO forecast incorporates historical data that reflect energy consumption levels and trends influenced by state-level energy efficiency policies in place at that time. The effects of these existing policies lower the sales level during the last historic year (e.g., if 2011 is the last historical year of data in AEO 2013, then the 2011 energy demand was lower than it would have been in the absence of existing energy efficiency policies) and may also affect AEO's near-term growth rates partially derived from recent historic demand growth trends (which otherwise would have been expected to be higher in the absence of existing energy efficiency policies).

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2. The AEO forecast assumes an ongoing and persistent savings from utility sector energy efficiency programs as reported in EIA-861 that expire after a defined period of time, or *measure lifetime*. Typically, the impacts of energy efficiency programs are estimated in terms of first-year savings, plus the persistent (cumulative) savings realized from that program (or energy efficiency measure) over an assumed measure lifetime (a 10-year lifetime is used for this analysis).[32] EPA's assessment of the AEO forecast, however, does not identify the expected end of these persistent savings (i.e., does not identify a consequent increase in energy intensity that should accompany the end of an energy efficiency savings stream), leading EPA to understand that the AEO forecast assumes that any measure reaching the end of the measure's lifetime will be replaced by an equal measure, providing an ongoing stream of savings beyond the lifetime of one efficiency measure.[33]

Recognizing that AEO 2013 is implicitly affected by these historic and persistent effects of state energy efficiency policies and programs, EPA concludes that some portion of the total policy- and program-induced energy efficiency savings are embedded in the AEO 2013 regional forecast and the AEO 2013-based state-level BAU forecast. EPA therefore developed a methodology for estimating these embedded savings for each state.[34]

This methodology involves two steps: estimating national savings from energy efficiency, and then allocating these national savings to the states covered in the analysis.

For national savings, reported cumulative energy efficiency savings from programs implemented in prior years (reported as *annual effects* via EIA-861, and as aggregated in EIA's Electric Power Annual for residential, commercial, and industrial sectors) are divided by reported electricity sales (also reported via EIA-861, and as aggregated in EIA's Electric Power Monthly, Retail Sales of Electricity by State by Sector by Provider). This calculation yields national average energy efficiency savings as a percentage of sales within the given year. Because the national average savings is calculated from the most recent year's total cumulative savings, this value is divided by the average energy efficiency measure lifetime, here assumed

[32] In this analysis, *first-year* energy efficiency savings refer to the savings in the first year that a specific measure is implemented, and *cumulative* energy efficiency savings refer to the aggregate stream of savings resulting from a measure. For example, consider that Program X installs 100 units of energy-efficient equipment every year for 10 years, and those installations save 100 MWh per year. In Program X's first year, both first-year savings and cumulative savings are 100 MWh. In the second year, first-year savings are again 100 MWh because another 100 units of the energy-efficient equipment has been installed, but the cumulative savings are 200 MWh because both the 100 units from the first year and the 100 units from the second year are each saving 100 MWh per year.
[33] Synapse Energy Economics (2012).
[34] During peer review, one reviewer questioned whether it is conceptually possible to calculate embedded savings from AEO because the level of detail regarding EIA's assumptions in AEO is not fully transparent, so determining specific embedded savings has inherent uncertainty.

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to be 10 years. This yields a percentage representing the ongoing annual effects of energy efficiency that are embedded in the AEO forecast (0.38 percent).[35]

Allocating the national average embedded savings to the individual states in this analysis uses state-specific data from the EIA-861. These embedded savings estimates used in the EPA analysis are presented in Table 2.

