Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State Implementation Plans/Tribal Implementation Plans

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SECTION 1.0: PURPOSE AND DOCUMENT ORGANIZATION

The purpose of this roadmap is to clarify guidance[1] EPA specifically issued in 2004 on incorporating energy efficiency and renewable energy (EE/RE) policies and programs into State Implementation Plans (SIPs), as well as related guidance[2] EPA issued in that year and in 2005. EE/RE policies and programs are cost effective strategies that state, tribal or local agencies can utilize to help meet air quality goals, SIP and Tribal Implementation Plans (TIP)[3] requirements (i.e., emissions reductions needed to demonstrate attainment and/or satisfy other Clean Air Act requirements).[4]

EPA recognizes that state, tribal or local agencies interested in incorporating these policies and programs in SIPs/TIPs need more detailed information on how to achieve that goal. EE/RE programs can also be part of a multi-pollutant emissions reduction strategy to help state, tribal and local agencies not just attain and maintain compliance with NAAQS, but also to improve visibility and reduce regional haze, reduce air toxics and greenhouse gases. To that end, this document provides a roadmap for understanding the requirements and other aspects of the four pathways available for incorporating EE/RE policies and programs into SIPs/TIPs:

> **Questions Manual Addresses**
>
> - What criteria should a state, local or tribal agency consider when choosing the best pathway for incorporating measures/programs in SIPs/TIPs?
> - What SIP/TIP criteria and other requirements should be satisfied when incorporating EE/RE policies into SIPs/TIPs?
> - For the control strategy pathway, what EE/RE quantification requirements and general guidelines are available?
> - What streamlined approaches are available for state, local and tribal agencies to utilize when accounting for EE/RE policies in SIPs/TIPs?
> - Is some kind of discount factor necessary to reflect uncertainty, not holding EE/RE measures to a higher standard than other SIP/TIP measures?

1. Projected emissions baseline for the future attainment year;

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[1] "Guidance on SIP Credits from Emission Reductions from Electric-Sector Energy Efficiency and Renewable Energy Measures," USEPA, http://www.epa.gov/ttncaaa1/t1/memoranda/ereseerem_gd.pdf, August 2004.

[2] "Incorporating Emerging and Voluntary Measures in a State Implementation Plan (SIP)," USEPA, http://www.epa.gov/ttncaaa1/t1/memoranda/evm_ievm_g.pdf, September 2004 and "Guidance on Incorporating Bundled Measures in a State Implementation Plan," USEPA, http://www.epa.gov/ttn/caaa/t1/memoranda/10885guideibminsip.pdf, August 2005.

[3] The 1990 CAA Amendments provide authority for Tribes to implement CAA programs and instructed EPA to adopt regulations so that eligible Tribes may manage their own EPA-approved air pollution control programs under the CAA. The 1998 Tribal Authority Rule (TAR) implements the provisions of section 301(d) of the CAA to authorize eligible Tribes to develop their own tribal programs. Under the TAR, a Tribe may be approved by EPA to be eligible to be treated in the same manner as a State for one or more CAA programs. Such a program may include, but is not limited to, a Tribal Implementation Plan (TIP). As the TAR makes clear, tribal governments are not required to submit a TIP, nor are they subject to deadlines mandated under the CAA. However, EPA must meet its obligations under the CAA.

[4] The other requirements include: Reasonable Further Progress, Rate of Progress, and Reasonable Available Control Technology/Reasonable Available Control Measures.

2. SIP control strategy;
3. Emerging/voluntary measures; and
4. Weight-of-evidence (WOE) determination.

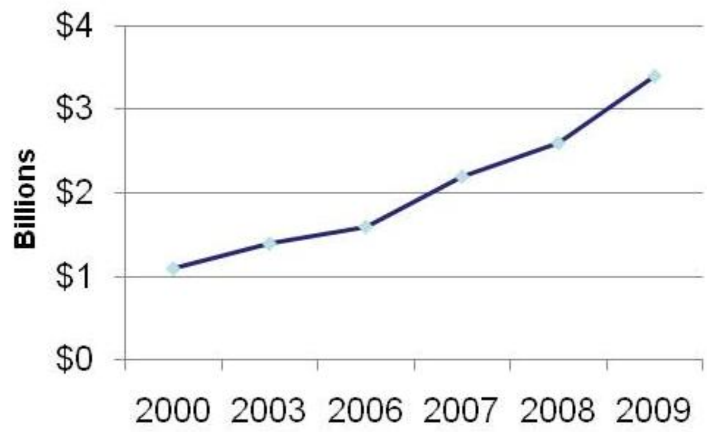
In doing so, the manual addresses several key policy issues, as described in the text box above.

EPA believes it is important to recognize the emission benefits resulting from EE/RE policies and programs in SIPs and TIPs. Therefore, EPA is encouraging state, tribal and local agencies to incorporate EE/RE policies into SIPs/TIPs (or to account for them in SIPs/TIPs) because these policies represent a real opportunity for state, tribal and local air quality planners to take advantage of the emission benefits of the policies. Three reasons are:

1) Over the past 10 years, states have increased their EE/RE investments by 209 percent, committing over $3 billion of ratepayer resources in 2009 to energy efficiency programs.[5] (See Figure 1.1 for ratepayer EE expenditures from 2000-2009.) Also, as of 2009, thirty states (including Washington, DC) had adopted renewable portfolio standard (RPS) which require their utilities to purchase increasing amounts of their electricity supply from renewable resources, more than double the number states in 2000 (see Figure 1.2).
2) EPA has issued revised National Ambient Air Quality Standards for ozone, SO_2, $PM_{2.5}$ and NO_2 that continue to drive the need to find greater emission reductions. EPA is encouraging state, tribal and local agencies to incorporate EE/RE policies and programs into SIPs/TIPs as they face a need to find greater pollutant reductions from the electric power generation sector to meet these revised standards. Moreover, the availability of EE permits the state, tribal and local agencies to diversify the control measures being considered beyond the traditional measures considered for point sources.
3) Improved precision and rigor for information related to the energy savings from energy efficiency, what generation resources are displaced by EE/RE and their resulting emissions benefits is more widely available so state, tribal and local agencies do not have to start analyses from scratch.

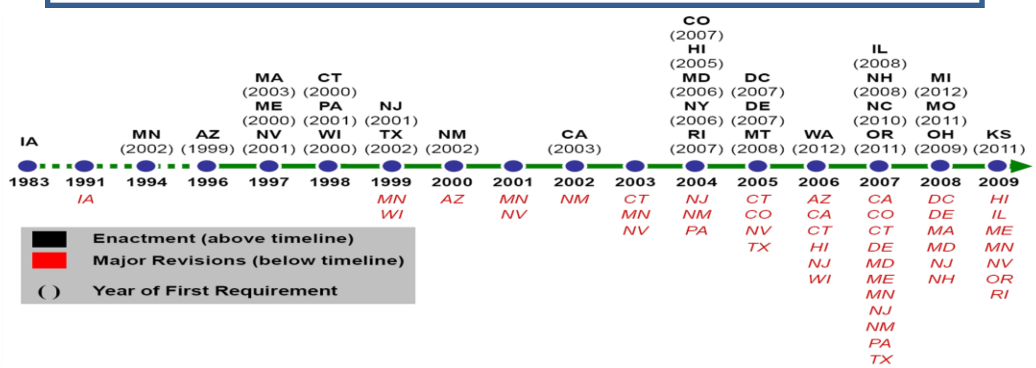
[5] "2010 State Energy Efficiency Scorecard," American Council for an Energy-Efficient Economy, http://www.aceee.org/sites/default/files/publications/researchreports/e107.pdf, October 2010.

Figure 1.1: Growth in State Energy Efficiency Expenditures



Source: www.aceee.org/publications

Figure 1.2: Growth in State RPS Policies



Source: www.cleanenergystates.org/Meetings/RPS_Summit_09/WISER_RPS_Summit2009.pdf

An EE/RE policy/program that is qualified under one of the four pathways described in this manual may help air quality agencies to improve their collaboration with state public service commissions and energy offices. If these energy-related offices understand that the state is relying upon the emissions benefits from EE/RE for the SIP, then the offices can work with the air agency at the planning stage to help design effective EE/RE policies/programs. And, the energy office or public service commission has a role to ensure that the emissions benefits are achieved.

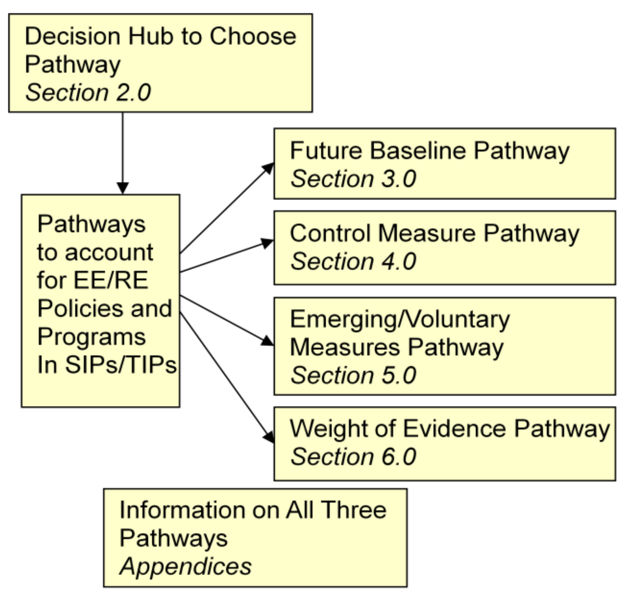
This Document Is Clarifying Existing Guidance And Is Not Regulation

This document is being issued to clarify existing guidance and not create new guidance. In addition, the Clean Air Act and implementing regulations at 40 CFR Part 51 contain legally binding requirements. This manual does not substitute for those provisions or regulations, nor is it a regulation itself. Thus, it does not impose binding, enforceable requirements on any party, and may not be applicable in all situations.

This manual pertains only to the stationary source sector and does not does not apply to mobile source emission reduction programs, including on-road and non-road vehicles. Guidance on mobile source strategies can be found at: http://www.epa.gov/otaq/stateresources/policy/pag_transp.htm. For more information about how to take credit for a voluntary mobile source emission reduction program, see http://www.epa.gov/otaq/stateresources/policy/general/vmep-gud.pdf).

The EPA and state, tribal and local agency decision makers retain the discretion to adopt approaches for approval of SIPs/TIPs that differ from this guidance where appropriate and consistent with applicable law. Any final decisions by EPA regarding a particular SIP will only be made based on the statute and regulations within the context of EPA notice-and-comment rulemaking on a submitted SIP revision. Therefore, interested parties may raise questions and objections about the substance of this guidance and appropriateness of its application to a particular situation. The EPA will, and state, tribal and local agencies should, consider whether or not the recommendations in the guidance are appropriate in a particular situation. This guidance is a living document and may be revised periodically without public notice. However, the EPA welcomes public comments on this document at any time and will consider

Figure 1.3: Organization of Manual



those comments in any future revision of this guidance document. Finally, this document does not prejudice any future final EPA decision regarding approval of any SIP.

Document Organization

This document is organized to provide a roadmap to show the options available for incorporating EE/RE policies and programs into SIPs/TIPs once state, tribal and local air quality planners understand the EE/RE policies and programs in their area. To achieve that goal, the main body of the report is intentionally short. However, the Appendices describe the mechanics and pathways state, tribal and local agencies interested in SIPs/TIPs can account for EE/RE may take. References to outside sources are also provided. (For links to sources external to EPA, note that EPA cannot attest to the accuracy of non-EPA information provided by these third-party sites or any other linked site. EPA is providing these links for your reference. In doing so, EPA does not endorse any non-government websites, companies or applications.) Figure 1.3 provides the organization of the manual. Figure 1.4 describes each appendix and its use.

Figure 1.4: How to Use the Appendices

Four Pathways:
Projected emissions baseline for the future attainment year
SIP control strategy
Emerging/voluntary measures
Weight-of-evidence (WOE) determination

For appendices that apply generally to all four options, see:

- **Appendix A** for glossary of energy and air quality terms
- **Appendix B** for information on how power distribution works in an area
- **Appendix D** for the fundamentals of EE/RE policies and some key information to determine what policies and programs your area has adopted and is implementing.
- **Appendix F** for an easy way to obtain a rough estimate of the emissions benefits from EE/RE policies and programs.
- **Appendix I** for information on energy savings from EE/RE policies that are "on the books"
- **Appendix J** for state examples of past or proposed incorporation of EE/RE in SIPs

For the baseline option, see:

- **Appendix C.2** for information on existing EPA baseline guidance
- **Appendix E** for the requirements of the baseline pathway

For the control strategy option, see:

- **Appendix C.3** for information on existing EPA control strategy guidance
- **Appendix F** for the requirements of the control strategy pathway

For the emerging/voluntary measures option, see:

- **Appendix C.4** for information on existing EPA voluntary/emerging measures guidance
- **Appendix G** for the requirements of the voluntary/emerging measures pathway

For the WOE option, see:

- **Appendix C.5** for information on existing EPA WOE guidance
- **Appendix H** for the requirements of the WOE pathway

SECTION 2.0: DECISION HUB TO DETERMINE PREFERRED PATHWAY(S)

The intent of the decision hub section is to help state, tribal and local agencies navigate through the many decisions each will encounter when deciding if and how to incorporate EE/RE policies and programs in a SIP. EPA has identified the most important EE/RE policy/program characteristics and questions state, tribal and local agencies should consider when determining which pathway they can take to account for the emission impacts of EE/RE policies and programs in a SIP. State, tribal and local agencies can apply their unique situation and needs to the EE/RE SIP Pathway Flow Chart (Figure 2.1) to help determine which pathway fits best for each applicable EE/RE policy and program. For more information on specific requirements, documentation and quantification methods refer to the appendix sections listed in Figure 2.1.

Decision-Making Process

The first task is to become familiar with the jurisdiction's EE/RE policies and programs, the electric system, the level of magnitude of potential emission benefits and existing EPA EE/RE SIP guidance. Certain terms are important to understand:

- **Energy efficiency/renewable energy policies** are regulations, statutes or state public utility commission orders that require parties to acquire energy efficiency and/or renewable energy or to commit to funding levels for programs aimed at acquiring EE/RE.
- **Energy efficiency program** means a program designed to increase adoption of energy efficient technologies and practices in particular end-use sectors through education and outreach, codes and standards, financial incentives, and/or technical assistance.
- **Renewable energy program** means a program designed to increase the production and use of renewable energy sources through resource procurement and development, education and outreach, financial incentives, and/or technical assistance.

Once a state, tribal or local agency has reviewed existing and upcoming EE/RE policies and programs in its jurisdiction, and the potential emissions benefits those policies and programs may offer, the next task is to determine what SIP pathway(s) to pursue for each EE/RE policy and program. There are some key questions to consider for each of the jurisdiction's EE/RE policies and programs (see Figure 2.1). Are the jurisdiction's policies and programs "on the books" (i.e., been adopted by a legislative or regulatory body) and does the jurisdiction have any voluntary or emerging programs? Those terms are defined as follows:

- **A voluntary program** is a "measure" or "strategy" that is not enforceable against an individual source or entity.
- **An emerging program** is a "measure" or "strategy" that does not have the same high level of certainty as traditional measures for quantification purposes.

<u>If a Jurisdiction wants to include EE/RE policies and programs in the voluntary/emerging pathway</u>:
On either side of the flowchart, if a jurisdiction has existing or upcoming voluntary and/or emerging programs and wants SIP/TIP credit for the emission reductions, then it should consider the emerging/voluntary measures pathway. Otherwise, the WOE pathway would be the appropriate option.

<u>If a Jurisdiction does not want to include EE/RE policies and programs in the voluntary/emerging pathway</u>:
On either side of the flowchart, if a jurisdiction is not including an EE/RE policy or program in the voluntary and/or emerging pathway, then it can consider two or three of the other pathways. Which of the three pathways a jurisdiction chooses depends upon whether the EE/RE policy/program is:

- "On the books" (i.e., been adopted by a legislative or regulatory body) or
- "On the way" (i.e., planned for adoption by a legislative or regulatory body prior to submittal of the SIP to EPA).

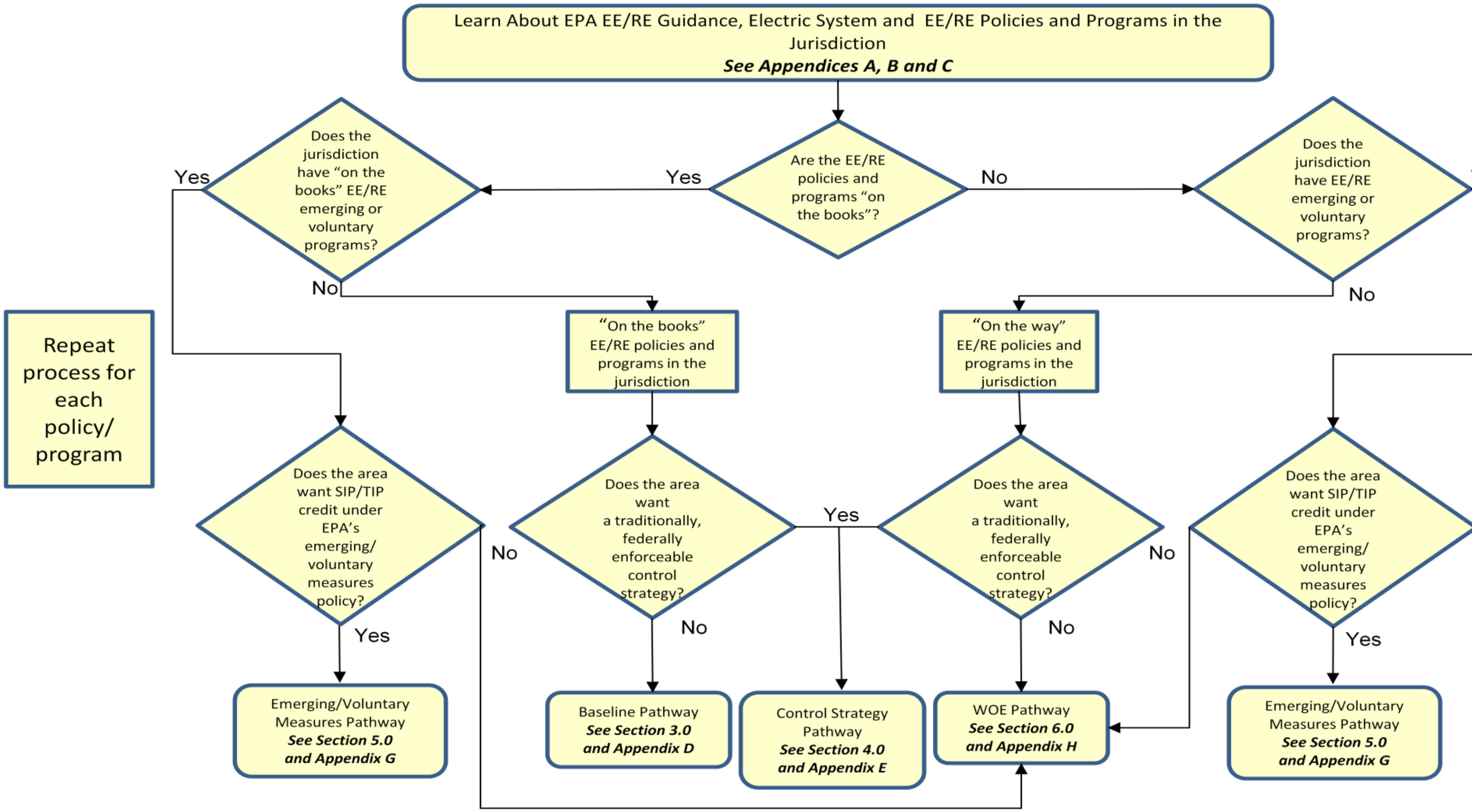
It also depends upon whether the state, tribal or local agency wants the EE/RE policies/programs to be incorporated into the SIP/TIP such that they can be discretely, traditionally enforceable by the federal government as a control strategy.

The flowchart provided in Figure 2.1 can be used to guide jurisdictions to ask these questions for each of its EE/RE policies and programs. Going through this exercise will help the jurisdiction consider how to group the EE/RE policies/programs into the appropriate SIP pathway:

- For the "on the books" policies and programs that will not become traditionally, federally enforceable as a control strategy, proceed to Section 3.0 and Appendix E for more information on the baseline pathway. (Although Figure 2.1 does not show it, a state, tribal or local agency could also pursue the WOE pathway for "on the books" policies/programs if it decided against the baseline and control strategy pathways.)
- For policies that are "on the way" regulations that will become traditionally, federally enforceable as a control strategy, proceed to Section 4.0 and Appendix F for more information on the control strategy pathway.
- For EE/RE programs that are emerging/voluntary, proceed to Section 5.0 and Appendix G for more information on the emerging/voluntary measures pathway.
- For EE/RE policies/programs for which the area is not seeking SIP credit, proceed to Section 6.0 and Appendix H for more information on the WOE pathway.