Table 2. Energy Efficiency Savings Estimated to be Embedded in AEO 2013[36]

State	Savings Estimated to be Embedded in AEO 2013 (percentage of BAU sales in each year)
Alabama	0.08
Alaska	0.01
Arizona	0.54
Arkansas	0.04
California	1.37
Colorado	0.47
Connecticut	1.34
Delaware	0.00
District of Columbia	0.06
Florida	0.36
Georgia	0.07
Hawaii	0.03
Idaho	0.62
Illinois	0.21
Indiana	0.17
Iowa	0.78
Kansas	0.02
Kentucky	0.10
Louisiana	0.00
Maine	0.54
Maryland	0.25
Massachusetts	0.63
Michigan	0.28
Minnesota	1.31
Mississippi	0.05
Missouri	0.05

[35] Synapse Energy Economics (2014).
[36] Synapse Energy Economics (2014), Exhibit 3.

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State	Savings Estimated to be Embedded in AEO 2013 (percentage of BAU sales in each year)
Montana	0.59
Nebraska	0.10
Nevada	0.62
New Hampshire	0.49
New Jersey	0.10
New Mexico	0.19
New York	0.69
North Carolina	0.13
North Dakota	0.02
Ohio	0.32
Oklahoma	0.07
Oregon	0.77
Pennsylvania	0.31
Rhode Island	1.12
South Carolina	0.11
South Dakota	0.03
Tennessee	0.18
Texas	0.15
Utah	0.66
Vermont	1.54
Virginia	0.03
Washington	0.74
West Virginia	0.02
Wisconsin	0.66
Wyoming	0.07

EPA estimates embedded savings for each state by multiplying the percentages shown in Table 2 by the BAU sales for that state. EPA only estimated embedded savings for the years in which states achieved savings from energy efficiency policies and, to the extent possible, for the segments of state electricity load to which the EE/RE policies apply. The next section of this paper includes discussion of how the cumulative total of the state's embedded savings is subtracted from the state's total energy efficiency policy savings to yield the impacts that are incremental to AEO 2013.

Methodology for Estimating Projected Energy Efficiency Savings from Energy Efficiency Policies

EPA scanned all 50 states to determine which had adopted one or more of the EE/RE policies included in this analysis as of June 2013. EPA then reviewed the relevant design details for each

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state policy using publically available information, such as state legislation, state rules and regulations, PUC orders, summary reports from the American Council for an Energy-Efficient Economy (ACEEE),[37] and the Database of State Incentives for Renewables and Efficiency (DSIRE).[38]

EPA estimated state-level energy efficiency savings from EERS policies and dedicated sources of energy efficiency program funding that are adopted in state law and/or codified in rule or order. Because these categories are not mutually exclusive, EPA took steps to avoid double counting of energy savings for states with EERS by treating EERS targets as overall goals that include savings from individual PBF-funded programs, RGGI-funded programs, and FCM revenues (in the states that have them). EPA found that qualifying individual programs were not incremental to the EERS target, so each state with reported savings has either EERS savings or dedicated sources of energy efficiency program funding.[39] EPA did not apply an adjustment for net versus gross savings; this issue is discussed further in "Important Sources of Uncertainty in the Analysis" below.

For each policy category, EPA estimated annual first-year electricity savings (i.e., savings achieved in a given year from programs implemented during that year) and cumulative savings from energy efficiency measures implemented in the current year and past years. EPA calculated cumulative savings using state-specific measure lifetimes (see Table 3 below) and assumed no decay of savings over the life of the measures.[40] EPA used a default lifetime of 10 years where state-specific assumptions were not available. EPA did not estimate first-year savings beyond the requirements of each state's policy period, except for a limited set of states whose policy indicated a continuation of savings beyond the policy period. For the majority of states, however, the forecast reverts to the AEO 2013 reference case-based forecast after the energy efficiency policy period ends.

Table 3. Measure Lifetime by State[41]

State	Measure Lifetime (years)
Arizona	9.8
California	9.1
Connecticut	9.6
Hawaii	9.2
Massachusetts	11.6
Minnesota	13.8
New Mexico	8.9
Oregon	11.2

[37] ACEEE (2012).
[38] DSIRE (2013).
[39] For more information, see http://www.epa.gov/statelocalclimate/state/statepolicies.html.
[40] An alternative, conservative assumption of linear degradation of measure lifetime, is available to states possessing the appropriate data.
[41] ACEEE (2014).