With each question in the flowchart process, there are tradeoffs. Table 2.1 describes key characteristics of each pathway, including pros and cons. Figure 2.2 provides a summary of key characteristics of the policies and programs that could be considered for each pathway.

Figure 2.1: EE/RE SIP/TIP Pathway Flow Chart



Note: This flowchart is intended to accommodate most EE/RE policies/programs, but not necessarily all. State, tribal and local agencies should consult with EPA regional offices on individual policies/programs that the flowchart does not address.

Figure 2.2: Characteristics of Policies/Programs Suitable for Each Pathway

Future Baseline Pathway	Control Strategy Pathway	Emerging/Voluntary Measures Pathway	Weight-of-Evidence Pathway
• "On the books" policies and programs • Can be state enforceable • Not traditionally, federally enforceable but enforceable through a Clean Air Act SIP call	• "On the way" policies and programs • EE/RE policies and programs for which area wishes to seek SIP credit • Traditionally, federally enforceable	• Locally-based EE/RE activities • Voluntary EE/RE policies and programs are not enforceable against a source • Emerging EE/RE policies and programs that are not easy to quantify • EE/RE policies and programs for which area wishes to seek SIP credit	• Emerging/voluntary measures • "On the way" or "on the books" EE/RE policies and programs • Not federally enforceable

Table 2.1: Key Aspects of Three SIP EE/RE Pathways

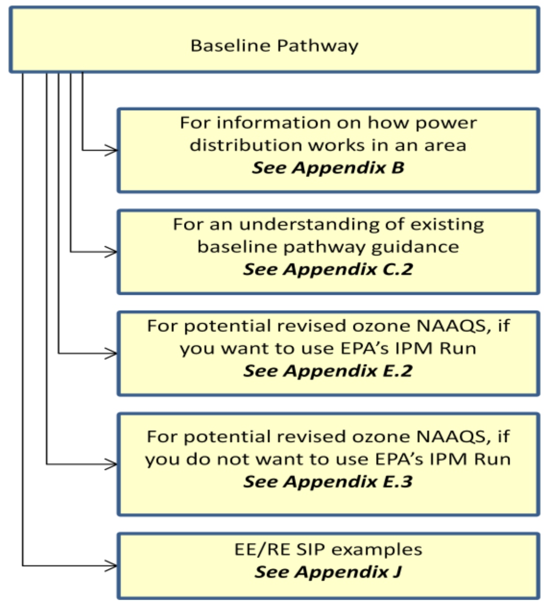
Pathway	Pros	Cons	Circumstances Best Suited For	Basic Steps to Implement
Future Baseline Option	• State, tribal and local agencies can utilize EPA's EGU baseline projections that incorporate "on the books" EE/RE policies • EGU baseline projections using energy models or similar methods reflect EGU operations as a whole system and account for a range of power sector policies and environmental constraints.	• To the extent that a jurisdiction is relying on EPA's baseline modeling runs, a con can be that any revisions can be expensive because the integrated planning model (IPM) EPA uses is a proprietary model. • EGU baseline projections are best done on a regional basis, rather than area by area. Coordination is necessary with other state, tribal and local agencies within your region (perhaps through regional planning organization). • Could be "enforced" by EPA through a Clean Air Act SIP call in which the Agency requests a SIP revision to make up an emissions shortfall due to a state failure to implement the policy as envisioned in the baseline.	• State, tribal and local agencies that want to include "On the books," EE/RE policies in their SIP that have not been accounted for elsewhere in the SIP	• Use available EPA EGU baseline projections or utilize a dynamic model that can project future emissions, federal, state, tribal and local requirements, and EE/RE policies within power sector
Control Strategy Option	• State, tribal and local agencies will gain a better understanding of which EGUs will displace emissions as a result of future EE/RE policies/programs. • State, tribal and local agencies will have a tons-per-day (TPD) amount of emissions for each EGU they expect to reduce based on a specified EE/RE policy and program. • State, tribal and local agencies will have emission reductions from a control strategy to help them attain	• More documentation is needed than the future baseline and WOE approaches because a jurisdiction would have to show that the EE/RE policy/program was permanent, enforceable, quantifiable, and surplus • Quantification can be more resource intensive because the state, tribal or local agency would have to perform more of the EGU analysis than the baseline pathway in which EPA is providing more support for EGU analysis	• Best suited for state, tribal and local agencies that have EE/RE policies that their area is required to adopt before it submits its SIP/TIP to EPA ("on the way" policies) and that will produce emissions benefits in the planning timeframe of their SIP/TIP.	• The state, tribal or local agency must demonstrate that policies are permanent, quantifiable, surplus and enforceable

Pathway	Pros	Cons	Circumstances Best Suited For	Basic Steps to Implement
Emerging/ Voluntary Measures Pathway	• Areas can obtain SIP/TIP credit up to six percent for EE/RE policies/programs, or more if they can make a clear convincing case • Recognizes that some EE/RE policies/programs are not easy to enforce or easily quantified	• Potentially does not offer as much potential SIP/TIP credit as the control strategy pathway because it establishes limitations and conditions that limit the credit which emerging/voluntary measures can receive • Quantification of emissions impacts may be difficult for emerging/voluntary measures	• Emerging/voluntary measures for which the state, tribal or local agency wishes to receive SIP/TIP credit.	• Develop description of policies and perform quantification of emissions impact of policies and programs. • Commit to monitor, evaluate, and report at least every three years to the public and EPA on the resulting emissions effect of the emission or pollutant reduction measure
WOE Option	• Documentation for this pathway is the least rigorous and requires the least amount of effort. • A state, tribal or local agency can include emission reductions from any policy or program that may impact a nonattainment area without demonstrating how the state, tribal or local agency will meet the SIP/TIP control strategy criteria.	• This option carries less impact than including an EE/RE policy in the SIP/TIP as part of the control strategy or in the emissions baseline.	• EE/RE policies/ programs where a state, tribal or local agency wants to claim emissions benefit that will affect the area's future year air quality design value, but modeling the impact of the policy/program is either too resource intensive or not possible. • State, tribal and local agencies can use this option only if they are within a prescribed margin of attaining the applicable National Ambient Air Quality Standard (NAAQS).	• Develop basic description of policies and perform basic quantification of emissions impact of policies and programs.

SECTION 3.0: FUTURE BASELINE PATHWAY

A baseline forecast of future emissions in the attainment year is made when a jurisdiction prepares a SIP/TIP or performs a SIP revision. The purpose of the baseline forecast is to document expected conditions in the absence of new measures or policies. Because projected emission levels are affected by demand for electric power and new generation capacity, jurisdictions can take steps to understand the impacts of their EE/RE policies and programs, and to represent these impacts in baseline emission forecasts. States, local, and tribal agencies interested in accounting for "on the books" EE/RE policies in the baseline pathway can conduct their own analysis or start by using EPA's existing methodology and results (see Appendix E).

Figure 3.1: Manual Roadmap for Baseline Pathway



EGU Emissions Baseline Projection Options for State, Tribal and Local Agencies

Jurisdictions seeking to include existing EE/RE policies and programs in SIPs/TIPs should consider adopting the future baseline pathway addressed here. By taking this approach, the emission impacts from existing policies (i.e., policies already adopted by a jurisdiction) are captured in the baseline, along with other "on the books" requirements, conditions, and assumptions affecting the electric generating unit (EGU) sector baseline forecast. A first step for jurisdictions is to identify the set of existing Federal and State policies and programs that are included (and those not included) in the baseline electricity demand forecast. State, local, and tribal agencies can then estimate the impacts of previously-omitted policies and programs, and use these results to develop a revised electricity demand forecast and/or revised forecast of future generation capacity. This updated demand and supply forecast can subsequently be used as a basis for the EGU sector emissions forecast over the period of interest. The new future emissions baseline – with a reflection of existing EE/RE policies and programs of interest – becomes the starting point from which additional control strategy measures are assessed.

Baseline Pathway Conditions

State, local and tribal agencies can include a ***specific EE/RE policy*** in the future SIP/TIP attainment year emissions baseline if:

It has already been adopted by an appropriate jurisdiction

AND

The effects of the policy have not already been accounted for in the SIP/TIP – that is, you are not double counting.

Appendix E discusses the steps a state, tribal or local agency needs to take to pursue this pathway, and process issues state, tribal and local agencies are likely to encounter such as expected level of effort, other resources needed, and stakeholders that need to be involved.

Agencies interested in leveraging EPA's energy modeling capability (using the IPM model) to quantify EE/RE under the forthcoming ozone NAAQS can start by reviewing Appendix E.2. States, local, and tribal agencies considering developing their own quantification method can review Appendix E.4. Appendix J provides examples of how other states have approached incorporating EE/RE policies into SIPs.

Baseline Conditions To Be Met

Certain conditions have to be met in order to include a policy in the future attainment year baseline. For example, energy efficiency resource standards (EERS) that have been adopted in law can be included in the baseline emissions forecast. However, if a state, tribal or local agency is currently discussing whether to adopt such a policy, or has proposed but not yet adopted one, it is not appropriate to include. Purely voluntary policies are likewise ineligible.

In addition, EPA wants to ensure that the emissions reductions from EE/RE policies are not counted twice. State, tribal and local agencies must clearly understand and account for the EE/RE policies/programs in the baseline forecast before attempting to adjust this forecast to account for additional EE/RE policies and programs.

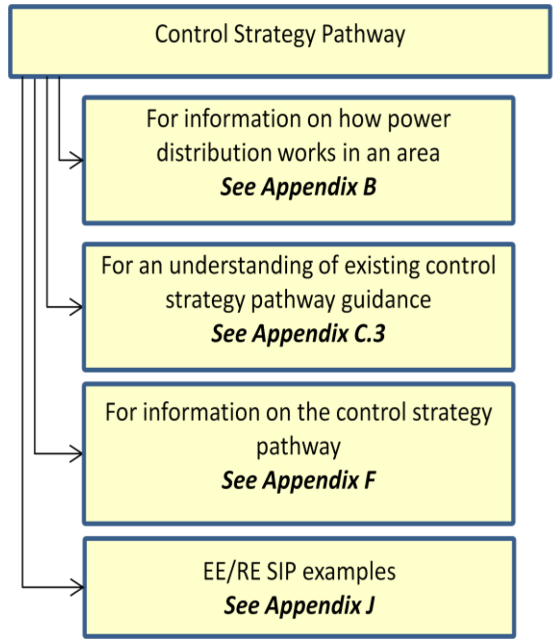
Mandatory Policies That Are Not Traditionally, Federally Enforceable

It is also important to understand that EE/RE policies incorporated into the future baseline are not traditionally, federally enforceable and that EPA may not bring an enforcement action against an entity for failure to meet Clean Air Act requirements. If the EE/RE policy or program is not implemented then the state may implement backup policies to make up for the emissions shortfall. Alternatively, EPA may initiate a SIP call under section 110 of the Clean Air Act in which EPA can request that the state revise the SIP to make up the emissions shortfall brought about the area's failure to implement the policy as envisioned in the baseline. Additionally, state utility regulators typically have their own mechanisms to require compliance with state EE/RE policy requirements, including financial incentives for exceeding state policy requirements and penalties for non-compliance.

SECTION 4.0: CONTROL STRATEGY PATHWAY

SIPs/TIPs must include strategies containing control measures to provide emissions reductions to enable nonattainment and maintenance areas to attain and meet certain SIP requirements. The control strategy pathway would provide state, tribal and local agencies the opportunity to include EE/RE policies as part of a control strategy. It is best suited for a state, tribal and local agency that has adopted EE/RE policies before it submits its SIP to EPA ("on the way" policies) and whose emissions benefits will be realized coincident with the planning timeframe of its SIP. The control strategy pathway offers the most visible and direct benefit in the SIP context and it is traditionally, federally enforceable, which may make it more desirable for some jurisdictions. In addition, an EE/RE policy/program that is qualified as a control strategy may help air quality agencies to improve their collaboration with state public service commissions and energy offices. If these energy-related offices understand that the state, tribal or local agency is relying upon the emissions benefits from EE/RE, that such benefits are required to be enforced, and that gaps in achieving the environmental objectives of EE/RE would require the air quality agency to be made up by other control strategies, then the offices can work with the air agency at the planning stage to help design effective EE/RE policies/programs. And, the energy office or public service commission has a role to ensure that the emissions benefits are achieved.

Figure 4.1: Manual Roadmap for Control Strategy Pathway



This pathway involves more analysis and documentation than the baseline, emerging/voluntary and WOE options. While both the control strategy and baseline options involve significant quantification efforts, state, tribal and local agencies that undertake the control strategy option also have to demonstrate that the emissions reductions resulting from their mandatory EE/RE policies are surplus, enforceable and permanent. This manual clarifies how those requirements can be satisfied. State, tribal and local agencies meeting the requirements would have to provide more documentation than would be necessary under the baseline, emerging/voluntary and WOE approaches.

Figure 4.2: Four Criteria the Control Strategy Pathway Must Address

Permanent

Evidence of regulation or legislation mandating program for planning period

Enforceable

Federal enforceability is key to EPA being able to provide expanded SIP credit for these programs

If the state failed to enforce the program, EPA has the discretion to enforce

Quantifiable

Quantification of benefits of EE/RE programs

Surplus

No double counting of emissions reductions

EPA requests a statement to that effect from the state, local or tribal government

Control Strategy Option Is Traditionally, Federally Enforceable

Because the control strategy option is traditionally, federally enforceable, process issues could be greater. The state, tribal or local air quality office will most likely need to reach out to the state Public Utility Commission and others to explain the implications of making the state, tribal or local agency's mandatory EE/RE policies traditionally, federally enforceable and to discuss a mechanism (in consultation with EPA Regional offices) for coordinating state enforcement with federal enforcement activities.

Additional details about this pathway are included in Appendix F. Appendix F.1 contains information on the four criteria and how a state, tribal or local agency can satisfy them (Figure 4.2 provides a brief description of the four criteria). With respect to quantifying the benefits of mandatory EE/RE policies, the approach outlined in Appendices F.2 to F.4 recognizes that some state, tribal and local agencies (or groups of state, tribal and local agencies) will possess the resources and capability to perform sophisticated modeling analyses of the energy and air benefits of mandatory EE/RE policies, while others will not. The appendices are organized by tiers of analysis from Tier One (advanced quantification) to Tier Three (basic quantification). Appendix J provides examples of initial state thinking about how to incorporate EE/RE policies into SIPs.

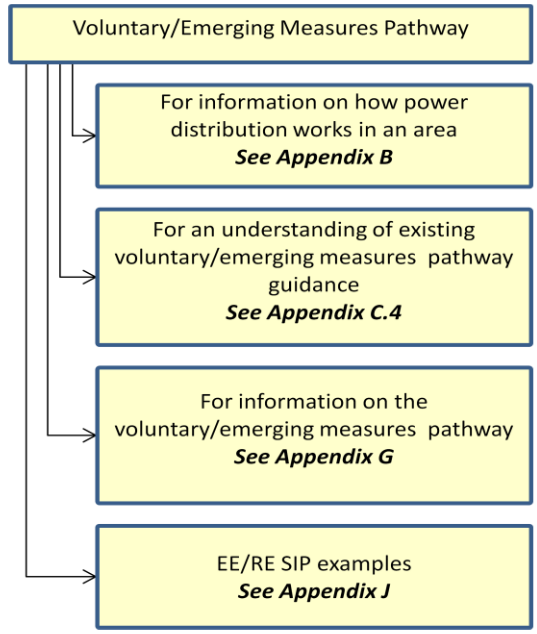
Basic Steps For Quantifying Mandatory EE/RE Policies

Overall, EPA's guidance on SIP credit spells out four steps to address when quantifying mandatory EE/RE policies under the control strategies pathway:

1) STEP 1 Quantify the energy savings that an energy efficiency policy will produce, or, for a renewable energy policy, the amount of energy generation that will occur, between the base year and the area's attainment future baseline year.
2) STEP 2 - Quantify or estimate displaced EGU emissions from energy impacts of an energy efficiency policy or renewable energy policy
3) STEP 3 - Determine the impact from the emission reduction on air quality in the nonattainment area.
4) STEP 4 - Provide a mechanism to validate or evaluate the effectiveness of the project or initiative.

SECTION 5.0: EMERGING/VOLUNTARY MEASURES PATHWAY

Figure 5.1: Manual Roadmap for Emerging/Voluntary Measures Pathway



A voluntary measure is a measure or strategy that is not enforceable against an individual source. An emerging measure is a measure or strategy that does not have the same high level of certainty as traditional measures for quantification purposes. A measure can be both voluntary and emerging. In 2004 Agency guidance EPA has recognized that many areas of the country have implemented most available traditional emission control strategies and want to try new types of pollutant reduction strategies to attain NAAQS, including voluntary EE/RE programs. The EPA supports and encourages the testing of voluntary and emerging pollutant reduction strategies.

This pathway is similar to the control strategy pathway in that an EE/RE program can receive emission reduction SIP credit under this option. For emerging/voluntary stationary measures, the presumptive SIP credit limit is 6 percent of the total amount of emission reductions required for the ROP, RFP, attainment, or maintenance demonstration purposes. These measures must satisfy the four criteria for SIP measures:

- Permanent
- Quantifiable
- Surplus
- Enforceable

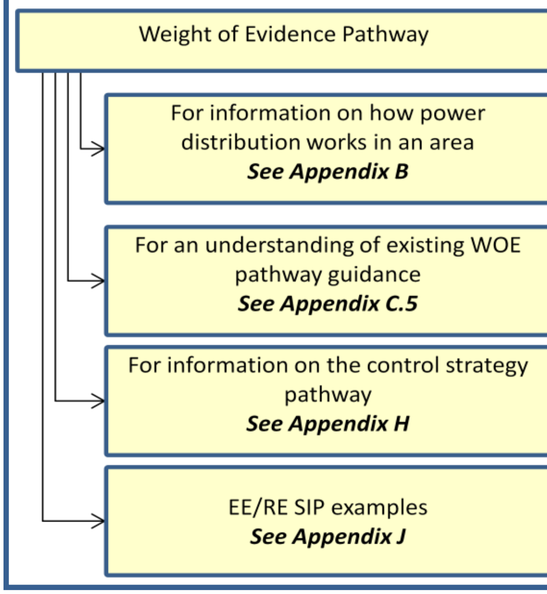
But the policy provides flexibility for emerging measures on the quantifiable criterion and for voluntary measures it provides flexibility on the enforceable criterion.

The pathway is well suited for areas that have voluntary and/or emerging EE/RE policies/programs are not easy to enforce and/or quantify but for which the area would like SIP credit. The pathway does not offer as much potential SIP credit as the control strategy pathway because it establishes limitations and conditions that limit the credit that emerging/voluntary measures can receive. The pathway provides a mechanism that allows state, tribal or local agencies to receive provisional emission reduction credit in their SIP for new emission control and pollutant reduction strategies that have the potential to generate additional emission reductions or air quality benefits. Provisionary emission reductions or pollutant reduction strategies can become permanent when post-implementation evaluations validate the amount of emission reductions achieved. The process issues and workload associated with this pathway are light to medium. They are greater than the WOE pathway and less than the control strategy pathway.

SECTION 6.0: WEIGHT OF EVIDENCE (WOE) PATHWAY

When state, tribal and local agencies prepare SIP demonstrations of attainment, sometimes air quality modeling results can be inconclusive and predict that areas will not attain a NAAQS based solely on modeling. In those cases, EPA guidance allows areas to submit weight-of-evidence demonstrations to show that, despite inconclusive modeling results, the area will still attain based on other evidence. Although WOE demonstrations can include mandatory EE/RE policies/programs, the WOE option is best suited for a state, tribal or local agency that has voluntary EE/RE programs that demonstrate, through basic quantification, that emissions reductions will occur within the same planning timeframe as that used for attainment. While the WOE approach involves the least amount of documentation and analysis, it also provides the most uncertain potential emissions reductions or air quality benefit for the SIP. Process issues for this option are likely to be light, including the level of effort expected, resources needed, and stakeholders that need to be involved.

Figure 6.1: Manual Roadmap for WOE Pathway



Weight of evidence demonstrations are described in guidance EPA has issued on their use in SIP attainment demonstrations.[6] Weight of evidence demonstrations are generally a set of analyses of air quality, emissions, meteorological data, and modeling data that State, tribal and local agencies can use to show that attainment of a NAAQS is likely, despite modeled results which may not show attainment or may be close to the level of the NAAQS. The greater the difference between the modeled design value and the level of the standard, the more compelling the additional evidence produced by analyses must be in order to conclude (based on the WOE results) that attainment is likely despite the inconclusive modeled attainment test. EPA guidance includes guidelines for assessing when corroborating analyses and/or weight of evidence determinations may be appropriate.

Emissions reductions from mandatory EE/RE policies and voluntary programs proposed for use in the WOE demonstration cannot be used elsewhere in the SIP. In other words, no double counting is permitted. And the measures must be in place for the duration of the SIP planning period. Appendix H describes the basics of the WOE approach in more depth and provides information on WOE analyses and WOE examples.

[6] "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze," http://www.epa.gov/scram001/guidance_sip.htm, EPA -454/B-07-002, April 2007.