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State	Measure Lifetime (years)
Rhode Island	11.1
Utah	11.3
Vermont	11.0
Wisconsin	11.4
Default	10.6

Energy Efficiency Resource Standards

An EERS is a policy that sets targets for energy savings over a specified timeframe from end-use energy efficiency programs operated by utilities or other program administrators. States typically specify annual first-year or cumulative targets as percentages of electricity sales or as absolute energy savings. They use different bases for specifying EERS goals: Some states specify goals based on sales from investor-owned utilities, while others have mandated savings (i.e., MWh) targets based on total sales or a subset of total sales.

EPA estimated energy savings for each state using formulas specific to the state's EERS, as shown below. EPA identified the appropriate sales basis for each state and, if the basis was not total sales, EPA used 2012 utility-level sales data from EIA-[42] and AEO 2013-based growth rates to develop baseline forecasts of sales of affected utilities (see Table 1). For most states, EPA assumes full achievement of EERS targets for all years during the compliance period. However, there are some states for which EPA does not assume full achievement of EERS targets in all years because of the way that the programs are designed. One example is an EERS policy that includes cost/rate caps or other design features (e.g., counting savings from building energy codes or historical energy efficiency programs) that may not lead to incremental energy savings relative to AEO 2013,[43] or are otherwise inconsistent with the EERS targets.[44] In addition, savings were not estimated for purely voluntary EERS.[45]

The general formulas used to estimate annual first-year and cumulative energy savings for each year (t) were:

1. **EERS With Annual First-Year Energy Efficiency Savings Targets Specified in Percent Terms**

$$A(t) = r(t) * Z(t-1)$$

[42] U.S. EIA (2014).

[43] Building energy codes are already incorporated in the AEO 2013 forecast, so any associated savings from those existing building codes already assumed in AEO 2013 would not be incremental to the AEO forecast, and thus are removed from the applicable state's EERS target. However, if the state/utility program action motivates new code adoption and implementation, those codes are incremental to any savings already embedded in the AEO forecast.

[44] For more information, see the individual state summary sheets at http://www.epa.gov/statelocalclimate/state/statepolicies.html.

[45] EPA acknowledges that it is possible that some savings may result from a voluntary EERS, so this is a methodological conservatism.

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$C(t) = A(t) + A(t-1) + \ldots + A(t-L+1)$
$I(t) = C(t) - E(t)$
$Z(t) = B(t) - I(t)$

where:
r is the annual first-year percent savings target,
A is the annual first-year energy savings,
L is the measure lifetime,
B is the baseline sales of utilities affected by these specific policies,
C is the cumulative energy savings,
E is the cumulative savings embedded in the AEO 2013 forecast,
I is the cumulative savings incremental to the AEO 2013 forecast, and
Z is the adjusted sales after application of cumulative incremental savings.

2. EERS With Annual First-Year Energy Efficiency Savings Targets Specified in Absolute Terms

$C(t) = A(t) + A(t-1) + \ldots + A(t-L+1)$
$I(t) = C(t) - E(t)$
$Z(t) = B(t) - I(t)$

where:
A is the annual first-year energy savings target,
L is the measure lifetime,
B is the baseline sales of utilities affected by these specific policies,
C is the cumulative energy savings,
E is the cumulative savings embedded in the AEO 2013 forecast,
I is the cumulative savings incremental to the AEO 2013 forecast, and
Z is the adjusted sales after application of cumulative incremental savings.

3. EERS With Cumulative Energy Efficiency Savings Targets Specified in Percent Terms

$A(t) = C(t) - C(t-1) + A(t-L)$

If $r(t)$ is available,
$C(t) = r(t) * B(t)$
$I(t) = C(t) - E(t)$
$Z(t) = B(t) - I(t)$

If $r(t)$ is not available,
$Z(t)$ is calculated by interpolation
$I(t) = B(t) - Z(t)$
$C(t) = I(t) + E(t)$

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where:
r is the cumulative percent savings target,
A is the annual first-year energy savings,
L is the measure lifetime,
B is the baseline sales of utilities affected by these specific policies,
C is the cumulative energy savings,
E is the cumulative savings embedded in the AEO 2013 forecast,
I is the cumulative savings incremental to the AEO 2013 forecast, and
Z is the adjusted sales after application of cumulative incremental savings.

4. **EERS With Cumulative Energy Efficiency Savings Targets Specified in Absolute Terms**

$A(t) = C(t) - C(t-1) + A(t-L)$

If $C(t)$ is available,
$I(t) = C(t) - E(t)$
$Z(t) = B(t) - I(t)$

If $C(t)$ is not available,
$Z(t)$ is calculated by interpolation
$I(t) = B(t) - Z(t)$
$C(t) = I(t) + E(t)$

where:
C is the cumulative energy savings target,
A is the annual first-year energy savings,
L is the measure lifetime,
B is the baseline sales of utilities affected by these specific policies,
E is the cumulative savings embedded in the AEO 2013 forecast,
I is the cumulative savings incremental to the AEO 2013 forecast, and
Z is the adjusted sales after application of cumulative incremental savings.

Some special considerations that warranted adjustments to the general formulas were as follows:

1. **RPS that define energy efficiency as a qualifying resource:** The states of Nevada and North Carolina have RPS that treat energy efficiency as a qualifying resource, subject to a quantitative limit. The National Energy Modeling System (NEMS), which is used to produce the AEO, does not currently have the capability to evaluate tradeoffs between energy efficiency and renewable energy in cases where both are eligible RPS resources; so, it relies on renewable energy to meet RPS requirements. For RPS policies explicitly included in AEO 2013, no incremental energy savings were estimated.

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2. **Compliance type and cost/rate caps:** Several states have EERS that use cost-containment provisions or other design features that may constrain the ability of energy efficiency program administrators to meet the EERS targets with incremental savings relative to the AEO. EPA identified five states with such design features—Arizona, Illinois, Minnesota, Ohio,[46] and Texas—and relied on available state-specific academic reports,[47] integrated resource plans,[48] and other studies[49] to make downward adjustments to the nominal EERS targets to reflect these design features, as appropriate.[50]

3. **"All cost-effective energy efficiency" targets:** Six states—Connecticut, Maine, Massachusetts, Rhode Island, Vermont, and Washington—require utilities (or other energy efficiency program administrators) to implement all cost-effective energy efficiency. In states with an "all cost-effective energy efficiency" requirement *and* EERS targets, EPA used the EERS targets until the policy sunset date and then assumed first-year savings equivalent to the last policy year, going forward.[51] In states with an "all cost-effective energy efficiency" target *without* an EERS target through 2020, EPA estimated savings based on utility plans[52] and energy efficiency resource potential studies.[53]

4. **State legislature or PUC disapproval of energy efficiency program budgets necessary to meet EERS targets:** Two states—Florida and Wisconsin—did not approve requests for the energy efficiency program budget increases necessary to meet growing EERS targets, opting instead to maintain current energy efficiency program offerings. In these states, EPA reduced the EERS nominal targets to the levels achieved with the approved energy efficiency program budgets.[54]

Energy Efficiency Program Funding

In states without an EERS policy, but with one or more sources of energy efficiency funding, EPA developed an approach for estimating the associated savings. The sources of funding evaluated by EPA include public benefits funds (PBFs), funding from the proceeds of Regional Greenhouse Gas Initiative (RGGI) allowance auctions, and funding from Forward Capacity Market (FCM) payments. Data for these energy efficiency programs are mainly available in terms of program