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Appendix A: Glossary

Allowances: Allowances represent the amount of a pollutant that a source is permitted to emit during a specified time in the future under a cap and trade program... Allowances are often confused with credits earned in the context of project-based or offset programs, in which sources trade with other facilities to attain compliance with a conventional regulatory requirement.

Baseline period: The period of time selected as representative of facility operations before the energy efficiency or renewable energy activity takes place.

Baseline: Conditions, including energy consumption and related emissions, which would have occurred without implementation of the subject project or program. Baseline conditions are sometimes referred to as "business-as-usual" conditions. Baselines are defined as either project-specific baselines or performance standard baselines.

Clean Air Act (CAA): The Clean Air Act is the law that defines EPA's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer. The last major change in the law occurred when Congress enacted the Clean Air Act Amendments of 1990. Legislation passed since then has made several minor changes.

Criteria Air Pollutant: The Clean Air Act requires EPA to set National Ambient Air Quality Standards for six common air pollutants. These commonly found air pollutants (also known as "criteria pollutants") are found all over the United States. They are particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead.

Demand: The time rate of energy flow. Demand usually refers to electric power measured in kW (equals kWh/h) but can also refer to natural gas, usually as Btu/hr, kBtu/ hr, or therms/day.

Discount rate: A measure of the time value of money. The choice of discount rate can have a large impact on the cost-effectiveness results for energy efficiency. As each cost-effectiveness test compares the net present value of costs and benefits for a given stakeholder perspective, its computation requires a discount rate assumption.

Electric generating unit(s) (EGU): This is an entity that supplies electricity to the electricity system relying on a variety of fuels.

Electricity Dispatch models: Electricity Dispatch models (also commonly referred to as "production cost" models) simulate the dynamic operation of the electric system, generally on a least-cost system dispatch. In general, these models optimize the dispatch of the system based on the variable costs of each resource and any operational constraints that have been entered into the model. These models are helpful in assessing which existing plants are displaced.

These models are also used in short-term planning and regulatory support.

Emissions & Generation Resource Integrated Database (eGRID): eGRID is an EPA-maintained comprehensive inventory of environmental attributes of electric power systems, providing air emissions data for the electric power sector.

Energy efficiency (EE): Refers to specific end-use programs, projects and measures that achieve the same or better level of performance as existing technology or approaches through lower energy consumption. These efforts reduce overall electricity consumption (reported in kilowatt or megawatt hours), often without explicit consideration for the timing of program-induced savings. Such savings are generally achieved by substituting technologically more advanced equipment to produce the same level of end-use services (e.g. lighting, heating, motor drive) with less electricity. Examples include high-efficiency appliances, efficient lighting programs, high-efficiency heating, ventilating and air conditioning (HVAC) systems or control modifications, efficient building design, advanced electric motor drives, and heat recovery systems.

Energy efficiency measure: Installation of equipment, installation of subsystems or systems, or modification of equipment, subsystems, systems, or operations on the customer side of the meter, in order to improve energy efficiency.

Energy efficiency policy: Energy efficiency policy means an enacted law and/or regulation by a state, locality or public utility commission order which requires applicable entities to adopt energy efficient technologies and/or practices, or to undertake activities to further such adoption in the marketplace. It can include: (1) policies that establish minimum efficiency requirements for new homes and buildings (building energy codes) or appliances (appliance standards); (2) policies that establish requirements on utilities (or other program administrators) to deliver a specified amount of energy savings by developing energy efficiency programs to increase market adoption of EE technologies and practices (energy efficiency resource standards); and (3) policies that commit to specified funding levels dedicated to implementing energy efficiency programs (e.g., public benefits funds). State and local governments both have authority over energy efficiency policies. EE policies are generally enforced over a multi-year period (e.g., through 2020) or until changed or updated by revised legislation or regulation (e.g., adopting a revised building energy code). These programs can be funded through ratepayer surcharges, Federal funds (e.g., ARRA, SEP), proceeds from pollution auctions such as the Regional Greenhouse Gas Initiative (RGGI) or any combination of the above.

Energy Efficiency Program: Energy efficiency program means a program designed to increase adoption of energy efficient technologies and practices in particular end-use sectors (or specific market segments within a sector) through education & outreach, financial incentives, and/or technical assistance. An individual EE program can be run by a utility, state or local government, and/or third parties. In most cases, EE program administrators (i.e., utilities, state agencies, or 3rd parties) develop and implement EE programs to meet adopted EE policy objectives. State Public Utilities Commissions (PUCs) oversee and approve the EE programs funded with rate-payer resources. EE programs typically operate over a 1-3 year period.

Energy model: This refers to the numerous models that are available for simulating the electric power system. They have strengths and weaknesses relative to each other, as a general matter, since they strike different tradeoffs between the level of rigor and ease of use.

Evaluation: The performance of studies and activities aimed at determining the effects of a program; any of a wide range of assessment activities associated with understanding or documenting program performance, assessing program or program-related markets and market operations; any of a wide range of evaluative efforts including assessing program-induced changes in energy efficiency markets, levels of demand or energy savings, and program cost-effectiveness.

Future attainment year baseline: A baseline forecast of future emissions is made when an area prepares a State Implementation Plan (SIP)/Tribal Implementation Plan. Future year emission projections provide a basis for considering control strategies for SIPs, conducting attainment analyses, and tracking progress towards meeting air quality standards.

Heating, Ventilating, and Air Conditioning (HVAC): This refers to technology to provide for indoor environmental comfort.

Integrated Planning Model (IPM): The EPA uses IPM to analyze the projected impact of environmental policies on the electric power sector in the 48 contiguous states and the District of Columbia. EPA has used multiple iterations of the IPM model in various analyses of regulations and legislative proposals.

Kilowatt-hour (KWh): A measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu.

Load shapes: Representations such as graphs, tables, and databases that describe energy consumption rates as a function of another variable such as time or outdoor air temperature.

Marginal emission rates: The emissions associated with the marginal generating unit in each hour of the day.

Measurement and verification (M&V): Data collection, monitoring, and analysis associated with the calculation of gross energy and demand savings from individual sites or projects. M&V can be a subset of program impact evaluation.

Megawatt (MW): One million watts of electricity.

Megawatt-hour (MWh): One thousand kilowatt-hours or 1million watt-hours.

National Ambient Air Quality Standards (NAAQS): The CAA, which was last amended in 1990, requires EPA to set NAAQS (40 CFR part 50) for pollutants considered harmful to public health and the environment. The CAA established two types of national air quality standards. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

Nitrogen Oxides (NO_x): Nitrogen oxide can refer to a binary compound of oxygen and nitrogen, or a mixture of such compounds.

"On the books" EE/RE Policies: EE/RE policies that have been adopted by a legislative or regulatory body.

"On the way" EE/RE Policies: EE/RE policies that are planned for adoption by a legislative or regulatory body prior to the submittal of the SIP in question to EPA.

Peak demand: The maximum level of metered demand during a specified period, such as a billing month or a peak demand period.

Portfolio: Either (a) a collection of similar programs addressing the same market, technology, or mechanisms or (b) the set of all programs conducted by one organization.

Program: A group of projects, with similar characteristics and installed in similar applications.

Public Utilities Commission (PUC) or Public Service Commission (PSC): A PUC or PSC is a governing body that regulates the rates and services of a public utility. In some cases, government bodies with the title "Public Service Commission" may be civil service oversight bodies, rather than utilities regulators.

Renewable Energy (RE): Energy resources are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

Renewable Energy Policy: Regulations, statutes, or state public utility commission orders that require parties to acquire renewable energy or to commit to funding levels for programs aimed at acquiring RE.

Renewable Energy Program: Renewable energy program means a program designed to increase the production and use of renewable energy sources through resource development and procurement, education & outreach, financial incentives, and/or technical assistance.

Renewable Portfolio Standard (RPS): An RPS is a regulation that requires the increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal.

State Implementation Plans (SIPs): A SIP is a plan developed by a state for how that state will comply with the requirements of the federal Clean Air

Act, administered by the Environmental Protection Agency. The SIP consists of narrative, rules, technical documentation, and agreements that an individual state will use to clean up polluted areas.

Traditional, Federal enforceability: This refers to what occurs in the SIP planning process when EPA approves a SIP control strategy submitted to it for review. When that occurs, it becomes traditionally federally enforceable, which provides EPA with authority to ensure the SIP is implemented.

Tribal Implementation Plans (TIPs): Although not required to do so, a tribe with Treatment as State eligibility may develop its own air quality control plan, called a Tribal Implementation Plan (TIP), for approval by EPA. A TIP enacted by a tribal government and approved by the EPA is legally binding under both tribal and federal law and may be enforced by the tribe, EPA, and the public.

Voluntary EE/RE Programs: Voluntary EE/RE programs are programs adopted by state and local governments or other parties to promote EE/RE that may or may not result from an EE/RE policy.

Voluntary/emerging measures policy: In September 2004, EPA issued guidance entitled: "Incorporating Emerging and Voluntary Measures in a State Implementation Plan (SIP)." The guidance provides a policy for areas to try new types of pollutant reduction strategies such as EE/RE programs to attain or maintain the NAAQS and meet CAA requirements.

Watt (W): The unit of electrical power equal to one ampere under a pressure of one volt. A Watt is equal to 1/746 horse power.

Weight-of-evidence (WOE): WOE refers to the augmenting of a SIP modeled attainment test with supplemental analyses may yield a conclusion differing from that indicated by the modeled attainment test results alone.

Appendix B: Overview of the U.S. Electric System

SECTION B.1: INTRODUCTION

Generating electricity from fossil fuels is the single largest source of anthropogenic carbon dioxide (CO2) emissions in the United States, representing 40 percent of CO2 emissions in 2008.[7] It is also the largest source of criteria air pollutants that affect air quality and human health. For these and other reasons there has been growing interest in understanding the impacts of state-level energy efficiency and renewable energy (EE/RE) policies on emissions from power generation. Much of this interest has come from state environmental regulators interested in including emission reductions from EE/RE policies in their plans for improving and maintaining air quality.

For these stakeholders and others working to analyze the effects of clean energy on air pollution emissions, there is a need to:

- Understand the electric system
- Understand how the system is likely to respond to the introduction of clean energy resources
- Conduct analysis that credibly and accurately represents this interaction and estimates reductions in air pollution

Appendix B is intended to address these needs[8]. It highlights the basic workings of the electric system and addresses important issues that arise in energy and emissions planning, most notably the "control strategy pathway" for state implementation plan (SIP)/Tribal Implementation Plan (TIP) quantification (see Appendix F). A key take-away from this Appendix is that the operation of regional power systems is complex and dynamic, so predicting how these systems will react to new resources – including energy efficiency and renewable energy – is likewise a complex undertaking.

SECTION B.2: ABOUT THE U.S. ELECTRIC SYSTEM

The most common way to generate electricity is to burn fossil fuels to convert water into steam, and to use the steam to spin a turbine that is connected to an electric generator. Generators can also be turned by water – as is the case with hydroelectric power plants – or by wind turbines. In all cases, the electricity generated at these facilities flows across the transmission and distribution system to where it is needed to meet customer demand in cities and rural areas.

[7] "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008," April 2010, Table ES-2.
[8] An additional resource for states interested in understanding the U.S. electric system is U.S. EPA's guidance, *Assessing the Multiple Benefits of Clean Energy: A Resource for States.* See: http://www.epa.gov/statelocalclimate/resources/benefits.html

The North American electric system is an interconnected network for generating, transmitting, and delivering electricity to consumers. Over the past 100 years, the system developed around a "central station" model that distributes power from large generating stations (often located near a fuel source) to customers located in load centers that are hundreds of miles away. The current electricity delivery system was designed and built in the 1950s to move large quantities of power from generators to consumers at low cost. Despite a recent trend towards more "distributed" power – in which small generation facilities are located near loads – most electric power in the U.S. continues to be generated at central-station facilities powered by coal, natural gas, nuclear, and hydropower.

The North American electric system is divided into four distinct grids in the continental United States and Canada: the Eastern, Western, Quebec, and Electric Reliability Council of Texas (ERCOT), as depicted in Figure B.2, *NERC Interconnections*. The generators, power lines, substations, and power distribution system are the responsibility of various utility companies working together under regional oversight to keep each grid operational. Each grid has only limited connections to the other three, but within them electricity is imported and exported continuously among numerous smaller power control areas (PCA).

PCAs are managed by system operators, or transmission organizations, whose main function is to maintain the reliability of the system in their areas (e.g., New England, New York, California, etc.). They do this by keeping the electricity supplied by the power plants in balance with that demanded by customers. This happens in real-time, every day of the year. In other words, energy is simultaneously being generated and consumed on each grid in the same quantity. There is very little ability to store electricity, and it is difficult for the grid to accommodate large, rapid changes in use and generation.

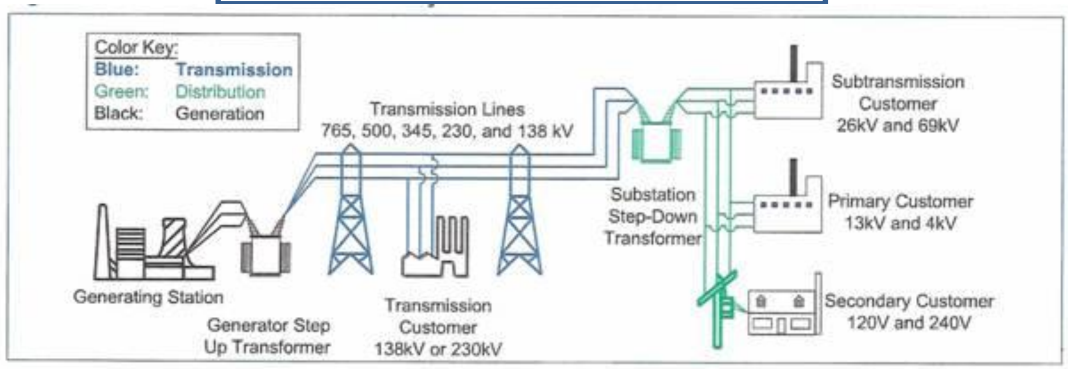
SECTION B.3: HOW THE ELECTRIC SYSTEM WORKS

Figure B.1 depicts the flow of power from the generating station, or power plant, to the transformer and transmission lines through a substation transformer (that reduces voltage) to the distribution lines. It then flows through the pole transformer to the consumer's service box. Electricity *transmission* typically refers to power flow between the generating station and a substation, and electricity *distribution* most often refers to delivery from the substation to consumers. The flow of electricity occurs in accordance with the laws of physics—along "paths of least resistance," in much the same way that water flows through a network of canals.

Over time in a given location, the consumer demand for power fluctuates significantly. For instance, residential electricity demand typically peaks in the morning and evening when residents are home and operating electricity-consuming products. In contrast, commercial electricity demand typically peaks during the middle of the day while industrial demand varies by individual firm and type of industry. System planners have to account for these variations as well as other factors such as weather and the availability of individual power plants, all while keeping the system in balance. Fortunately, the aggregate demand of the many jurisdictions across a single grid behaves in a relatively predictable manner.

To meet consumer demand, the grid operators rely on a fleet of power plants with different operational characteristics, fuels, and cost structures. Base load plants such as nuclear and most coal plants operate 24 hours a day and do not readily cycle up and down. They are meant to start up and keep running until maintenance is needed. Base load units are also characterized by relatively high capital costs and a ramp-up process that is slow, expensive, and results in wear on the generating units. As power demand increases over the course of a day, intermediate and peaking plants come on line. These plants have the physical capability to quickly ramp up power production to meet increasing demand and to rapidly cycle down once that demand dissipates. These plants are often engines or turbines that are fueled by oil or natural gas (see Figure B.3).

Figure B.1: System Flow of Electricity



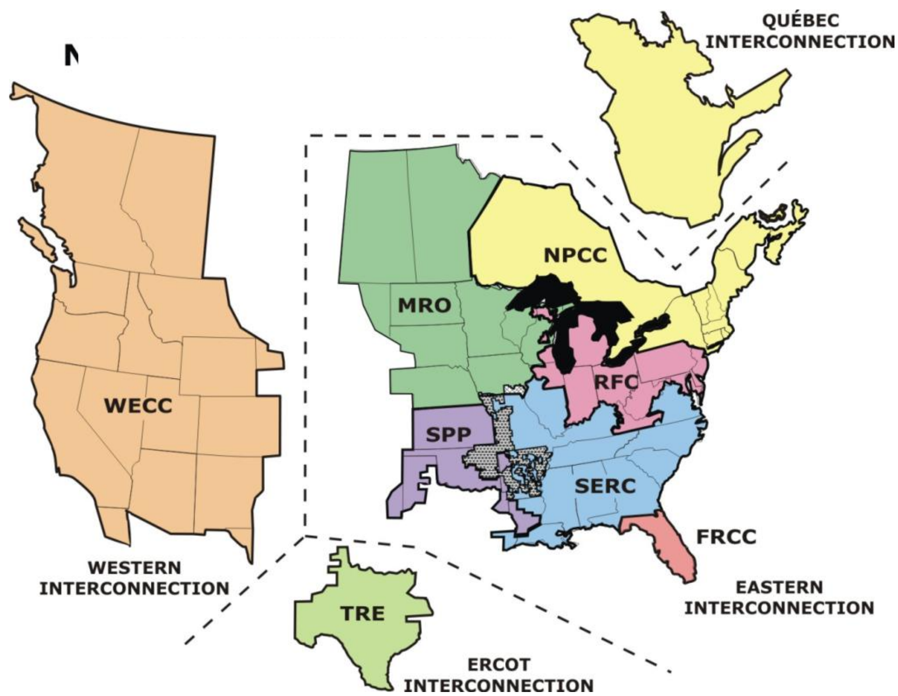
The Marginal Unit

- The highest-cost unit dispatched at any point in time is said to be "on the margin" and is known as the "marginal unit." At peak times, for example, high-cost combustion turbines and gas/oil peaking units are frequently on the margin. During off-peak times, plants with lower operating costs (e.g., combined cycle gas turbines and coal-fired steam units) can be on the margin. In some regions the cost used to determine merit order for dispatch is the variable cost of running each plant (mainly fuel cost), but in other regions the criterion for dispatch is a bid price submitted by the owners of the generators

The decision of which power plants to dispatch and in what order is based in principle on economics, with the lowest-cost resources dispatched first and the highest cost resources last. The last resources to be called upon are referred to as the marginal units, which are typically the most expensive units to run. In some cases in certain parts of the country, these plants can also be among the dirtiest and least efficient of the power plant fleet.

Renewable energy and energy efficiency can affect the dispatch in different ways, though both cause marginal units to run less frequently and result in fewer air emissions. In the case of efficiency, energy consumption is lowered at the point of consumption resulting in a reduction in demand on the electric system and a corresponding reduction in emissions from the power plant fleet.

Figure B.2: NERC Interconnections



In contrast, renewable energy sources reduce the output from the marginal unit by producing electricity for the power. Thus, a wind farm producing electricity displaces the need for electricity that would have otherwise been produced by that marginal unit. Since wind power results in zero emissions, overall emissions from the power plant fleet are reduced (absent a cap on emissions that determines overall pollution levels).

This theory of "economic dispatch" predicts that any new resource shifts upward all resources above it in the dispatch order, reducing demand on the marginal unit (the most expensive unit needed to meet demand). Actual plant dispatch, however, is frequently more complicated than the representation in Figure B.3 for three main reasons:

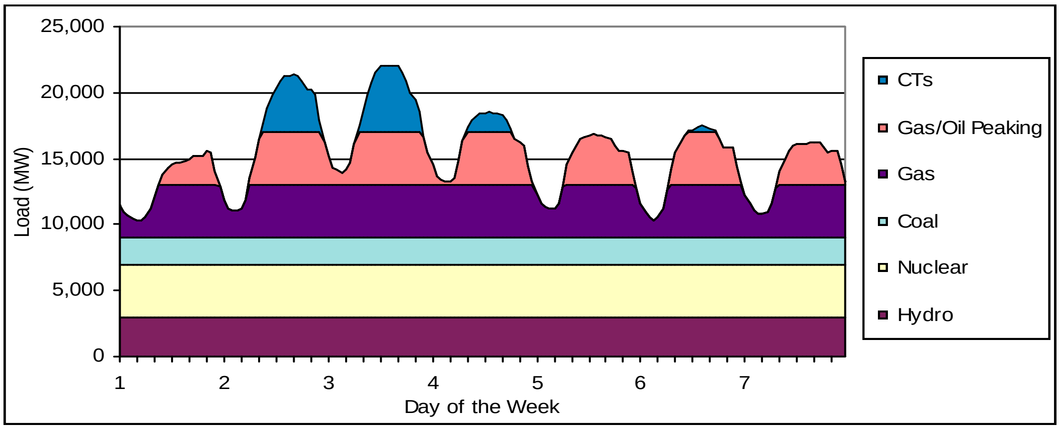
- Transmission constraints may require system operators to dispatch certain units that are more expensive than other available units.
- It is time consuming to start and stop many types of large generating units. Limitations on unit "ramp-up rates" also force system operators to keep some

units running during periods when they are not needed (in order to have the units available when they are needed). These are referred to as load following, or intermediate units, and are often running at a lower and less efficient rate while not producing any power for input into the grid.