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[46] EPA recognizes that Ohio's authorizing law was altered in June 2014 by SB 310, which froze cumulative savings at 4.2 percent (the value expected to be achieved by the end of 2014) for 2015 and 2016. EPA revised its analysis and forecast to reflect this change.
[47] Satchwell (2011).
[48] Ameren Illinois (2010), ComEd (2010).
[49] Good Company Associates (2010).
[50] For more information, see http://www.epa.gov/statelocalclimate/state/statepolicies.html.
[51] EPA acknowledges that this is likely a methodological conservatism.
[52] Connecticut DEEP-BETP (2012), Mass Save (2012), EMT (2010), EMT (2012), National Grid (2008), EERMC (2010), VEIC (2009).
[53] NWPCC (2010).
[54] For more information, see http://www.epa.gov/statelocalclimate/state/statepolicies.html.

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administrator expenditures (i.e., the cost to the utility of administering energy efficiency programs, exclusive of customer costs), so EPA calculated savings based on estimates of energy savings per program dollar spent. For each state with qualifying programs, EPA obtained information on annual program funding from state[55] or utility publications,[56] and from state stakeholder feedback during the public review period, and projected funding for each future year as equal to the funding for the year for which the latest information is available. The funding information consists of either actual or committed expenditures, depending on the data source. Estimates of levelized costs of saved energy (LCSE) were available for some states from ACEEE (2009a). These are presented in Table 4. The ACEEE report presents costs of saved energy as reported by programs, except in cases where the methods used by program administrators to estimate the LCSE were different from ACEEE's standard approach. In such cases, ACEEE calculates LCSE as:

$$LCSE = (F*CRF) / A$$
$$CRF = (d*(1+d)^L) / ((1+d)^L-1)$$

where:
A is the annual first-year energy savings,
F is the annual program funding,
CRF is the Capital Recovery Factor,
L is the measure lifetime, and
d is the discount rate.

ACEEE uses a real discount rate of 5 percent to calculate the Capitol Recovery Factor, and estimates that the average LCSE across the states included in the report is $0.025/kilowatt hour (kWh). To apply ACEEE's LCSE estimates in a manner that is consistent with the methodology by which they were calculated, this analysis also used a discount rate of 5 percent.[57] The average LCSE of $0.025/kWh was used as the default LCSE where state-specific estimates were not available. In order to adjust for the effects of inflation, EPA converted the dollar values employed in the ACEEE analysis (reported in 2007$) to 2011$, which is the price metric used throughout the AEO 2013 analysis. Implicit price deflators for gross domestic product were assumed as the measure for conversion.[58] EPA did not assume a decay of savings during the measure life, so savings for each year are equal to the lifetime savings averaged over the measure lifetime.

[55] DCSEU (2012), DSEU (2013), NHEU (2012), NJ CEP (2013).
[56] MDU (2012), MECA (2011), NorthWestern Energy (2012).
[57] A 5-percent discount rate is also the average of the two rates (i.e., 3 percent and 7 percent) that EPA currently uses when performing economic analysis as a part of its rule development; for more information, see http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.
[58] U.S. BEA (2013), Table 1.1.9.

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Table 4. Levelized Cost by State[59]

State	Levelized Cost of Saved Energy[60] (2007$/kWh)	Levelized Cost of Saved Energy (2011$/kWh)
California	$0.029	$0.031
Connecticut	$0.028	$0.030
Iowa	$0.017	$0.018
Massachusetts	$0.031	$0.033
Minnesota	$0.021	$0.022
Nevada	$0.019	$0.020
New Jersey	$0.026	$0.028
New Mexico	$0.033	$0.035
New York	$0.019	$0.020
Oregon	$0.016	$0.017
Rhode Island	$0.030	$0.032
Texas	$0.017	$0.018
Vermont	$0.027	$0.029
Wisconsin	$0.033	$0.035
Default (simple average)	$0.025	$0.027

EPA estimated energy savings from ratepayer-funded programs in each year (t) using the following formulas:

$$CRF = (d*(1+d)^L) / ((1+d)^L-1)$$
$$A(t) = (F(t) * CRF) / LCSE(t)$$
$$C(t) = A(t) + A(t-1) + \ldots + A(t-L+1)$$

where:
CRF is the Capital Recovery Factor,
L is the measure lifetime,
d is the discount rate,
A is the annual first-year energy savings,
F is the annual program funding,
LCSE is the levelized cost of saved energy in 2011$, and
C is the cumulative energy savings.