- System operators do not treat generating units as single entities in the dispatch process. Instead, plant owners in competitive markets typically bid the power from an individual generating unit into a smaller number of "blocks" that are instead bid into the grid.

Because actual unit dispatch often looks very different from the ideal shown in Figure B.3., environmental regulators and others should be aware of how these electric-system realities are represented in control-measure estimates of emissions reductions.

Figure B.3: Unit Dispatch in a Power System



SECTION B.4: THE LOCATION OF EMISSIONS REDUCTIONS RELATIVE TO THE SITING OF CLEAN ENERGY RESOURCES

The goal of clean energy policies in the SIP planning context is typically to reduce emissions within the state, tribal area or region where the policies are implemented. To achieve this goal, all (or a portion of) the emissions reductions from EE/RE must occur in a location that affects air quality in the implementing jurisdiction. The environmental regulator can take steps to ensure that the analysis supporting such a policy accounts for the interconnected and dynamic nature of the power system, and that it examines the possibility that the benefits of clean energy policies may not be completely realized within the jurisdiction of interest.

This can be illustrated by the example of a state with a renewable portfolio standard requiring utilities to buy a fixed percentage of their electricity from renewable energy facilities. If a local utility signs an energy-purchase contract with the nearest renewable facility, the state may find it difficult to correlate wind power produced by that wind farm to a corresponding reduction in electric output and emissions from specific fossil-fuel generators. The implementing state needs to ensure that the emission reductions occur at an upwind or nearby facility that affects the implementing state's air quality.

For this reason, it is critically important to understand and accurately predict how the regional power grid is likely to behave when assessing the emissions benefits from clean energy resources.

Appendix C: Existing Energy Efficiency/Renewable Energy Guidance

SECTION C.1: INTRODUCTION

The purpose of this appendix is to provide brief information on existing EPA guidance that touches on EE/RE and SIPs. It is organized by pathway. EPA has issued five guidance documents related to incorporating EE/RE programs in SIPs or one of the four pathways:

- Guidance on State Implementation Plan (SIP) Credits for Emission Reductions from Electric-Sector Energy Efficiency and Renewable Energy Measures, August 2004.
- Guidance on Incorporating Emerging and Voluntary Measures in a State Implementation Plan (SIP), September 2004.
- Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze, April 2007.
- Incorporating Emerging and Voluntary Measures in a State Implementation Plan (SIP), September 2004.
- Guidance on Incorporating Bundled Measures in a State Implementation Plan, August 2005.

SECTION C.2: EXISTING GUIDANCE ON BASELINE PATHWAY

There are several guidance documents that provide recommendations on how to estimate emissions for future years. Among point source emissions, there are two major subsets: electric generating utilities (EGUs) and non-EGUs. The Clean Air Markets Division (CAMD) of the U.S. EPA uses the Integrated Planning Model (IPM) to model emissions trading programs and to predict future-year emissions from EGUs. More information on IPM is available at (http://www.epa.gov/airmarkt/epa-ipm/). Additionally, IPM-based emissions are posted by CAMD on EPA's website (http://www.epa.gov/airmarkets/epa-ipm/iaqr.html). Other models may exist and could be used for estimation of future-year emissions.

SECTION C.3: EXISTING GUIDANCE ON CONTROL MEASURE PATHWAY

EPA guidance spells out the criteria that energy efficiency/renewable energy (EE/RE) measures need to address to be a SIP control measure:

- Quantifiable;
- Surplus;
- Enforceable; and

- Permanent.

Quantifiable

The EE/RE measure guidance spells out four steps to address when trying to quantify EE/RE measures:

- STEP1: Estimate the energy savings that an energy efficiency measure will produce, or, for a renewable energy project, the amount of energy generation that will occur.
- STEP 2 - Convert the energy impact in STEP 1 into an estimated emissions reduction.
- STEP 3 - Determine the impact from the estimated emission reduction on air quality in the nonattainment area.
- STEP 4 - Provide a mechanism to validate or evaluate the effectiveness of the project or initiative.

The guidance also indicates that emission reductions generated by measures to reduce emissions must be quantifiable and include procedures to evaluate and verify over time the level of emission reductions actually achieved. The emission quantification and evaluation methods in this guidance may be used to satisfy this criterion. However, since there can be many types of energy efficiency or renewable programs covering many different areas, alternative protocols may also be acceptable, and would be evaluated, as necessary, on a case-by-case basis.

Surplus

The EE/RE measure guidance indicates that emission reductions are surplus as long as they are not otherwise relied on to meet air quality attainment requirements in air quality programs related to your SIP. In the event that the measures to reduce utility emissions are relied on by you to meet air quality-related program requirements, they are no longer surplus and may not be used as an additional reduction to meet SIP emission reduction requirements, such as the attainment demonstration, RFP, or ROP. The surplus requirement is especially important in areas subject to a cap and trade program.

If an energy efficiency program causes several EGUs that are part of a cap and trade program to scale back the amount of electricity they generate and therefore reduce overall emissions, it may be difficult to show that these reductions meet the “surplus” criteria for crediting the measure. This is because the units are still allowed to emit up to the same number of allowances in the program even though the amount of electricity they need to generate has been reduced. The energy efficiency or renewable energy measure, in effect, allow the EGUs to comply with the cap and trade program with a slightly higher average emission rate and a theoretically lower allowance price. Therefore, the estimated emission reductions from the energy efficiency or renewable energy measure would typically not be surplus, and would essentially be double counted if we permitted the allowances that were freed up by the measure to be used and also provided additional SIP credit for the energy efficiency actions.

The presence of a cap and trade program, however, does not necessarily prohibit the use of energy efficiency and renewable energy measures by a State agency to achieve additional SIP reductions. One acceptable way of achieving additional emission reductions from energy efficiency and renewable energy measures in the presence of a cap and trade program is through the retirement of allowances commensurate to the emissions expected to be reduced by the energy efficiency measures. The retirement of allowances provides some level of assurance that the energy efficiency measures will achieve emission reductions that are surplus to the emissions reductions under the cap and trade program. Another way is to clearly demonstrate that emissions decrease in the area despite the cap and trade program and the ability for plants to sell more electricity to other areas. This demonstration will likely entail a detailed analysis of electricity dispatch and allowance markets to determine the specific impact of the measures on the system.

Enforceable

The EE/RE measures guidance indicates that EE/RE measures may be:

- Enforceable directly against a source;
- Enforceable against another party responsible for the energy efficiency or renewable energy activity; or
- Included under our voluntary measures policy.[9]

EPA believes that most measures you may consider under the guidance would fall into the second or third categories listed above. Energy efficiency and renewable energy are unlike traditional control measures on stationary sources. There is typically a physical distance between where the measure is implemented and the emission reductions, as well as a geographic distribution to the emission reductions. Since electric generating units are interconnected in the electric grid, a reduction in energy demand or generation from a renewable resource will likely affect the operation and emissions of several fossil fired units in the system. The energy efficiency or renewable energy measure itself may be enforceable against the entities undertaking the activity even though they are not responsible for the operation of the electric generators at which the emission reductions are estimated for purposes of the SIP. For example, you could require certain entities to purchase an amount of renewable energy. If you rely upon such requirements within the SIP, then such measure could be enforceable against the entities required to purchase the renewable electricity or to reduce energy consumption, even if those entities are not responsible for the operation of the electricity generating units at which the emission reductions are expected to occur.

If the reductions are "enforceable directly against the source", then they are considered enforceable if:

- They are independently verifiable;
- Violations are defined;

[9] "Incorporating Voluntary Stationary Source Emission Reduction Programs into State Implementation Plans," USEPA/OAQPS, January 19, 2001, http://www.epa.gov/ttn/oarpg/t1/memoranda/coverpol.pdf .

- Those liable for violations can be identified;
- The state and EPA maintain the ability to apply penalties and secure appropriate corrective actions where applicable;
- Citizens have access to all the emissions-related information obtained from the source;
- Citizens can file suits against the source for violations; and
- They are practicably enforceable in accordance with EPA guidance on practicable enforceability.

If the reductions are "enforceable against another party responsible for the energy efficiency or renewable energy activity", then they are considered enforceable if:

- The activity or measure is independently verifiable;
- Violations are defined;
- Those liable for violations can be identified;
- The state and EPA maintain the ability to apply penalties and secure appropriate corrective actions where applicable;
- Citizens have access to all the required activity information from the responsible party;
- Citizens can file suits against the responsible party for violations; and
- The activity or measure is practicably enforceable in accordance with EPA guidance on practicable enforceability.

Permanent

The EE/RE measure should be permanent throughout the term for which the credit is granted unless it is replaced by another measure or the State demonstrates in a SIP revision that the emission reductions from the measure are no longer needed to meet applicable requirements.

SECTION C.4: EXISTING GUIDANCE ON EMERGING/VOLUNTARY MEASURES PATHWAY

EPA guidance describes an emerging measure as a new emission reduction or pollutant reduction measure that is more difficult to accurately quantify than traditional SIP emission reduction measures. The difficulty in quantifying the emission or pollutant reductions may be due to scientific, technological, or informational uncertainty. The ability to quantify reductions from emerging measures may require development of a protocol based on assumptions and/or modeling to estimate the reduction impacts of the emerging measure. A voluntary measure is an action by a source that will reduce emissions of a criteria pollutant or a precursor to a criteria pollutant that the State could claim as an emission reduction in its SIP for purposes of demonstrating attainment or maintenance of the NAAQS, RFP, or ROP, but that is not directly enforceable against a source. EPA guidance also describes how States can identify individual voluntary and emerging measures and "bundle" them in a single SIP submission.

How A State Can Get SIP Approval For Emerging/Voluntary Measures

A State would submit a SIP to EPA which:

- Identifies and describes the measure;
- Contains projections of emission or pollutant reductions attributable to the program, along with relevant technical support documentation, including, for emerging measures, a full discussion of the relevant best available science supporting the measure;
- Enforceably commits the State to implementation of those parts of the measure for which the State or local government is responsible;
- Enforceably commits the State to monitor, evaluate, and report at least every three years to the public and EPA on the resulting emissions effect of the emission or pollutant reduction measure;
- Enforceably commits the State to remedy any SIP credit shortfall in a timely manner, if the program does not achieve projected emission reductions;
- Meets all other requirements for SIP revisions under sections 110 and 172 of the CAA; and
- Undergoes public notice and comment as any other SIP revision.

Four Criteria For SIP Emerging/Voluntary Measures

Quantifiable

Emissions and emission reductions attributed to the measure are quantifiable if someone can reliably and replicably measure or determine them. Any uncertainty in the quantification should be addressed by following the guidance contained in the Economic Incentives Program (EIP)[10] in section 5.2 (b). Voluntary measures should meet this provision unless the measure is also an emerging measure.

For emerging measures, EPA allows flexibility for the quantification requirement. Some areas want to try new types of emission control or pollution reduction strategies. Some of these new strategies have a substantial chance to be as effective (and possibly more effective) than current measures in reducing criteria pollutant levels. The EPA supports and wishes to promote the testing of new emission and pollutant control strategies. This policy provides a mechanism that allows States to receive provisional emission reduction credit in their SIP for new emission control and pollutant reduction strategies that have the potential to generate additional emission reductions or air quality benefits. Provisionary emission reductions or pollutant reduction strategies can become permanent when post-implementation evaluations validate the amount of emission reductions achieved. “Provisionary” in this case means the State may use particular emission reductions for RFP or other purposes before the quantification procedure has been fully validated. Even though these emission reductions can be used to fulfill CAA emission reduction requirements, if post implementation evaluations do not show that all the projected emissions reductions have occurred, the State must reconcile the difference

[10] “Improving Air Quality with Economic Incentive Programs,” EPA- 452/R-01-001, January 2001.

between the projected and actual emissions reductions. In order to encourage emerging new programs with which EPA and the States do not have significant experience, but which are technically and scientifically sound, the Agency believes it is appropriate to allow quantification based on best available science or information where direct, empirically verified data are not available. In these circumstances, the State should quantify the pollution reduction based on the best knowledge currently available for the measure being considered. The State should develop a protocol based on a carefully considered determination of the activities that it is committing to undertake and the activities' projected impact on pollution. The estimates may be based on modeling, on extrapolated experience for similar types of projects or on another approach that is likely to yield a reasonable estimate of pollution reduction.

Surplus

Emission reductions used to meet air quality attainment requirements are surplus as long as they are not otherwise relied on in air quality-related programs relating to a SIP. For voluntary and emerging measures, EPA believes these reductions should also be surplus to adopted State air quality programs, even those programs that are not in the SIP, such as a consent decree and Federal rules that focus on reducing criteria pollutants or their precursors. For emission reductions used for attainment, RFP, ROP, maintenance or general conformity, the emission reductions cannot *already* be assumed for the same requirement, where the requirements are cumulative. An emission reduction may be used for more than one of these requirements. For example, emission reductions used to meet the RFP requirement may also be used for the attainment demonstration. However emission reductions are not surplus if they have already been assumed in a program. In other words, States cannot claim emission reductions that are already assumed in the existing SIP, or that result from any other emission reduction or limitation of a criteria pollutant or precursor that the State is required to have to attain or maintain a NAAQS or satisfy other CAA requirements. In the event that emission reductions relied on from a measure are subsequently required by a new air quality related program, such as those listed above, those emission reductions would no longer be surplus for this purpose.

Enforceable

While we have already stated that voluntary measures are not enforceable against the source, the State would be responsible for assuring that the emission reductions credited in the SIP occur. The State would make an enforceable commitment to monitor, assess and report on the emission reductions resulting from the voluntary measures and to remedy any shortfalls from forecasted emission reductions in a timely manner as discussed below.

Emission reductions and other required actions are enforceable against the source if for each source:

- They are independently verifiable;
- Program violations are defined;
- Those liable can be identified;

- For emerging measures, the State and the EPA maintain the ability to apply penalties and secure appropriate corrective action where applicable;
- They are enforceable in accordance with other EPA guidance on practicable enforceability;
- For voluntary measures, the EPA maintains the ability to apply penalties and secure appropriate corrective action from the State where applicable and the State maintains the secure appropriate corrective action with respect to portions of the program that are directly enforceable against the source;
- Citizens have access to all the emissions-related information obtained from the source; and
- For emerging measures, citizens can file suits against sources for violations.

Permanent

The voluntary/emerging measures guidance indicates that an emission reduction strategy must continue throughout the term that the credit is granted unless it is replaced by another measure (through a SIP revision) or the State demonstrates in a SIP revision that the emission reductions from the measure are no longer needed to meet requirements that apply to voluntary and emerging measures.

Emission Reduction (SIP) Credit

The EPA believes that it is appropriate to presumptively limit the amount of emission reductions allowed for approval under this policy. Although EPA concludes that emerging measures are consistent with the statute because all emerging measures will be accompanied with an appropriate enforceable backstop commitment from the state as described in this policy, EPA believes it is appropriate to limit these measures to a small portion of the SIP given the untested nature of the control mechanisms. The presumptive limit is 6 percent of the total amount of emission reductions required for the ROP, RFP, attainment, or maintenance demonstration purposes. The limit applies to the total number of emission reductions that can be claimed from any combination of voluntary and/or emerging measures, including those measures that are both voluntary and emerging. The limit is presumptive in that EPA believes it may approve measures into a SIP in excess of the presumptive six percent where a clear and convincing justification is made by the State as to why a higher limit should apply in their case. Any request for a higher limit will be reviewed by EPA on a case-by-case basis. Any approval of emerging measures under this policy will be conducted through full notice-and-comment rulemaking in the context of a particular state SIP revision.

Bundling Emerging/Voluntary Measures

Emerging/voluntary measures can also be bundled together. The emissions reductions for each measure in the bundle would be quantified and, after applying an appropriate discount factor for uncertainty, the total reductions would be summed together in the SIP submission. After SIP approval, each individual measure would be implemented according to its schedule in the SIP. It is the performance of the entire bundle (the sum of the emissions reductions from all the measures in the bundle) that is considered for SIP evaluation purposes, not the effectiveness of any individual measure.

SECTION C.5: EXISTING GUIDANCE ON WOE PATHWAY

The air quality modeling guidance issued in 2007 addresses the weight-of-evidence approach for attainment demonstrations. The guidance indicates that States/Tribes should always perform complementary analyses of air quality, emissions and meteorological data, and consider modeling outputs other than the results of the attainment test. Such analyses are instrumental in guiding the conduct of an air quality modeling application. Sometimes, the results of corroboratory analyses may be used in a *weight of evidence determination* to show that attainment is likely despite modeled results which may be inconclusive. The further the attainment test is from being passed, the more compelling contrary evidence produced by corroboratory analyses must be to draw a conclusion differing from that implied by the modeled attainment test results. If a conclusion differs from the outcome of the modeled test, then the need for subsequent review (several years hence) with more complete data bases is increased. If the test is failed by a wide margin (e.g., future design values outside the recommended range at an individual site or multiple sites/locations), it is far less likely that the more qualitative arguments made in a weight of evidence determination can be sufficiently convincing to conclude that the NAAQS will be attained. Table 2.1 contains guidelines for assessing when corroboratory analyses and/or weight of evidence determinations may be appropriate.

In a weight of evidence (WOE) determination, States/Tribes should review results from several diverse types of air quality analyses, including results from the modeled attainment test. As a first step, States/Tribes should note whether or not the results from each of these analyses support a conclusion that the proposed strategy will meet the air quality goal. Secondly, States/Tribes should weigh each type of analysis according to its credibility, as well as its ability to address the question being posed (i.e., is the strategy adequate for meeting the NAAQS by a defined deadline?). The conclusions derived in the two preceding steps are combined to make an overall assessment of whether meeting the air quality goal is likely. This last step is a qualitative one. If it is concluded that a strategy is inadequate to demonstrate attainment, a new strategy is selected for review, and the process is repeated. States/Tribes should provide a written rationale documenting how and why the conclusion is reached regarding the adequacy of the final selected strategy. Results obtained with air quality models are an essential part of a weight of evidence determination and should ordinarily be very influential in deciding whether the NAAQS will be met.

Appendix D: Understanding State Renewable Energy and Energy Efficiency Policies

SECTION D.1: INTRODUCTION

States have adopted and implemented a wide range of policies aimed at increasing the quantity of energy efficiency and renewable energy resources. These policies have been implemented for many reasons including energy security, resource diversity, economic development, reducing exposure to volatile fuel prices, and improving air and water quality and public health. This appendix provides a general description of common energy efficiency and renewable energy policies, and provides some key questions for state officials to consider when evaluating whether it makes sense for a state to account for the future impacts of EE/RE policies in a SIP.

SECTION D.2: OVERVIEW OF STATE RENEWABLE ENERGY POLICIES

For purposes of this manual, the discussion of renewable energy policies will focus on state Renewable Portfolio Standards (RPS). States may have other renewable energy policies including surcharges on bills to be invested in renewable energy projects, financial and tax incentives to allow businesses and residents to install renewable energy projects on their sites, and tax incentives to lure renewable energy businesses to a state. RPS are emphasized here as these policies, when implemented, impact the operation of large numbers of power plants and potentially decrease emissions from that sector in a particular state or power pool.

RPS are typically implemented and enforced by state energy officials or public service commissions, and require that entities that sell electricity in that state to consumers to procure a minimum amount of their electricity supply from renewable electricity sources. RPSs are also enforced by these agencies, and must be updated and/or revised by legislation or regulation.

For more information on RPSs and other state renewable energy policies, see EPA's Guide to Action (Chapter 5) and other resources highlighted in section D.6 of this appendix.

As of this writing, 37 states had implemented some form of a RPS.[11] However, there are significant differences between state policy designs, including:

[11] http://www.dsireusa.org/

- The quantity of renewable energy that utilities must buy procure as a percentage of the total annual electricity demand;
- The definition of what energy sources qualify as renewable;
- The geographic location where the renewable energy facilities need to be located;
- Vintage restrictions or not, to determine the eligibility of facilities (e.g., hydro facilities that existed prior to the RPS being enacted);
- Whether the renewable portfolio standard is voluntary;
- Penalties and the amount that utilities must pay if they do not meet the RPS

In order to consider a RPS as a control strategy, or to factor it into a baseline calculation, the state needs to understand the details of its RPS, and its impacts on the operations and emissions of fossil fuel fired power plants that affect its state. For instance, at its most basic, a RPS may require the construction of renewable energy facilities such as wind farms. Since technologies have not yet developed to store significant quantities of electricity, when a wind plant is generating electricity, then a local fossil plant will be backed off, producing emission benefits. If a state's RPS requires that renewable energy be produced locally, then localized emission benefits will be easier to demonstrate. If a state allows renewable energy to be imported from far away, the benefit becomes a bit harder to prove.

In addition, the US Department of Energy's Annual Energy Outlook (AEO) factors state RPS programs into its reference case energy demand forecasts. For example, the AEO 2010 includes state RPS policies which were in place as of September 2009. As a result, state emission forecasts that use the IPM model will already have state RPS policies reflected in the forecast. States using IPM would not need to do additional work to include the RPS in their SIPs because that would result in double counting.

See Table D.1 for a comparison of programs in three states. For example, the Massachusetts has very aggressive RPS requirements. Its program requires that 15% of the state's electricity demand come from Class I renewable resources (wind, solar, hydro, landfill gas, etc.) by 2020, and increases 1% per year after that. Massachusetts has 2 classes of renewable resources, with RPS obligations for each. Class I are the newest renewable energy facilities, while Class II are "vintage facilities" that were in operation prior to 1997. Class II also includes waste energy facilities. In addition, much of the MA RPS obligations are being met by imports from other states and power pools.[12]

SECTION D.3: OVERVIEW OF STATE ENERGY EFFICIENCY POLICIES

For purposes of this manual, energy efficiency policies refer to a range of laws, regulations and programs aimed at reducing energy demand through the use of more energy efficient equipment, technologies and practices. These programs can be funded through ratepayer surcharges, Federal funds (e.g., ARRA, State Energy Programs, proceeds from pollution auctions such as the Regional Greenhouse Gas Initiative (RGGI) and/or any combination of the above). Examples include:

[12] *A power pool is an association of two or more interconnected electric systems having an agreement to coordinate operations and planning for improved reliability and efficiencies.*

- Minimum efficiency requirements for new homes and buildings (building energy codes) or appliances (appliance standards)
- Requirements for utilities (or other program administrators) to deliver a specified amount of energy savings by developing energy efficiency programs to increase market adoption of EE technologies and practices (i.e., energy efficiency resource standards)
- Specified funding levels dedicated to implementing energy efficiency programs (e.g., public benefits funds, air pollution allowance auction revenue).

In addition to the EE policies described above, a number of important regulatory mechanisms (e.g., utility incentive structures, innovative rate designs, smart grid investments) can help achieve a state's overall energy efficiency goals. However, these approaches are less relevant for the purposes of this guidance, either because the impacts of these policies are accounted for in the policies already described above or because the impacts of their impacts are especially difficult to quantify.

Federal, state, and local governments may have authority over energy efficiency policies. For example, building energy code policies are typically developed at the federal level, adopted by states, and enforced by localities. Almost all states have some form of electric-sector energy efficiency programs. Most of them are funded through ratepayer surcharges, block grants to the states from the Department of Energy (DOE) or with proceeds from auctions such as RGGI. The money collected from these surcharges is then reinvested, under the supervision of the Public Utility Commission, in a series of programs approved by each state to achieve the stated policy goals of reducing energy consumption. Examples of these types of programs include providing subsidies for more energy efficient equipment, revision to building codes and standards, etc. These programs may be administered by utility officials, independent third party energy authorities, and/or state energy officials.

Similar to RPS discussed above, energy efficiency policies vary by state. Differences include:

- Level of funding;
- Stability of funding year to year;
- Evaluation, Measurement and Verification (EM&V) techniques and energy savings calculations;
- Energy savings goals for the programs;
- Degree of enforceability

In order to appropriately estimate the energy savings from these programs a state must have infrastructure in place to support Evaluation, Measurement and Verification (EM&V) efforts. A rigorous and credible EM&V program will provide environmental regulators with a degree of certainty that savings claimed by the energy efficiency policies are actually being achieved.

For more information on state energy efficiency policies, see EPA's Guide to Action (Chapter 4) and the other resources highlighted in section D.6 of this appendix.
For more information on state regulatory mechanisms, see the National Action Plan for Energy Efficiency.

In order to consider energy efficiency policy as a control strategy, or to factor it into a baseline calculation, the state needs to understand the details of its policy, and its impacts on the operations and emissions of fossil fuel fired power plants that affect its state. At its most basic, when users are using less electricity, then less electricity needs to be generated and emissions are thus avoided. Energy efficiency programs result in emission benefits since a power plant that otherwise might be dispatched is sitting idle or operating at a lower output.

Once the state is comfortable with the estimates of energy savings, those savings then need to be evaluated against the operational characteristics of the power pool in which they are implemented. Often times, energy savings reported from energy efficiency programs are given in a gross number of kilowatt hours per year, without respect to the time of year or time of day in which those savings may have been realized. Given that emissions associated with electricity generation are not evenly distributed over the course of a day, a month or a year, some correlation needs to be demonstrated between the time of day and year that an energy efficiency measure provides benefit. For instance, during hot summer days many more power plants are running to meet increased electricity demand. On those days, emissions are typically higher than a cool fall day due to the fact that older, less efficient, and dirtier plants are called to meet the increased demand during those periods.

So, in order to accurately characterize the emission benefit from an energy efficiency program, the state needs to be able to tie the energy savings from that effort to the emissions associated with the time that the effort is reducing demand from the electric grid. This exercise is much more complex than is the case for an RPS due to the fact that renewable energy sold into a power pool is tracked and metered every hour of the day; whereas the benefits from efficiency are estimated using EM&V techniques (see Appendix E for more details on appropriate quantification methodologies).

For more information on converting energy efficiency and renewable energy policy impacts into emissions impacts, see Appendix E for the baseline pathway, Appendix F for the control measure pathway, and Appendix G for the weight of evidence pathway.

SECTION D.4: EXAMPLES OF STATE POLICIES

Table D.1 provides examples of three states' policies. The states featured are for illustrative purposes only, but are intended to show the range of policies in place today. The state of Connecticut has a mature set of programs that have been mandated by the state legislature and are well funded. The state's primary EE program is a ratepayer funded Public Benefit Program that, among other activities, provides resources to assist homeowners and businesses to adopt a range of energy efficient technologies and practices. In 2009, Connecticut ranked 9th in the United States with respect to per capita energy efficiency expenditures. The state's RPS program was started in 2000 and will reach a maximum required percentage of 27 percent by 2020, among the highest in the country.[13]

In 2007, North Carolina created its renewable energy and energy efficiency portfolio standard (REEPS). Under the REEPS, public electric utilities in the state must obtain renewable energy power and energy efficiency savings of 3% of prior-year electricity sales in 2012, increasing to 12.5% in 2021. Energy efficiency is capped at 25% of the 2012-2018 targets and at 40% of the 2021 target. Under this program, individual utilities now administer energy efficiency and renewable energy programs in North Carolina with oversight and approval from the North Carolina Utilities Commission. Rate-regulated utilities may recover the costs for renewable energy and energy efficiency programs through a Demand Side Management/Energy Efficiency rate rider.[14]

Utilities in Mississippi offer few energy efficiency programs. Some do report energy savings and one utility company offers loans for residential customers. Mississippi currently has no RPS program.

Table D.1 - Brief Overview of RE/EE Policies for Three States

EE/RE Policies	Connecticut	North Carolina	Mississippi
Energy Efficiency Policies	Yes	Yes	Yes
How Long have EE policies been in place?	2000	2005	1980
Annual Funding for EE	$73.4 million	$64.3 million	$9.2 million
Impact of EE Policies	354,000 Mwh saved (2008)	15,000 Mwh saved (2008)	11,000 Mwh saved (2008)
Renewable Energy Policies	Yes	Yes	No
How long has RPS been in place?	1998	2008	N/A
Impact of RPS	27% of electric demand by 2020	12.5% of electric demand by 2021	N/A
Compliance Mechanism	Yes	Yes	N/A

SECTION D.5: HOW STATE EE/RE PROGRAMS AND POLICIES ARE ADMINISTERED

As stated earlier, most EE and RE policies are implemented by state energy offices or public utility/service commissions, and not administered through a state's environmental office, though the benefits from these programs may have significant positive environmental impacts. While a state environmental agency may not administer or enforce these policies, their successful implementation may have significant environmental impacts. For example, an RPS that requires utilities to purchase from renewable energy facilities within its state or air shed may result in fossil fired units in

[13] http://apps1.eere.energy.gov/states/maps/renewable_portfolio_states.cfm
[14] http://www.aceee.org/sector/state-policy/north-carolina

the same area running less frequently resulting in significant air pollution benefits that are not reflected in a typical DEP permitting program for power plants. So it is in the interests of DEP staff to become acquainted with these policies and their potential environmental benefits.

In all cases, it is important for state environmental regulators to familiarize themselves with their counterparts in the PUCs and energy offices in their respective states.

EPA encourages States to focus the majority of its EE/RE in SIPs effort on EE/RE policies, since these are what States can point to as being "on the books" and because policies have more potential to provide meaningful impacts. Many of the specific EE/RE programs a State runs in any particular year will be captured by accounting for the policies that fund or require them. In attempting to account for individual EE/RE program impacts in SIPs, States should be sure to demonstrate that these programs are incremental to any EE/RE policies the State is also accounting for in its SIP. For example, if a State is already accounting for the impacts of its EERS, it should not also include incremental impacts for a residential CFL incentive program that the utilities in the state develop to help meet the EERS.

SECTION D.6: WHERE TO GO FOR MORE INFORMATION

There are several places the reader can go for more information including:

- The Database of State Incentives for Renewables and Efficiency (DSIRE) is a comprehensive source of information on state, local, utility and federal incentives and policies that promote renewable energy and energy efficiency. Established in 1995 and funded by the U.S. Department of Energy, DSIRE is an ongoing project of the N.C. Solar Center and the Interstate Renewable Energy Council. http://www.dsireusa.org/
- The American Council for an Energy Efficient Economy (ACEEE) is a national nonprofit organization dedicated to advancing and deploying energy efficiency technologies, policies, programs, and behavior. They provide up to date information on energy efficiency programs and policies for all 50 states. http://www.aceee.org/sector/state-policy
- EPA State Climate and Energy Program: http://epa.gov/statelocalclimate/state/index.html
- Guide to Action: http://epa.gov/statelocalclimate/resources/action-guide.html
- National Action Plan for EE: http://www.epa.gov/cleanenergy/energy-programs/suca/resources.html
- LBNL on RPS: http://eetd.lbl.gov/ea/ems/reports/lbnl-154e-revised.pdf
- LBNL or EE: http://eetd.lbl.gov/ea/ems/reports/lbnl-2258e.pdf
- The Regulatory Assistance Project: www.raponline.org

Appendix E: Baseline Pathway

SECTION E.1: BASICS OF FUTURE ATTAINMENT YEAR BASELINE APPROACHES

Introduction To The Baseline Pathway For SIP/TIP Air Quality Modeling

A baseline forecast of emissions in the future attainment year is made when a jurisdiction prepares a SIP/TIP or performs a SIP/TIP revision. Because projected emission levels are affected by demand for electric power and new generation capacity, jurisdictions can take steps to understand the impacts of their EE/RE policies and programs, and to represent these impacts in baseline emission forecasts.

The goal of developing a future emissions baseline projection is to account for as many important variables as possible that affect future year emissions which will in turn affect ambient air quality levels. Emission levels (in addition to meteorology and topography, transport and fate of pollutants) are one of the most important parameters in determining resultant ambient air quality; however, emissions and ambient concentrations are not linearly related. Hence state, tribal and local agencies need an Air Quality Modeling (AQM) analysis for a base year and a future attainment year to assess the relationship between emission levels and the resultant ambient air quality. Similarly, emission projections provide a basis for developing control strategies for SIPs/TIPs, conducting control policy future attainment year AQM attainment analyses, and tracking progress towards meeting air quality standards.

Completed	Action
✓	Select a baseline demand forecast to use for EGU projections
✓	Assess new and existing generation capacity of EGU’s in future year(s)
✓	Determine what EE/RE policy assumptions are already in EGU baseline forecast
✓	Select energy model or other approach for projecting EGU emissions
✓	Account for “on the books” mandatory EE/RE policies in modeling or other approach
✓	Document results of modeling or other approach

EPA’s Baseline Emission Forecast For EGUs

EPA develops and periodically updates a power sector database, The National Electric Energy Data System (NEEDS). NEEDS contains the unit level records of all existing and planned/committed units in EPA power sector modeling applications. The NEEDS database includes basic geographic, operating, air emissions, and other data on these generating units.

EPA uses the Integrated Planning Model (IPM) to simulate the power sector behavior and to analyze the impact of environmental regulations. A detailed documentation of the latest publicly available versions of NEEDS and IPM are available at http://www.epa.gov/airmarkets/progsregs/epa-ipm/BaseCasev410.html

IPM is a multi-regional, dynamic, deterministic linear programming model of the U.S. electric power sector. It provides forecasts of least cost capacity expansion, electricity dispatch, and emission control strategies while meeting energy demand and environmental, transmission, dispatch, and reliability constraints. IPM can be used to evaluate the cost and emissions impacts of proposed policies to limit emissions of sulfur dioxide (SO2), nitrogen oxides (NOx), carbon dioxide (CO2), mercury (Hg) and HCl from the electric power sector. Other emissions (including PM2.5 and PM10) are also calculated with a post-processing step. IPM's capabilities in power sector modeling include on-the-books (for baseline) or proposed (policy/control strategy) environmental constraints (Federal or State level rules, settlements and consent decrees) as well as EE/RE policies. IPM outputs are streamlined to be used as direct inputs into AQM.

State, Tribal Or Local Developed Baseline Forecast

State, tribal or local agencies may develop SIP/TIP-credible baseline emissions inventories for the EGU sector or may utilize emission projections developed by EPA. If a state, tribal or local agency chooses to develop their own future baseline emission projections, the methodology used for the projections and or emissions growth need to be documented in detail. If the methodology is highly dependent upon a large number of input decisions (including expert judgment) that could vary from one application of this approach to another, then EPA will review those input decisions when it reviews a SIP/TIP and will judge at that point whether the modeling is acceptable. This approach is consistent with what EPA does for other emission inventory and projections compiled for other source sectors. For instance, for those emission source sectors where an EPA approved or recommended model exits, EPA does not give automatic approval of its use in any SIP/TIP without consideration of the inputs. In the same way, EPA will ask for the detailed documentation of inputs (in this case, expert judgment decisions made by the submitter of SIP/TIP). EPA's review will consider the specific input assumptions and EPA may request further information or verification of the assumptions presented. In summary, whether a particular application of a state, tribal or local agency will be approved in a SIP/TIP will depend on the review of actual inputs, application by a state, and credibility of the predictions.

Tradeoffs Between Four SIP/TIP Pathways

If a state, tribal or local agency is deciding into which SIP/TIP pathway to incorporate its EE/RE policies, it is important to understand inherent tradeoffs among the future baseline attainment year, control measure, voluntary and emerging and weight of evidence pathways.

1) For the baseline pathway, state, tribal and local agencies generally include EE/RE policies that are currently "on the books" at the time the baseline forecast analysis commences. This means the EE/RE policy must already be adopted in federal or state regulation, a public utility commission order and/or law to reflect the level of emissions in the future attainment year that will result if no additional control strategies are implemented. .
2) Assumptions included in SIP/TIP baseline projections are not subject to the same enforceability requirements as SIP/TIP control measures. For example, EE/RE

policies explicitly incorporated into a baseline future attainment year must be "on the books". If the EE/RE policy is not implemented, state, tribal or local agencies must work with their Regional EPA Office to determine how to take corrective action, such as a SIP/TIP revision. EPA does have the authority to issue a call for a revised SIP/TIP to be submitted by a state, tribal or local agency, if baseline assumptions are not corrected.

Incorporating EE/RE Policies For The Baseline Pathway

Accurately describing EE/RE policies is a critical step for completing an EGU baseline forecast. The realized and future expected energy savings from EE polices directly affects electricity demand growth rates and their emissions in EGU baseline projections. Similarly, RE policies directly affect the electric power sector's future portfolio of power supply that is dispatched to meet demand. Therefore, understanding the EE/RE policy assumptions will help predict how electricity demand and supply will change emissions in the future. For more information on EE/RE policies, see Appendix D

The next section illustrates the steps states should consider when incorporating "on the books" EE and/or RE policies within the baseline.

SECTION E.2: STEPS FOR INCORPORATING "ON THE BOOKS" EE POLICIES

This section illustrates the three steps states should consider when incorporating "on the books" EE policies within the baseline. After these steps, state, tribal and local agencies should be ready to proceed to the final fourth step that is described in section E.4 – forecasting the impacts in the EGU sector.

State, tribal and local agencies have two options for each of the following steps: using the information provided by the Energy Information Administration (EIA) or using information from provided by regional grid operators, Regional Transmission Organization or Independent System Operators.

Step 1: Determine What Baseline Demand Forecast The State Or Region Will Use For EGU Projections

Energy Information Administration's (EIA) Demand Forecasts

The standard national baseline projection for the EGU sector comes from the Energy Information Administration (EIA). EIA, the statistical arm of the Department of Energy, publishes an Annual Energy Outlook[15] (AEO) every year that forecasts the future 25 years of U.S. energy demand, supply and price. For example, EPA makes use of AEO demand projections for its electric sector forecasting. EPA updates the modeling platforms with the new AEO forecasts as they become available. Energy supply and demand projections from the AEO are also used as growth indicators upon which growth factors for fuel/combustion-related processes are based.

[15] Most recent version as of the release of this document is AEO 2010

Projections included in the AEO forecast are generated from the National Energy Modeling System (NEMS), which is a computer-based energy-economy modeling system developed and maintained by DOE. It projects the production, imports, conversion, consumption, and prices of energy, subject to assumptions on macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological choice criteria, cost and performance characteristics of energy technologies, and demographics.

Regional Transmission Organization Or Independent System Operator Demand Forecasts

If States prefer, they can use the EGU baseline projections provided by regional transmission organizations or independent system operators. States should work closely with their regional office if their demand forecast information comes from one of these organizations to ensure all environmental regulations are accounted for in the analysis.

Step 2: Determine What EE Policy Assumptions Are Already In EGU Baseline Demand Projections

Energy Information Administration's (EIA) EE Policy Assumptions

EIA's Annual Energy Outlook documentation includes description of the many assumptions they make in conducting their modeling. For AEO 2010, EIA includes several federal policies and regulations that are "on the books" as of September 2009. The EE policies that are explicitly in the 2010 AEO baseline projections[16] are the following:

- Federal Appliance Standards[17]
  10 Residential & 10 Commercial Appliance Categories
- Federal Funding for State Energy Program (SEP) and Energy Efficiency Community Block Grant (EECBG), Weatherization Program, Green Schools and Smart Grid Expenditures. (E.g., through the American Recovery and Reinvestment Act (ARRA))[18]
- Building Codes[19]
  All States adopt and enforce:
  IECC 2006 Code by 2011 and IECC 2009 Code by 2018 ASHRAE 90.1-2007 by 2018

Regional Transmission Organization Or Independent System Operator EE Policy Assumptions

If a state is using demand forecasts from their regional transmission organizations or independent system operators, they should ask if the following EE policies are explicitly

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[16] AEO 2010 information can be found at: http://www.eia.doe.gov/oiaf/archive/aeo10/index.html
[17] U.S. Energy Information Administration (2010). Assumptions to the Annual Energy Outlook 2010: With Projections to 2035, Appendix A. p. 170-185
[18] U.S. Energy Information Administration (2010). Annual Energy Outlook 2010: With Projections to 2035. p. 8-10.
[19] Ibid pg. 8

modeled with their load forecast, implicitly embedded within load forecast (e.g., accounted for econometrically) or not reflected within the load forecast.

- Energy Efficiency policies or programs funded by utility rate payers
- 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
- Combined heat and power capacity additions
- Other distributed generation capacity additions
- Other applicable policies/programs

Step 3: Review State, Tribal And Local "On The Books" EE Policies To Determine If More Can Be Included Into The EGU Baseline Demand Projections.

Evaluating State, Tribal And Local EE/RE Policies Compared To Energy Information Administration's (EIA) Assumptions

If states are using AEO 2010 demand forecast assumptions, EPA has identified "on the books" EE policies not already explicitly incorporated into Annual Energy Outlook 2010 and developed assumptions about estimating EE policies implicitly embedded within EIA's load forecast (e.g., accounted for econometrically). EPA is providing an approvable methodology and energy savings information for future years 2012, 2015 and 2020[20]:

- Energy Efficiency Resource Standards
- Other commitments to ratepayer-funded EE Programs (e.g., public benefit funds, IRP, "all cost-effective" EE requirement)
- RGGI Funded EE Programs

Evaluating State EE Policies Compared To Regional Forecast Assumptions

If a state, tribal or local agency does not use EIA's demand forecasts, the jurisdiction should talk with their regional transmission organizations or independent system operators to determine if additional "on the books" state EE policies can be incorporated in their forecast.

SECTION E.3: STEPS FOR INCORPORATING "ON THE BOOKS" RE POLICIES

This section illustrates the three steps states should consider when incorporating "on the books" RE policies within the baseline. After these steps, state, tribal and local agencies

[20] See appendix I for details on the methodology and energy savings/generation information for the policies listed here.

should be ready to proceed to the final fourth step – forecasting the impacts in the EGU sector.

Step 1: Determine What Renewable Energy Sources Are Already In Baseline Inventory And The Relative Emission Factor For Each Type Of Renewable Energy Generated In The State Or Region

As a first step, States need to assess what type of renewable energy is already incorporated into the energy supply mix (absent of any policy influence or past policy influence).