[59] ACEEE (2009a), Table 1.
[60] LCSE is based on program administrator costs, not on total resource costs (which include the costs to participating utility customers).

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For this analysis, EPA did not estimate the magnitude of savings from energy efficiency programs funded by dedicated funding sources (i.e., RGGI and FCMs) separately, but instead incorporated their funds in the Energy Efficiency Program Funding category. This decision was motivated by the availability of state-level program budget information data, which aggregated the funding sources.

Methodology for Generating State-Adjusted Forecast That Reflects Incremental Energy Savings

EPA estimated energy savings that are incremental to the reference case (AEO 2013) by subtracting cumulative savings embedded in AEO 2013 from total savings from EERS, programs funded by PBFs, and other program funding sources (e.g., RGGI and FCM):

$$I(t) = C(t) - E(t)$$

where:
C is the cumulative energy savings,
E is the cumulative savings embedded in the AEO 2013 forecast, and
I is the cumulative savings incremental to the AEO 2013 forecast.

The state-adjusted electricity sales forecast includes the impact of energy efficiency savings that are incremental to the BAU reference case. State-level adjusted sales (Z) are calculated as:

$$Z(t) = B(t) - I(t)$$

where:
B is the baseline total sales, and
I is the cumulative savings incremental to the AEO 2013 forecast.

Methodology for Estimating Renewable Energy Sales from Renewable Portfolio Standards Beyond What Is Captured in AEO 2013

The AEO 2013 reference case incorporates RPS policies or substantively similar laws in place at the time of forecast development. In general, AEO assumes that utilities will meet the RPS targets; however, where states have explicitly limited state funding for RPS implementation, AEO assumes that utilities comply with RPS requirements only to the extent that state funding allows, as described in the AEO assumptions documents.

This analysis maintains consistency with these limiting assumptions. Because there are only two states that are not captured in AEO 2013, EPA included the RPS policies for these two states, Hawaii and Minnesota. The RPS-related energy production in Hawaii is considered incremental to the AEO forecast because the state is excluded from AEO 2013 modeling.[61] Minnesota was

[61] U.S. EIA (2013), "NEMS provides electricity market projections for the contiguous lower 48 states only," p. 13.

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added because its RPS target was changed[62] after the analysis underlying the AEO assumptions was performed. The expected increase of 1.5 percent for certain utility types after 2020 counts as incremental to AEO.

EIA did not identify funding limitations for either state, and EPA assumed that their full RPS targets would be achieved. Table 5 presents final RPS targets used in this analysis for the two states for which EPA identified updated RPS requirements.

Because the RPS targets for Hawaii were only available for 2015, 2020, and 2030, EPA estimated sales in intervening years by interpolation. Similarly, the Minnesota targets for 2016, 2020, and 2025 were used to interpolate expected sales levels for all years.

RPS requirements were frozen in percent terms for the years after the RPS policy period.

Table 5. Renewable Portfolio Standard Assumptions Made in This Analysis

State	State RPS Generation (in thousand GWh)		
	2015	2020	2030
Hawaii[63]	1.39	2.16	3.43
Minnesota	0.00	0.64	0.65

Important Sources of Uncertainty in the Analysis

In conducting this analysis, EPA used the best available information and adopted assumptions intended to reduce the likelihood of overstating the impacts of the states' EE/RE policies.