Step 2: Determine What RE Policy Assumptions Are Already In EGU Baseline Supply Projections

Energy Information Administration's (EIA) RE Policy Assumptions

For AEO 2010, EIA includes state renewable energy portfolio standards policies that are "on the books" as of September 2009. EPA uses the same RPS assumptions as EIA. The RE policies that are explicitly in the 2010 AEO baseline projections[21] and EPA's EGU projections are the following:

- Renewable Energy Portfolio Standards (RPS)[22]
  30 States and D.C. Effective as of Sept. 2009

Step 3: Review State, Tribal And Local "On The Books" RE Policies To Determine If More Can Be Included Into The EGU Baseline Demand Projections

States should examine if the information source for EGU supply projections includes all state RE adopted policies. If states are using EIA's supply forecast assumptions, EPA has identified "on the books" RE policies not already explicitly incorporated into Annual Energy Outlook 2010. EPA is providing an approvable methodology and energy information for future attainment years 2012, 2015 and 2020[23]:

- Renewable Energy Portfolio Standards (RPS)
  Five States effective after Sept. 2009 and before December 2010

Documentation Requirements

In all, EE/RE policies are only a few of the many assumptions incorporated into an EGU baseline projection. Any EE/RE policies that are explicitly included in an EGU baseline projection must be properly documented as shown below.

[21] AEO 2010 information can be found at: http://www.eia.doe.gov/oiaf/archive/aeo10/index.html

[22] See full list at: U.S. Energy Information Administration (2010). Annual Energy Outlook 2010: With Projections to 2035. p. 14-17

[23] See appendix I for details on the methodology and energy savings/generation information for the policies listed here.

Table E.2: EE/RE Policies State X Explicitly Included in Baseline Projections

Policy Name	Year Enacted	Policy Requirements	Annual Energy Savings/ Generation in Base Year	Annual Energy Savings/ Generation in the Future Attainment Year(s)	For RE Policies: Type of RE source and corresponding Emission Rate

Step 4: Perform Energy Modeling To Project EGU Baseline Emissions

Use IPM Modeling To Project Future Attainment Year Baseline For SIP/TIP Air Quality Modeling

EPA is providing technical information for incorporating EE/RE policies in EGU baseline projections. IPM runs will be available for interested states to adopt as their SIP/TIP EGU baseline projections. The EE/RE policies incorporated in EPA's baseline modeling were determined based on EPA and State input. Appendix I has more information on the methodology used to quantify the energy saved/generated from state "on the books" policies as well as how that information is integrated into IPM model runs.

SECTION E.4: FUTURE ATTAINMENT YEAR BASELINE USING OTHER APPROACHES FOR SIP/TIP AIR QUALITY MODELING

In addition to or instead of IPM modeling offered by EPA, states can conduct their own SIP/TIP baseline emissions growth/forecast for the electric power sector. (The methodology and final product of such effort will be evaluated for SIP/TIP-credibility) If a state prefers to forecast EGU emissions through their own means, EPA has provided information on types of dispatch models, energy models or capacity expansion models available for use in Appendix F. For long term projections (more than 5 years), capacity expansion models can predict how the electric system will evolve over time; includes what capacity will be added through the construction of new generating units and what units will be retired, in response to changes in new regulations, demand and prices. This method involves allowing the model to predict what will likely happen to the resource mix based on costs of new technology, growth, existing fleet of generating assets, environmental regulations (current and planned) and EE/RE policy assumptions.

> **We are providing:**
> - Estimates of energy savings and generation for state "on the books" EE/RE policies in a format useful for State and EPA to use for EGU baseline future attainment years – Refer to Appendix I for more information

Alternative methodologies are highly dependent upon a large number of input decisions (including expert judgment) that could vary from one application to another. EPA regional offices will review those input decisions when it reviews a SIP/TIP and will judge at that point whether the modeling is acceptable. Whether or not an EPA approved or recommended model exists, EPA cannot give approval of a baseline model or approach used in any SIP/TIP without consideration of the inputs. EPA will ask for the detailed documentation of inputs (in this case, expert judgment decisions or by the submitter of SIP/TIP). EPA's review will consider the specific input assumptions and may question some of them. However, whether a particular application of an alternative approach will be approved in a SIP/TIP will depend on the review of actual inputs, application by a state, and credibility of the predictions.

Using EPA's EGU baseline run has advantages:

- No cost run available to states
- EPA will work with states to modify input parameters and assumptions to reflect state's views
- EPA and States are collaborating to capture specific "on the books" EE/RE Policies
- IPM emission outputs are directly compatible for Air Quality Modeling

Appendix F: Control Strategy Pathway

SECTION F.1: BASICS OF CONTROL STRATEGY PATHWAY

Description Of Pathway

A control strategy is a policy, program, or requirement used by a state, tribal or local agency in a nonattainment or maintenance area to reduce ambient air pollution levels in order to satisfy Clean Air Act requirements. States adopt control strategies for the purposes of attaining the National Ambient Air Quality Standards (NAAQS), demonstrating reasonable progress towards attainment, and maintaining the NAAQS.

Completed	Action
✓	Determine that the jurisdiction wants the EE/RE policy and program to be enforceable under the CAA. (See enforcement criterion in Section F.6 for details)
✓	Assess if the EGUs in the nonattainment area are subject to a cap and trade program for the applicable pollutant. (See surplus criterion, in section F.6 for details)
✓	Estimate the magnitude of potential emission reductions before undertaking more comprehensive analysis (See Tier 4 in Section F.3 for details)
✓	Follow the Quantification Steps 1-4. • Estimate EE savings or generation from EE/RE policy/program • Quantify emissions of EGUs displaced • Determine emission impacts of emission reductions in nonattainment area • Provide mechanism to evaluate and verify results. (See Sections F.2,F.3 and F.4 for details)
✓	Provide mechanism to ensure Federal enforceability
✓	Ensure EE/RE policies/programs are permanent and surplus

After control strategies are adopted, they are submitted to EPA for incorporation into a State Implementation Plan (SIP) or Tribal Implementation Plan (TIP) for a particular air pollutant. Taken together, all of the control strategies in a SIP/TIP must reduce emissions to levels that achieve attainment, maintenance, or reasonable further progress, depending on the type of SIP/TIP.

This appendix addresses the tradeoffs, level of effort, methods, and other key requirements involved in incorporating energy efficiency and renewable energy (EE/RE) policies and programs in a SIP. As with any SIP/TIP pathway, EPA recommends that state, tribal and local agencies coordinate with their EPA regional office as soon as they decide to move forward

Tradeoffs Of Control Strategy Pathway

Including EE/RE policies and programs in a control strategy in a SIP can help jurisdictions meet their air quality goals by accounting for emission reductions needed to show attainment, progress, or maintenance. The control strategy pathway may be an especially appealing option to state, tribal and local agencies that are having difficulty reaching attainment and are seeking new and viable emissions reductions opportunities.

Several tradeoffs and issues should be considered when deciding whether including EE/RE policies and programs in the control measure pathway is consistent with the jurisdiction's circumstances and objectives,. This will enable a state, local and tribal agency to evaluate the merits of following the control measure approach in the context of the other three pathways for achieving similar objectives, as addressed elsewhere in this document.

Key tradeoffs and considerations when deciding whether to pursue the control measure pathway include:

- **Transparency:** Of the four pathways this option offers the most transparent and direct approach to estimating the air quality impacts of EE/RE policies. State, tribal and local agencies will gain a better understanding of which EGUs will displace emissions as a result of future EE/RE policies/programs. State, tribal and local agencies will have a tons-per-day (TPD) amount of emissions for each EGU they expect to reduce based on a specified EE/RE policy and program. State, tribal and local agencies will have emission reductions from a control strategy to help them attain.
- **Documentation:** More documentation is needed than the future baseline and WOE approaches because under the Clean Air Act a jurisdiction would have to show that the EE/RE policy/program was permanent, enforceable, quantifiable, and surplus. (Sections F.2 – F.4 offer steps for quantifying the emission reduction impact from EE/RE measures, and section F.5 addresses the permanent, enforceable, and surplus requirement.)
- **Traditional, Federal Enforceability:** EE/RE policies and programs that are included as a control strategy must be enforceable against the implementing party. State, tribal and local agencies need to consider their role and responsibility, as well as the associated resources needed to enforce EE/RE policies included in a control strategy.
- **Coordination:** Early coordination will help ensure that responsible agencies and entities understand their roles and have sufficient time dedicated to incorporating EE/RE policies and programs as a SIP control strategy. Developing strategies and determining their efficacy for meeting and maintaining compliance with applicable NAAQS requires a high level of coordination amongst multiple government agencies
- **Level of Analytical Rigor:** Overall, quantification under this pathway can be more resource intensive because the state, tribal or local agency would have to perform more of the EGU analysis than the baseline pathway in which EPA is providing more support for EGU analysis. The specific level of effort necessary for quantifying the emission reduction impacts depends on the analytical approach selected. Although more sophisticated techniques typically require a greater level of effort, a discount factor is built into the framework such that the less sophisticated the technique, the more that resulting emission reductions are

discounted. Section F.3 of this appendix describes tiers of analysis that range from more to less sophisticated.

- **Coordination Across Relevant State Agencies:** Another factor affecting level of effort is the degree to which agencies responsible for SIP implementation coordinate with entities responsible for overseeing and evaluating EE/RE policies and programs (e.g., typically the state's public utility commission). The purpose of these discussions is:

  - For the Air Quality Planners to fully understand the elements of the EE/RE policy or program (including extent, duration, and anticipated impact of the policies/programs)
  - To ensure that all parties understand the implications of including EE/RE in the SIP, including the obligation to sustain the program consistent with agreements in the SIP
  - To help the respective agencies better understand the other's roles and responsibilities. In many cases, formal agreements can be established between state air agencies and PUCs to outline each entity's obligations for implementing the state's EE/RE activities, quantifying their impact, and including them in the SIP.

Steps A State Needs To Take To Quantify Emissions Impacts

The next sections outline four steps for quantifying EE/RE policy or programs as a control measure strategy:

1. STEP 1: Estimate the energy savings that an energy efficiency policy or program(s) will produce, or, for a renewable energy project, the amount of energy generation that will occur.
2. STEP 2 - Quantify or estimate displaced EGU emissions from energy impacts of an energy efficiency or renewable energy policy/program(s).
3. STEP 3 - Determine the impact from the emission reduction on air quality in the nonattainment area.
4. STEP 4 - Provide a mechanism to validate or evaluate the effectiveness of the project or initiative.

SECTION F.2: STEP 1: ESTIMATE THE ENERGY SAVINGS THAT AN ENERGY EFFICIENCY POLICY WILL PRODUCE, OR, FOR A RENEWABLE ENERGY POLICY, THE AMOUNT OF ENERGY GENERATION THAT WILL OCCUR

Introduction

After states develop an EGU baseline emission projection for future attainment years, the next decision a state will make is to determine which EE/RE policies and programs it wants to incorporate in its SIP as a control measure. Thereafter, the state will need to determine the specific ways that the EE/RE policies/programs will affect either electricity demand or generation supply characteristics of the applicable EGUs for the State's emissions analysis. This involves understanding the type and quality of the historical or predicted energy saving/generation information (at different time frames - annual, peak, seasonal and/or hourly information).

Essentially this first step is to contact the energy experts in your jurisdiction to obtain estimates of the KWh impacts from the EE/RE policy/program of interest. EPA recommends starting with the Public Utility Commission staff and State Energy Offices. If jurisdictions need further information, the Energy Information Administration, and electric grid operators can also be sources. Electric grid operators could be a large utility that controls the dispatch of resources. A regional transmission organization or an independent service organization can be helpful resources. These organizations should have the energy impacts information or, at a minimum, serve as the most useful sources for developing the energy savings or generation estimates for particular EE/RE policies or programs.

Energy Savings From Energy Efficiency (EE) Policies

Energy savings refers to the expected reduction in the amount of energy generated by an existing utility system as a result of the specific energy efficiency policy and/or program. Energy savings can reduce current energy demand, future demand, or both. For EE, the purpose of this step is to determine the energy saving impacts of the specific EE policy/program.

In some circumstances, quantifying emission reductions may rely on determining the actual energy impact, in practice, of the EE policy/program. Therefore, for later verification purposes, data on the amount of energy savings that an energy efficiency policy and/or program delivers and the amount of renewable generation that takes place may need to be collected and compared to original estimates.

For determining the amount of energy saved for EE policies and programs, although each energy efficiency policy and/or program will have individual factors to be taken into account, the general approach is as follows:

- Determine the baseline forecast of energy use for the activity subject to the energy efficiency policy and/or program.[24]
- Determine the projected energy use after implementation of the EE policy and/or program.
- Subtract A) from B). The result yields the projected energy savings due to the energy efficiency policy and/or program.

When communicating with your state agency counterparts several factors should be considered when estimating the prospective energy savings of an EE/RE policy and/or program.[25] These include:

- *Program period:* What year does the policy/program start? End?

[24] EPA (2010d).Chapter 2
[25] EPA (2010d). page 42

- *Anticipated compliance or penetration rate:* How many utilities will achieve the target or standard called for? How many consumers will invest in new equipment based on the initiative? How will this rate change over the time period?
- *Annual degradation factor:* How quickly will the performance of the measure installed degrade or become less efficient?
- *Transmission and distribution (T&D) loss:* Is there an increase or decrease in T&D losses that would require adjustment of the energy savings estimate?

Renewable Energy Generated From Renewable Energy Policies

Renewable energy policies and programs are designed to increase the amount of renewable energy generation over time. For renewable energy and also for less polluting sources of new energy, such as cogeneration and fuel cells this step is to determines how much energy would be displaced by the RE policy and/or program. In general, for renewable sources, the answer would be the total amount of energy provided to the grid by the renewable energy source.

Performance data for renewable technologies are available from the National Renewable Energy Laboratory (NREL), as well as universities and other organizations that promote or conduct research on the applications of renewable energy. In addition, generation-related data and RE potential information can be obtained from many sources, including:

- State energy offices
- Utility Integrated Resource Planning (IRP) filings,
- Public utility commissions,
- Independent system operators (ISOs),
- North American Electric Reliability Corporation (NERC),
- EPA's Emissions & Generation Resource Integrated Database (eGRID) ,
- DOE's Energy Information Administration (EIA),
- DOE's National Renewable Energy Laboratory (NREL).

Taking Into Account The Future Attainment Year(S) Baseline Forecast When Developing EE/RE Policy And/Or Program Energy Impacts For The Control Measure Pathway

The SIP baseline consists of the current inventory of emissions in the SIP plus any assumptions regarding growth, or reduction in growth, and its affect on emissions. If a state, tribal or local agency takes into account certain energy efficiency or renewable energy policies and programs in developing its projected emissions baseline for the EGU sector, the resulting projected baseline emissions may be lower than a scenario without such activities. In this case, such activities are already accounted for in the SIP, as part of the projected baseline emissions.

Importantly, to avoid double counting, additional emission reductions should not be granted for those activities already considered in a State's projection of future baseline emissions for EGUs. If a has jurisdiction applied certain energy efficiency or renewable energy policies and/or programs in its projected EGU emissions baseline, it cannot account for additional emission reductions for those same commitments in the SIP, since the effect of the EE/RE policy and/or program has already been accounted for in the baseline. However, a state may seek emission reductions for EE/RE policies and programs beyond those are already included in the baseline assumptions.

The next section recognizes that some states (or groups of states) have the resources and capability to perform sophisticated modeling analyses of the energy and air benefits of EE/RE programs, while others do not. The quantification steps envisioned below present four tiers of analysis. Tier one is the ideal approach that hopefully many states can follow. Tiers two and three are credible approaches that would provide less reliable estimates and, therefore, could be "discounted." This section draws greatly from a reference document for quantifying EE/RE programs: *Assessing the Multiple Benefits of Clean Energy*, USEPA, February 2010.[26] Jurisdictions can consult this resources for more detail as they proceed through these steps,.

SECTION F.3: STEP 2: QUANTIFY OR ESTIMATE DISPLACED EGU EMISSIONS FROM ENERGY IMPACTS OF AN ENERGY EFFICIENCY POLICY OR RENEWABLE ENERGY POLICY.

Introduction

This section outlines four different approaches for quantifying displaced emissions. The approaches outlined in this section are "tiered" by the rigor of each method. Tier One and Tier Two approaches are the most rigorous. All quantification approaches provide a methodology for quantifying displaced emissions and important assumptions that must be documented. Where a tool is not specified, the methodology explains how to account for the complex interactions applicable to the electrical grid.

Each approach requires different levels of EE savings information and RE generation information to complete the emissions displacement analysis. Emission displacement approaches using a dispatch model, capacity expansion model and adjusted historical hourly generation stacking analysis can use hourly EE/RE saving and generation information. If a state, tribal or local agency applies energy savings to the third and fourth tiered approach then annual or seasonal savings information is needed.

<u>Tier One - Dispatch or Capacity Expansion Model Approach</u> This method outlines how dynamic simulation models predict which EGUs will be displaced as a result of the EE/RE policy and program. The dispatch and capacity expansion models account for the complex interactions of the grid such as, transmission constraints, import/export dynamics, estimate the amount of fossil fuel generation displaced, corresponding displaced emissions at a scale fine enough to indicate if it is affecting an applicable nonattainment area. This tier also covers States predicting future emission impacts using a future capacity model.

<u>Tier Two - Adjusted Historical Hourly Generation Stacking Approach</u> This method requires technical manipulation of *actual* historical generation, load and emission rates to determine EGU dispatch order and marginal emissions rates. By applying this approach

[26] EPA (2010d) Assessing the Multiple Benefits of Clean Energy.

State, tribal and local agencies will understand which EGUs are "baseload", load following or EGUs used for peak demand in every hour of a historical year. Secondly, jurisdictions would need to account for the complex nature of the electrical grid by gathering information on electricity imports, exports and transmission constraints.

Tier Three – Capacity Factor Approach This method is based on the assumption that an EGU's capacity factor is an indicator for the amount of generation subject to displacement. This method does not approximate hourly EGU dispatch or predict which EGU is on the margin every hour of the year. Rather, general assumptions are applied about EGUs historical annual or seasonal generation within the region of interest. (A discount factor may be applied for this approach)

The Tier Four – eGRID Subregion Emission Rates Approach This method entails a simple calculation where a jurisdiction would multiply the amount of generation or electricity sales displaced by the EE/RE policy/program by the "non-base load" emission rate indicated for a specific pollutant in an eGRID subregion.[27] The non-base load emission rate for an eGRID subregion represents an average emission rate for the EGUs that are likely to be displaced by an EE/RE policy and program. This method is recommended to help determine if state, tribal or local agencies feel the magnitude of the potential emission reductions justifies the additional effort entailed with carrying out a more sophisticated analysis that could be used for SIP submission under the control strategy pathway.

Tier One Approach Using Dispatch And Capacity Expansion Models

Dispatch Models – Measuring Hourly Marginal Emission Rates

An electric system dispatch model captures the impact of the portfolio of RE generation or EE programs during each hour that the new portfolio of EE/RE resource(s) operates. Dispatch models are designed to simulate energy transfers among different regions, optimize system dispatch from generating units (multiple generation blocks from a single unit within one hour), transmission constraints, forced outages and limitations on specific power plants (e.g., ramp rates, start-up constraints minimum down time).

Dispatch models specifically replicate least-cost system dispatch, with the lowest cost resources dispatched first and the highest cost last. Dispatch models determine which generating units are displaced and when they are displaced based on economic and operating constraints. Dispatch models determine which EGUs operate on the "margin" in the electrical power system - typically the most expensive unit needed to meet demand is the "marginal EGU" in a given time period. States can use hourly dispatch or energy models to determine hourly marginal emission rates (lbs/kWh), which can then be aggregated by time period and applied to a portfolio of programs used to achieve the EE/RE policy requirement.[28]

[27] Grid loss factors should be included in this calculation. Please refer to the eGRID Technical Support Document for more information. Found at: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010TechnicalSupportDocument.pdf

[28] EPA (2010d), pgs 69-70.

There are important considerations when using dynamic simulation models such as dispatch models. Since this method can be less transparent than other methods, jurisdictions should work closely with the EPA regional office when determining important input assumptions for any dispatch or energy model used to measure displaced emissions.

The following information should accompany a state, tribal and local agency's SIP submittal under this pathway for any quantification of emission reductions using a dispatch or similar type of model.

Required documentation for dispatch model input assumptions:

- Type and amount of energy savings/generation information used – Specify if peak (MW), annual (MWh), seasonal, and/or hourly load information was applied for EE/RE policy
- Fuel prices assumed for all fuels and technologies
- Emission rates for each applicable EGU

Capacity Expansion Models – Measuring Long Term Impacts of New Capacity

Capacity expansion models are typically used for longer-term studies (e.g., five to 20 years), where the impacts are dominated by long-term investment and retirement decisions. They are also typically used to evaluate large geographic areas.