For this analysis, EPA is highlighting four sources of uncertainty to keep in mind when utilizing these estimates and employing similar methods:

1. The impacts of state energy efficiency policies embedded in the AEO reference case
2. Approval of sufficient energy efficiency program budgets necessary to meet the EERS targets
3. Variations in state approaches for evaluating and reporting energy efficiency savings
4. Application of regional growth rates to states within that region

[62] DSIRE (2013a). Law HF 279 was enacted on May 23, 2013. The 2020 target for Xcel Energy was increased from 30 percent to 31.5 percent. The target for non-Xcel public utilities was increased from 20 percent to 21.5 percent in 2020 and from 25 percent to 26.5 percent in 2025.

[63] NEMS provides electricity market projections for the contiguous lower 48 states only, so the impacts of Hawaii's RPS are not included in AEO 2013.

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As discussed earlier, the AEO reference case likely includes the impacts of some programs that are not explicitly identified in the AEO documentation. Estimating the impacts of existing energy efficiency policies at the national level, and then applying these national savings to individual states, requires significant simplifying assumptions about the degree to which these impacts are embedded in electricity sales projections and the associated magnitude of double counting. While intrinsic uncertainty exists (and as expressed by one peer reviewer who questioned whether the concept of calculated embedded savings from the AEO is even possible), EPA believes that its assumptions are reasonable in light of available data. It also should be noted that some experts have questioned the accuracy and quality of EIA-861 *cumulative* or *lifetime* efficiency data, and that the data has its obvious limitations in that it is based on data self-reported by utilities.[64]

Another source of uncertainty relates to the approval of energy efficiency program budgets necessary to meet the adopted targets. The energy efficiency policy that drives the core results of this analysis—EERS—depends on the approval of energy efficiency program budgets necessary to meet the targets, often by PUCs. Several states' EERS legislation includes explicit cost or rate impact caps that may constrain the ability of energy efficiency program administrators to meet the nominal EERS targets, and EPA attempts to account for this design feature in its analysis. However, even in states without specific cost or rate impact caps, PUCs generally have authority over energy efficiency program budgets and, as the EERS targets increase in stringency (necessitating larger energy efficiency program budgets), there is uncertainty over whether PUCs will continue to approve the budgets necessary to achieve the EERS targets. While recent reports have documented steadily increasing energy efficiency program budgets,[65] and generally good progress with states reporting achievement of EERS targets,[66] this will be an issue for states to track in the future as EERS targets increase. A similar source of uncertainty resides with state legislatures, which could expand or constrict EERS across the years covered by this analysis.

A third source of uncertainty in EPA's analysis is the energy savings definitions that states use when calculating and reporting program impacts. In some states, energy savings are evaluated and reported to PUCs as *gross savings*, that is, inclusive of savings attributed to an efficiency program that would have occurred even in the absence of the program (i.e., program savings not attributable to a specific program intervention). Other states require the reporting of *net* savings, which adjust gross savings by accounting for so-called *free-riders*, or customers who receive program rebates even though they would have invested in the efficient equipment without the program. Net savings also account for *free-drivers*, or induced market effects, and other considerations. This difference in how energy savings are defined and measured complicates efforts to make cross-state comparisons. The degree of uncertainty this conveys to EPA's analysis is not precisely known, but ACEEE uses a negative adjustment factor of 10 percent applied to gross savings to reconcile the two values for their annual State Scorecard.

[64] Per review by Maggie Molina, ACEEE.
[65] IEE (2012).
[66] ACEEE (2011).

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Such an adjustment is not used in this analysis, although states can make such adjustments in their own analyses if they so desire. A recent survey indicated that approximately two-thirds of the states report gross savings and one-third report net savings.[67]

During the peer review process, another source of uncertainty was raised related to the use of AEO 2013 average annual growth rates from each EMM region to represent the growth rates of states within those EMM regions. This is the approach used in this analysis for preparing state-level baseline sales. While it is recognized that not all states within a given EMM region will experience similar growth patterns simply because they are grouped geographically, alternative sources that were identified did not offer a reliable basis for seeking to refine state-specific growth rates. EPA finds that this assumption is appropriate for this illustrative analysis, but encourages states to apply their own state-specific assumptions to analyses that they conduct.

[67] ACEEE (2012b).

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