Capacity expansion models predict how the electric system will evolve over time, including what capacity will be added through the construction of new generating units and what units will be retired**,** in response to changes in new regulations, demand and prices. This method involves allowing the model to predict what will likely happen to the resource mix based on costs of new technology, growth, existing fleet of generating assets, environmental regulations (current and planned), and considering dispatch both with and without the new clean energy resource. [29]

The following information should accompany a state, tribal and local agency's SIP submittal under this pathway for any quantification of emission reductions using a Capacity Expansion Model or similar type of model.

Required documentation for Capacity Expansion Model input assumptions:

- Fuel price forecasts, EGU retirements, and EE/RE regulatory requirements (e.g., renewable portfolio standards).
- Plant type and emission rates of assumed new generation for all applicable future years
- If model outputs were validated or calibrated against actual data or another projection model.

[29] EPA (2010d). Pages. 71-72.

Tier Two Approach For "Stacking" EGUs And Quantifying Displaced EGU Emissions

Adjusted Historical Hourly Generation Dispatch Order

This approach requires technical manipulation of *actual* historical generation, load and emission rates to determine EGU dispatch order and marginal emissions rates. First, a jurisdiction must obtain historical hourly generation (E.g., data from Continuous Emission Monitoring (CEM)) from applicable EGUs to analyze the production of each generating unit and how EGUs change throughout the day as loads changed. Then, states should compare EGU generation and load information to identify 'base load' units (EGUs that do not change generation based on changes in load requirements), following load units (EGUs that increase and decrease production in response to changes in load) and peaking units – (EGUs only operating at peak load times.)

Since individual units do not necessarily fall into one category all the time, it is important to structure the analysis to capture these differences. One way to do this is to analyze the dispatch order of the EGUs within different seasons or time periods (e.g., spring versus summer and peak versus off-peak periods.) This analysis is the basis for how to calculate weighted average marginal emission rates (the average of EGUs likely to be displaced by EE/RE policies/programs) for any group of hours.

The following sections explain the five major steps for developing an hourly dispatch order using actual historical data.

1) First, determine the relevant set of EGUs for the analysis. This involves identifying the power control area(s) (PCA(s))[30] in which the EE/RE policies/programs are or will be located. (see Appendix B for more information on how the electrical grid works)
2) Second, order the relevant set of EGUs to represent typical dispatch.
    - Adjust dispatch order based on major energy transfers between the PCA and other areas.
3) Third, quantify the displaced emissions from the applicable EGUs. (Also known as, marginal emission rates)
4) Fourth, apply the EE/RE policy/program control measure to determine the displaced emissions profile from applicable EGUs.
5) Fifth, analyze future emissions inventory to determine future EGU generation and emission characteristics.

[30] A Power Control Area (or balancing authority) is a portion of an integrated power grid for which a single dispatcher has operational control of all electric generators. PCAs range in size from small municipal utilities to large power pools such as PJM Interconnection.

Step 1: *Determine relevant set of EGUs for analysis*
First identify the power control area(s) (PCA(s)) where the EE/RE policy are or will be located. The PCA is an area where one operator is responsible for balancing generation and load for the electrical facilities in the area.[11] Larger PCAs are operated by a single operator of the transmission grid can be over a multi-state region, such as PJM Interconnection or ISO New England. These regional operators (known either as Regional Transmission Operators (RTOs) or Independent System Operators (ISOs)) are regulated by the Federal Energy Regulatory Commission (FERC) to operate the dispatch of the power system over the region, based on bids provided by the generators in the region.

Once a jurisdiction identifies the area of analysis the next step is to understand if there are any transmission constraints or congestion management zones within the PCA(s).

Transmission constraints can limit the flow of electricity from one area to another because of physical constraints. These constraints can divide a PCA/RTO/ISO into several distinct dispatch zones, called "congestion management zones".

Some congestion management zones can become so congested at certain times of the day they can become "load pockets". In these areas, during constrained hours, higher-cost generating units within the load pocket must operate rather than lower cost units outside the pocket.[31]

Knowing if an EE/RE policy/program is located within the load pocket is important because it would change the normal dispatch order of the EGUs in the analysis, by forcing a higher-cost EGU to operate out of normal merit order. Thus, the load pocket would be the primary area of analysis during the constrained hours, while the entire PCA might be the primary area during other hours. It is particularly important to check for transmission constraints in a displaced emissions analysis, because many new resources are likely to be located in load pockets in response to reliability policies and market signals.[32]

Once the area of analysis and related transmission constraints are clear, state, tribal and local agencies can gather information on where EGUs are located within the defined area(s) of analysis. The next step outlines how to develop a dispatch order using historical hourly generation information.

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[31] Synapse 2005. Methods for Estimating Emissions Avoided by Renewable Energy and Energy Efficiency. Page 7.

[32] The process of checking for important transmission constraints involves reviewing ISO data and communicating with system operators or other parties familiar with the control area in question. Important transmission constraints are usually well known, and in many cases ISO rules or policies exist that address them directly. Examples of such policies are ISO New England's RFP for demand response and generating capacity in SW CT and the 80% installed capacity requirement in New York City.

Step 2: *Develop a Dispatch Order for Relevant Set of EGUs using Historical Hourly Information*
First, a jurisdiction must obtain historical hourly generation (E.g., data from Continuous Emission Monitoring (CEM)) from applicable EGUs to analyze the production of each generating unit and how EGUs change throughout the day as load changes. EPA collects data in hourly intervals from Continuous Emission Monitors (CEMS) for all large EGUs subject to EPA's trading programs.[33] Then, states, local and tribal agencies should compare EGU generation and load information to identify 'base load' units (EGUs that do not change generation based on changes in load requirements), following load units (EGUs that increase and decrease production in response to changes in load) and peaking units – (EGUs only operating at peak load times.)

Once the database is developed, identify load following units in each hour of the year. Load following units are defined as units that increased output during an hour in which system load increased or decreased output during an hour in which system load decreased.

Step 2a: *Account for energy imports and exports of the area of analysis.*
The EGUs located in the area of analysis may import or export significant amounts of energy. The first step in address electricity transfers is to determine whether there has been significant movement in recent years between the area of analysis and other areas. The following data sources are available for electricity import/export information.

- Data on total generation and export/import percentages will indicate whether it is a net importer or exporter as well as the magnitude of transfers relative to total generation.[34]
- Most system operators (RTO/ISO) release information annually about generation, loads and interchange on their system.
- Reviewing long-term power purchase agreements that underlie exports and import transfer information.

If the area of analysis is a net exporter or importer the next step is determine if the transfer level follows a daily load pattern, a seasonal load pattern or is a consistent source of energy throughout the year. Once typical energy transfers are characterized, the dispatch order in the area of analysis should be adjusted to account for these transfers within the relevant time frames.[35]

Step 3: *Quantify the displaced emissions from the applicable EGUs*
The amount of emission reductions that will occur from the EE/RE policy and program is directly tied to the emission rate of the EGUs at which the energy is displaced.

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[33] This information can be found at EPA's Clean Air Markets Website: http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=emissions.prepackaged_select
[34] EPA (2010b) eGRID 2010V1_0_STIE_USGC.
[35] Synapse (2005)

Use the hourly load-following emission rates to assess displacement from any type of EE/RE policy and program based on the hours in which the respective EE/RE policy/program is expected to reduce load requirements. These weighted average emission rates of load following EGUs should reflect the group of EGUs that system operators would use to meet marginal demand in that hour. Hourly emission rates can reveal which hours of the day a set of EGUs in the area of analysis is emitting the most. This allows for comparing emission rates at the set of baseload, load following and EGUs that respond to peak demand.

Step 4: *Apply energy savings and/or generation impacts of EE/RE policy/program to displaced EGUs*
Determine which EGUs within the dispatch order will be affected by evaluating how the EE/RE policy reduces load or displaces generation of the area of analysis. Most importantly identify if the EE/RE policy impacts peak hours and/or base load energy use. It is possible for multiple EE/RE policies/programs affect both base load and peak hours of a day. In that case, add the programs bottom up to obtain an aggregate level of energy savings and generation on an hourly basis and apply their impacts to the predicted displaced EGUs.[36]

Step 5: *Future Generation and Displaced Emissions*
If the projections for EE/RE policies and programs extend out more than 5 years then a state should develop assumptions for how future generation will change over time. The jurisdiction must examine each area of analysis 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 multiple organizations that project how EGUs will meet future demand and react to new environmental regulations. EPA recommends obtaining projections future EGU information from EPA, EIA, or regional transmission organizations.

It is also important to consider which new resources may be entering an area and whether there are plans for transmission upgrades. Energy efficiency can avoid the need for new or upgraded transmission lines. Depending upon the region, upgrades could encourage further development of renewable energy, or may permit greater access by older, high-emitting sources that may be more likely to run if the new transmission is built.

Tier Three Approach For Developing An EGU Dispatch Order And Estimating Displaced EGU Emissions

Capacity Factor Approach

This approach is based on the assumption that an EGU's capacity factor is an indicator for the amount of generation subject to displacement of an EE/RE policy/program. This method does not approximate hourly EGU dispatch or predict which EGU is on the margin for any hour of the year. Rather, general assumptions are made about EGUs historical annual or seasonal generation within the region of interest. The effects of

[36] Synapse (2005)

EE/RE policies and programs are allocated to the EGUs in the region based on each unit's capacity factor. For example, base load units are rarely subject to displacement and, as a result, they have very high capacity factors (> 70 percent). Units with low capacity factors (<20 percent) are load following or peaking units and are subject to displacement.

The following sections explain the five major steps for a historical capacity factor displacement analysis. *Steps one, three and five require the same procedures as the tier two approach and will not be repeated in this section.*

1) First, determine the relevant set of EGUs for the analysis. This involves identifying the power control area(s) (PCA(s))[37] in which the EE/RE policies/programs are or will be located. (see Appendix B for more information on how the electrical grid works)
2) Second, order the relevant set of EGUs to represent typical dispatch.
    a. Allocate reduced generation based on historical capacity factors on a seasonal basis
    b. Adjust dispatch order based on major energy transfers between the PCA and other areas.
3) Third, quantify the displaced emissions from the applicable EGUs. (Also known as, marginal emission rates)
4) Fourth, apply the EE/RE policy/program control measure to determine the displaced emissions profile from applicable EGUs.
5) Fifth, analyze future emissions inventory to determine future EGU generation and emission characteristics.

<u>Step 1</u>: *Determine relevant set of EGUs for area of analysis*
See step one under the Tier Two Approach for details on the procedures for this step.

<u>Step 2</u>: *Place relevant set of generating units in an order representing typical dispatch.*
The historical capacity factor approach involves a simple rule that organizes EGUs within a simplified dispatch order. The rule, summarized in Figure F.2, indicates that EGUs with lower historical capacity factors will be displaced at a greater rate than units with higher capacity factors.[38]

EGUs with the lowest capacity factors would be considered the marginal EGUs within the dispatch order. For instance, EGUs with capacity factors 20 percent and below would be completely displaced by EE/RE policies/programs.

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[37] A Power Control Area (or balancing authority) is a portion of an integrated power grid for which a single dispatcher has operational control of all electric generators. PCAs range in size from small municipal utilities to large power pools such as PJM Interconnection.

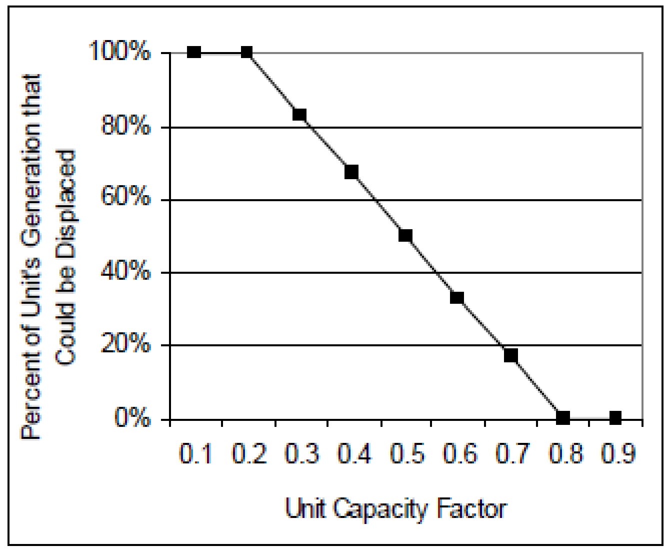
[38] It is important to note that a unit may be "on", i.e. generating electricity for a given hour. But, it may only be operating at partial load. (Also known as spinning reserve)

In contrast, EGUs with the highest capacity factors would be considered "baseload" EGUs. For instance, EGUs with capacity factors 70 percent and above would be displaced by EE/RE policy/program at a lower rate and some not at all.

EGUs between these extremes would be considered "load following" and the EGUs would be displaced linearly as capacity factor rises.

When ordering generating units into a di … s and large amounts of import or export of energy in the area of analysis. EGUs can be taken off line periodically for planned and unplanned maintenance work, and these outages influence where the EGU is placed within the dispatch order. However, EGUs that are typically "base load" plants should not jump to a peaking unit because of historical outages, however lower prices in other fuels such as natural gas may also influence the dispatch order of traditional base load coal plants.

Figure F.1 Capacity Factor Approach[16]



<u>Step 2a</u>: *Allocating reduced generation based on historical capacity factors on a seasonal basis*
Seasonal capacity factors should be used, rather than annual, in allocating reduced generation. If annual capacity factors are used, any seasonal patterns in plant utilization would be lost. For example, many combustion turbines operate only during summer daytime hours during a typical year. The use of annual capacity factors would allocate displaced emissions to these units during other seasons of the year.

<u>Step 2.b</u>: *Account for Energy imports and exports*
See step three under the Tier Two Approach for details on the procedures for this step.

<u>Step 3</u>: *Quantify the displaced emissions from the applicable EGUs*
Develop an appropriate capacity factor rule to estimate displaced emissions by evaluating how the EE/RE policy/program will displace the applicable EGUs. Historical seasonal and annual emission rates are available in EPA's eGRID resource.[39]

<u>Step 4</u>: *Apply EE/RE policy impacts to determine EGU displacement*
In some cases it helps to identify if the EE/RE policy/program targets peak hours and/or base load energy use. For example, introducing more wind generation on the system

[39] EPA (2010c) eGRID Version 1.0 Year 2007 Summary Tables

could displace base load generation, in contrast, demand response programs would target peak demand.

To apply the general rule outlined in Step 2 and 3, follow the steps below.

- First, calculate the amount of each unit's generation (MWhs) that could be displaced.
- Second, take the total energy produced or saved and allocate reduced generation to the applicable EGUs.
- Third, obtain the historical EGU emission rates to determine the amount of emission reductions from the displaced generation. [multiply emission rate by column [6] in this example]

Table F.1 illustrates this process, evaluating an efficiency program projected to save 1,000 MWhs pear year. There are seven generating units in this hypothetical power system, labeled A through G.

- Column [2] shows the percentage of each unit's production that could be displaced by the efficiency program, based on the rule from Figure 7.
- Column [3] shows each unit's actual generation in the historical year being used.
- Column [4] shows the amount of energy that could be displaced at each unit – column [2] times column [3].
- Column [5] shows the percentage of the energy saved by the efficiency program (1,000 MWs) allocated to each unit, and
- Column [6] shows the MWhs displaced at each generating unit.

Table F.1: Allocating Displaced Energy Using the Capacity Factor Approach[40]

[1] Unit	[2] % Displaceable	[3] Historical Gen. (MWh)	[4] MWhs Displaceable	[5] % of Energy Saved Allocated to Unit	[6] MWhs Displaced
A	100%	50,000	50,000	7%	65
B	82%	65,000	53,300	7%	69
C	79%	120,000	94,800	12%	123
D	48%	500,000	240,000	31%	312
E	22%	1,500,000	330,000	43%	430
F	0%	1,800,000	0	0%	0
G	0%	2,000,000	0	0%	0
Totals		6,035,000	768,100	100%	1,000

Step 5: *Future Generation and Displaced Emissions*.
See step five under the Tier Two approach for details.

[40] Synapse (2005) page 17.

Tier Four Approach eGRID Subregion Emission Rates

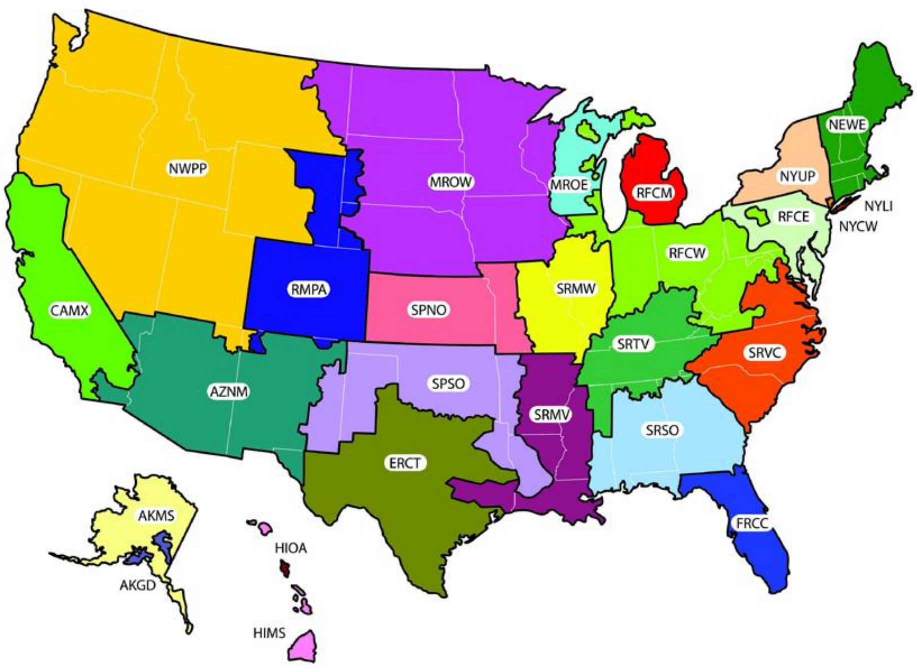
"Non-Base load" eGRID Emission Rates

The eGRID subregion non-baseload output emission rates are recommended to estimate emission reductions from EE/RE policies and programs that reduce consumption of grid supplied electricity. Non-baseload output emission rates are associated with the emissions from plants that combust fuel and have capacity factors less than 80%. These data are derived from plant level data and aggregated up to the eGRID subregion level.[41]

States can use this approach to estimate the relative magnitude of emission impacts from a potential EE/RE policy or program by using the following equation.

Tons of emissions reduced from EE/RE policy and program = non-base load emission rate (lb/MWh) x (1/1-grid loss factor) x reduced consumption or supply in energy of EE policy and program (MWh) x (2000lbs/1 short ton conversion for criteria pollutants)

Figure F.2: eGRID2010 Subregion Representational Map



Source: EPA (2010a) page B-1

[41] EPA(2010a) eGRID Technical Support Document

Table F.2: eGRID Non-Base load Emission Rates in 2007[42]

eGRID subregion acronym	eGRID subregion name	Non-baseload output emission rates		
		NO_x (lb/MWh)	Ozone season NO_x (lb/MWh)	SO_2 (lb/MWh)
AKGD	ASCC Alaska Grid	2.7006	2.7781	1.3563
AKMS	ASCC Miscellaneous	20.8079	20.7284	1.7088
AZNM	WECC Southwest	1.0408	1.0189	0.4500
CAMX	WECC California	0.3481	0.3213	0.1699
ERCT	ERCOT All	0.5254	0.5440	0.6708
FRCC	FRCC All	1.6465	1.6452	2.6173
HIMS	HICC Miscellaneous	8.4570	8.6419	2.4412
HIOA	HICC Oahu	3.4674	3.5661	5.5465
MROE	MRO East	3.3246	3.1142	6.9891
MROW	MRO West	3.7435	3.6304	6.2192
NEWE	NPCC New England	0.8070	0.7584	2.4570
NWPP	WECC Northwest	1.8687	1.9246	0.7560
NYCW	NPCC NYC/Westchester	0.9107	0.8936	0.7154
NYLI	NPCC Long Island	1.4251	1.3364	2.1349
NYUP	NPCC Upstate NY	1.4287	1.2893	5.3505
RFCE	RFC East	2.1931	1.7993	9.7750
RFCM	RFC Michigan	2.1878	1.7064	6.6509
RFCW	RFC West	3.2024	2.2120	11.6345
RMPA	WECC Rockies	1.8311	1.8692	1.6391
SPNO	SPP North	3.2652	2.9412	5.6117
SPSO	SPP South	1.9948	1.8466	1.9899
SRMV	SERC Mississippi Valley	1.5027	1.5747	1.1215
SRMW	SERC Midwest	2.4532	1.5207	6.9192
SRSO	SERC South	2.1828	1.7771	8.4600
SRTV	SERC Tennessee Valley	2.9453	1.8351	7.2787
SRVC	SERC Virginia/Carolina	2.0702	1.5899	7.9666
U.S.		**1.9542**	**1.6205**	**5.0676**

[42] EPA (2010c)

Table F.3: Displaced Emissions Methodology Comparisons

TIER	DISPLACED EMISSIONS METHODOLOGY	EXAMPLES	ADVANTAGES	DISADVANTAGES
One	Dispatch Model and Energy Models	Prosym Promod IPM Ventyx Market Analytics OTC workbook MARKAL	Most credible way to estimate impacts of new resource on power system. Simulates energy transfers between regions, transmission constraints and optimized dispatch	Expensive, complex and some models are less transparent. All dispatch models are proprietary.
Two	Hourly Marginal Emissions Rates	Use CEMS data from CAMD database. Create CEMS-Base Load Following Method	Credible in that it captures actual dispatch of fossil fuel generators following load.	Does not account for impacts on hydro or energy transfers. Could be labor intensive.
Three	Historical Capacity Factors	Use Simplified capacity factor rule	Rule establishes dispatch order	Oversimplification of dispatch order, assumes past historical generation patterns will persist in future.
Four	Allocating Reduced generation to plants based on capacity factors	Egrid non-baseload emission rates Green Power Equivalency Calculator (for RE only)	Uses capacity factor as a proxy to capture marginal units emissions	Ignores all non emitting generation (E.g., hydro) Assumes one unit is generating per hour of day, not representative system dispatch

SECTION F.4: STEP 3: DETERMINE THE IMPACT FROM THE ESTIMATED EMISSION REDUCTION ON AIR QUALITY IN THE NONATTAINMENT AREA

Displaced emissions should be attributed to each applicable EGU in order to determine how those emissions reductions will improve the air quality in the nonattainment area. [43] Even if the EE/RE policy and program is clearly shown to occur in a nonattainment area, unless a jurisdiction is able to determine where the displacement of electrical generation will likely occur, it is problematic to assign the emission reductions to the nonattainment area. For example, if the nonattainment area imports a significant amount of electricity from locations outside and downwind of the area, reduced demand from energy efficiency could result in less electricity being imported, rather than reduced production (and consequently reduced emissions)

[43] The current policy with respect to taking credit for emissions reductions outside nonattainment areas for purposes of Reasonable Further Progress in ozone SIPs is as follows: RFP credit can be taken for VOC and NO_x emission reductions within 100 kilometers (km) and 200 km, respectively, outside the nonattainment area under certain circumstances. This policy is currently under reconsideration. See "Reasonable Further Progress Requirements for the 1997 8-Hour Ozone National Ambient Air Quality," 75 Federal Register 80420-80425, 80421, http://www.gpo.gov/fdsys/pkg/FR-2010-12-22/pdf/2010-32139.pdf,.

within the nonattainment area, or in areas affecting its air quality. Conversely, if the energy savings reduce emissions at upwind sources, then the measure may produce some air quality benefits to the area. (For more details, see the section below on determining the geographical area where emissions occur)

The state should use the appropriate air quality model to evaluate the extent to which reductions will improve air quality in the nonattainment area from the selected EE/RE policy as a control strategy.

Determining The Geographic Area Where Emission Reductions Occur

Determining the location of the emission reduction that occur at fossil fuel fired generation is challenging because electricity from numerous generators is fed into an electrical grid from which many different consumers at various locations will draw power. There typically is no direct connection between a specific facility generating electricity and the end user of that electricity. Understanding how the electric grid operates in a jurisdictions area is the first important step in making educated decisions about which units would be affected by a certain EE/RE policy and program. The better you can estimate at which power plants a EE/RE policy or program will likely affect generation and the better you can forecast the emission rates at those power plants, the better the emission estimate you will have for the SIP submission.

Energy Efficiency

Out of the many scenarios state, tribal and local may encounter, there are three common scenarios jurisdictions may need to consider when determining which EGU(s) are affected by the applicable EE policy and program. Amongst the three scenarios, jurisdictions may encounter varying degrees of imported or exported electricity between the area of analysis or Power Control Area (PCA). The first scenario explains where the emission reductions may occur when very small amounts of electricity is imported or exported into a PCA and the third scenario explains the circumstances around PCAs with large transfers of electricity imports and/or exports.

First Scenario: The EE policy and/or program directly reduce EGU generation within the same power control area because both are located within the same power control area (and nonattainment area) and there is minimal reliance on imported or exported electricity. The Electric Reliability Council of Texas (ERCOT) is an example of this scenario, where only 0.07% of energy was exported outside of the PCA and none was imported.[44] In addition, in 2007, HI, AK, MI, IA, and OR imported or exported less than 1% of electricity into or out of their respective states.

Second Scenario: The EE policy and/or program could directly reduce EGU generation within the same PCA and nonattainment area because the EGUs within the respective PCA export or import a small amount of electricity (e.g., less than 10%) to or from another PCA located outside of the nonattainment area. In this case, it is very possible that the EE/RE policy and/or program implemented in one nonattainment area could

[44] EPA (2010b)

influence EGUs to operate less in the same nonattainment area. For example, the following states exported less than 10% of electricity in 2007; IN, NE, AR, and TX. In addition, the following states imported less than 10% of electricity in 2007; MI, IA, OR, MO, KY, CO, GA, MS, VT and NY.[11]

Third Scenario: The EE policy and/or program may not directly reduce EGU generation within the same PCA, and nonattainment area, because the EGUs within the respective area either export or import a significant amount (e.g., over 40%)of electricity to or from another power control area(s) located outside of the nonattainment area and State. In this case, the EE/RE policy and/or program within one PCA would influence EGUs to operate less in PCA(s) outside of where the policy/program is implemented. Determining if the benefits are upwind from the nonattainment area of interest may be necessary. For example, the following five states exported at least 40% of the electricity generated within their state in 2007; WY, WV, ND, NH and MT.[45] In addition, the following five states imported at least 36% of electricity from outside the state in 2007; DC, ID, SD, DE, and VA.[11]

EPA suggests that states seeking emission reductions from EE policy and programs determine with the relevant PCA and congestion management zone (CM) in the nonattainment area and understand seasonal or hourly differences during the timeframe of interest. There are many cases in which the PCA will be a larger geographical area compared to the nonattainment area. In that instance, it is important to investigate the smaller areas within the electrical grid called, Congestion Management zones (CM) and determine the amount of electricity imported and exported out of the CM. The state, tribal or local agency should contact its EPA Regional Office to discuss a method by which decreased demand can be apportioned among the EGUs in other PCA(s), CMs and nonattainment areas.

For example, the EGUs located within a PCA containing a nonattainment area may export a large percentage of their power production to a distant city outside the nonattainment area. If that distant city adopted aggressive energy conservation measures which resulted in a significant decrease in demand from the EGUs in the nonattainment area, emission reductions for the nonattainment area may be appropriate but would depend on:

- If a state or municipal policy in the distant city requires implementation of the electricity demand program.
- If the demand reduction for EGUs in the nonattainment is permanent OR temporary and subject to elimination due to short-term market forces (i.e., redirection of the power to another market)?

[45] EPA (2010b)

Renewable Energy

Determining the location of the fossil fuel fired units that can operate less as renewable energy becomes available can be a complex task, particularly when the renewable resources are located outside the nonattainment area that seeks to use the reduction for SIP purposes.

Step 1: Determine the location of the fossil fuel fired EGUs that have been able to reduce their output as renewable energy resources were made available on past days. This information should already exist at the ISO / RTO that oversees the electrical grid for the area.

Step 2: Understanding how the grid has responded in the past as renewable resources have come on-line to develop planning assumptions for how the grid will respond in the future.

Step 3: Obtain and review the results from existing dispatch modeling conducted by the grid operator of the PCA, ISO or RTO. The grid operators have the most pressing need to accurately determine the impact that renewable energy resources will have on the future operation of the electrical network.

In areas of the country where several states in close proximity to one another implement RE policies and programs, it may be advantageous for these states to work together in conjunction with their ISO / RTO and EPA Regional office to identify the overall impact of the RE policy and programs on the electrical grid in the future. Ideally, such a process will yield a technically valid solution that attributes the emission reductions from decreased reliance on fossil fuel fired EGUs in an equitable manner between the states, and also ensures that double counting of emission reductions does not occur.

EPA understands that conducting this type of analysis may be beyond the means of the jurisdictions that implement these RE policies and programs. Accordingly, we encourage any state, tribal and local that needs assistance with this to contact the relevant EPA regional office for assistance. A list of EPA contacts is provided in section ___ of this document.

SECTION F.5: STEP 4: PROVIDE A MECHANISM TO VALIDATE OR EVALUATE THE EFFECTIVENESS OF THE POLICY

The purpose of this step is to determine the type of monitoring, record keeping and reporting needed to evaluate whether the expected energy impacts, emission reductions and/or air quality improvements were achieved in practice. For energy efficiency policies, if the state wants to incorporate energy efficiency policies as a control measure, there should be an effort to evaluate, measure, and verify the impacts of energy efficiency. For more information on this topic, see the National Action Plan for Energy Efficiency Guide on EM&V.[46]

[46] DOE (2006) National Action Plan for Energy Efficiency Report.

For RE policies and programs, jurisdictions should have in place systems to track whether energy providers are meeting the percentage targets for renewable energy in the program. Typically, the state public utility commissions or state energy offices monitor utility compliance or performance on a year-to-year basis.

SECTION F.6: OTHER CRITERIA FOR CONTROL MEASURE PATHWAY

In addition to the quantification of the emission reduction impact of the EE/RE policy and program measures, jurisdictions must also determine whether the measure satisfies the Clean Air Act requirements of permanent, enforceable, and surplus. Each of these requirements is discussed below.

Permanent Criterion

The EE/RE policy and/or program control strategy should be permanent throughout the term for which the emission reductions are granted unless it is replaced by another measure or the State demonstrates in a SIP revision that the emission reductions from the measure are no longer needed to meet applicable requirements.

The state or responsible party must demonstrate that adequate personnel and program resources are committed to implement and enforce the program. To demonstrate that this requirement has been met, jurisdictions should provide:

- Evidence that funding has been (or will be) obligated to implement the activity;
- Evidence that all necessary approvals have been obtained from all appropriate government entities; and
- Evidence of inclusion of the EE/RE program in a state regulation or statute.
    - For RPS policies, the state needs to adopt regulation or legislation mandating the program with a state commitment in the SIP to continued implementation of the program

For energy efficiency policies and programs, the permanence of some programs, such as purchase programs for energy efficient equipment and products, would need to be addressed to ensure that:

- The purchased equipment/products would be replaced at the end of their useful lives with comparably efficient equipment, or,
- That if there isn't a plan to replace the EE equipment/products, the loss of EE savings is reflected in the SIP. However, a SIP commitment to continue support and funding for the EE program in the future will provide some assurance that as old equipment is replaced, it is replaced with comparable or more efficient equipment.

Enforceable Criterion

Emission reductions used to meet SIP RFP or attainment needs must be enforceable against a source, and the state and EPA must have the ability to apply penalties if deemed appropriate. Additionally, citizens must have access to the emissions related information obtained from the sources, and must be able to file suits against the source for violations.

The state's renewable portfolio standards (RPS) and EE policies and programs must be mandatory, created either by specific state legislation commission order or regulation. If a state submits EE/RE programs for incorporation into its SIP, the programs also become federally enforceable. Making state adopted EE/RE programs federally enforceable puts them on par with more traditional air pollution control programs for which states have sought SIP credit for in the past.

To ensure state overview and enforcement of these programs, EPA envisions the need for an MOU between the state DEP and the DPUC or other state entity to delegate enforcement of the program. From EPA's standpoint, it does not matter what part of State government enforces the program – it could be the DEP or PUC – so long as the state agency in question has authority from the legislature to administer and enforce the program.[47] When EPA brings the program into the SIP, EPA has to have the option to impose CAA-mandated penalties when the agency determines this is an appropriate course of action. However, if the state "must" initiate enforcement, there is no need for EPA to take enforcement action. Failure of the state to act would be appropriately addressed in discussions with or an action against the State, not the entities in non-compliance. Enforcement of the proposed EE/RE SIP policy and program elements should be addressed in the State-EPA agreements on enforcement which delineate the roles of each party and, on an annual basis, the sharing of enforcement responsibilities to which the state and EPA agree, including who will pursue which cases under this program.

Surplus Criterion

Jurisdictions cannot "double-count" emissions; Emission reductions associated with the EE/RE program must not be relied upon in any other air quality program included in jurisdictions SIP. . To demonstrate that this requirement has been met, jurisdictions should provide:

- A statement that the appropriate agency has reviewed the control strategy and confirms that it is not accounted for in other parts of the SIP; and
- A statement describing the potential areas of overlap, if any, and steps to ensure that emission reductions are surplus and that there is no double-counting

If a cap and trade program is present, one method for demonstrating the surplus criterion has been met is to retire allowances or otherwise ensure emissions will not increase somewhere else within the cap.

[47] The criteria described here that EPA would use to evaluate the enforceability of a SIP that incorporates renewable energy incorporate by implication the requirement that the emissions data reflects the full implications of renewables use on the grid. Recent studies document that at certain levels of wind production (e.g., 20 percent), emissions factors on natural gas and coal facilities used to balance the grid are significantly different from emissions factors for those units when used without wind on the grid. The emissions data or emissions factors used in an enforcement case would have to reflect the actual emission rates associated with actual wind power usage.

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Appendix G: Emerging/Voluntary Measures Pathway

SECTION G.1: BASICS OF EMERGING/VOLUNTARY MEASURES

Pathway Description

In 2004 Agency guidance EPA has recognized that many areas of the country have implemented most available traditional emission control strategies and are interested in new types of pollutant reduction strategies to attain and maintain applicable NAAQS, including voluntary EE/RE programs. The EPA supports and encourages the testing of voluntary and emerging pollutant reduction strategies. A voluntary measure is a measure or strategy that is not enforceable against an individual source. An emerging measure is a measure or strategy that does not have the same high level of certainty as traditional measures for quantification purposes. A measure can be both voluntary and emerging.

Completed	Action
✓	Identify and describe the emerging/voluntary EE/RE programs to include
✓	Calculate emissions reductions, including description of quantification technique
✓	The State has to make an enforceable commitment to implement those parts of the measure for which the State or local government is responsible
✓	The State has to make an enforceable commitment to monitor, evaluate, and report at least every three years on progress toward emission reductions
✓	The State has to make an enforceable commitment to remedy any SIP/TIP credit shortfall if the program does not achieve projected emission reductions
✓	Certify EE/RE programs are permanent and surplus

This pathway is similar to the control strategy pathway in that an EE/RE program can receive emission reduction SIP/TIP credit under this option and must satisfy the four criteria for SIP/TIP measures:

- Permanent
- Quantifiable
- Surplus
- Enforceable

But the policy provides flexibility for emerging measures on the quantifiable criterion and for voluntary measures it provides flexibility on the enforceable criterion.

Tradeoffs Of Pathway

The quantity of potential SIP/TIP credit for the emerging/voluntary measures pathway is generally limited as compared to the control strategy pathway. The limitations and conditions under which emerging/voluntary measures can receive credit are determined at the beginning of the SIP/TIP process, and provisional pollutant reduction credit is provided under the assumption that the EE/RE measures will achieve the quantity of the initially estimated emission reductions.

What Circumstances And Type Of State, Tribal And Local Agencies Is The Pathway Best Suited For

The pathway is well suited for areas that have voluntary and/or emerging EE/RE policies/programs that are not easy to enforce and/or quantify but for which the area would like SIP/TIP credit.

Four Steps State, Tribal And Local Agencies Needs To Take To Implement The Pathway

To implement this pathway, state, tribal and local agencies need to pursue four steps:

1) Identify and describe the voluntary EE/RE programs that it wishes to include as emerging/voluntary measures.
2) Calculate expected emission reductions from the voluntary EE/RE programs and document the technique.
3) Commit to implement the programs and to monitor, evaluate, and report at least every three years on progress toward emission reductions.
4) Ensure that the EE/RE emission reductions included in the WOE demonstration are not accounted for as part of the other two pathways to avoid double counting and that they are permanent.

Process Issues Including Expected Level Of Effort, Other Resources Needed, And Stakeholders Involved

The process issues and workload are greater than the WOE pathway and less than the control strategy pathway. Quantification of emissions reductions associated with a state's EE/RE programs and policies and their enforceability will require discussion and verification on the emissions and energy savings data with staff in the state public utilities commission, the regional transmission organization, or both.

SECTION G.2: VOLUNTARY/EMERGING MEASURES PATHWAY ANALYSIS AND DOCUMENTATION

In order to adopt and implement emission reduction strategies to meet SIP/TIP CAA requirements, such as RFP, ROP, attainment demonstrations, general conformity, and maintenance, the reductions from control measures must be:

Permanent

The state or responsible party must demonstrate that adequate personnel and program resources are committed to implement and enforce the program. The emission reductions expected from the state's EE/RE programs should continue through the term for which the credit is granted unless replaced by another measure, or the state demonstrates through a SIP/TIP revision that the measure is no longer necessary.

Quantifiable

As noted in Appendix C, for emerging/voluntary stationary measures the presumptive limit is 6 percent of the total amount of emission reductions required for the ROP, RFP, attainment, or maintenance demonstration purposes. The limit applies to the total number of emission reductions that can be claimed from any combination of voluntary and/or emerging measures, including those measures that are both voluntary and emerging. The limit is presumptive in that EPA believes it may approve measures into a SIP/TIP in excess of the presumptive six percent where a clear and convincing justification is made by the state. tribal or local agency as to why a higher limit should apply in their case. Any request for a higher limit will be reviewed by EPA on a case-by-case basis.

For emerging measures, EPA allows flexibility for the quantification requirement. Some areas want to try new types of emission control or pollution reduction strategies. EPA's policy provides a mechanism that allows the state. tribal or local agency to receive provisional emission reduction credit in their SIP/TIP for new emission control and pollutant reduction strategies that have the potential to generate additional emission reductions or air quality benefits. In these circumstances, the state. tribal or local agency should quantify the pollution reduction based on the best knowledge currently available for the measure being considered. The state. tribal or local agency should develop a protocol based on a carefully considered determination of the activities that it is committing to undertake and the activities' projected impact on pollution. The estimates may be based on modeling, on extrapolated experience for similar types of projects or on another approach that is likely to yield a reasonable estimate of pollution reduction. EPA recommends that state, tribal and local agencies consider the Tier Three or Four techniques presented in Appendix F as a way to approach quantification, recognizing that for emerging/voluntary programs is probably not warranted.

Surplus

The state. tribal or local agency needs to certify that the emission reductions being claimed for credit under the emerging/voluntary measures policy are not also reflected in the emissions baseline or included as part of a WOE demonstration.

Enforceable

As described in Appendix F, the emerging/voluntary measures policy provides some flexibility on enforceability for voluntary by requiring the state. tribal or local agency to assure that the emission reductions credited in the SIP/TIP occur. The state. tribal or local agency would make an enforceable commitment to monitor, assess and report on the emission reductions resulting from the voluntary measures and to remedy any shortfalls from forecasted emission reductions in a timely manner. These commitments would be needed from the state. tribal or local agency.

Appendix H: Weight of Evidence Pathway

SECTION H.1: BASICS OF WOE

Pathway Description

When state, tribal or local agencies conduct air quality modeling to assess the attainment of a NAAQS, considering the efficacy of existing and future control measures, EPA guidance encourages them to perform complementary analyses of air quality, emissions, meteorological data, and other modeling information to help corroborate the conclusions of the attainment demonstration. Sometimes, the results of corroboratory analyses may be used in a *weight of evidence determination* to show that attainment is likely despite modeled results which may not show attainment or may be close to the level of the NAAQS. The further the predicted, modeled design value is from the standard, the more compelling the contrary evidence produced by corroboratory analyses must be to draw a conclusion that differs from that implied by the modeled attainment test results. If a conclusion differs from the outcome of the modeling, then the need for subsequent review (several years hence) with more complete data is increased. If the attainment test is failed by a wide margin, it is far less likely that the more qualitative arguments made in a weight of evidence determination can be sufficiently convincing to conclude that the NAAQS will be attained.

Completed	Action
✓	Identify the EE/RE programs and policies to include
✓	Ensure EE/RE programs and policies will be in place for planning period
✓	Calculate emissions reductions, including description of quantification technique
✓	Ensure emissions reductions are not double counted

In a WOE determination, states should review results from several diverse types of air quality analyses, including results from the modeled attainment test. The diverse types of analyses could include consideration of the impact of EE/RE programs, among other factors. Weight of evidence demonstrations are generally described in guidance EPA has issued on their use in SIP attainment demonstrations.[48]

Tradeoffs Of Pathway

Of the three options, this pathway involves the least documentation and analysis but it does not provide a direct quantification of the potential air quality benefit for the SIP/TIP.

[48] http://www.epa.gov/scram001/guidance_sip.htm

What Circumstances And Type Of States The Pathway Is Best Suited For

This option is best suited for a state that has mandatory policies and programs that are difficult to quantify and/or model[49] or voluntary EE/RE programs that it can demonstrate, through basic quantification, will produce emissions reductions in the planning timeframe for attainment.

Four Steps State, Tribal And Local Agencies Needs To Take To Implement The Pathway

To implement this pathway, State, tribal and local agencies need to pursue four steps:

1) Identify the EE/RE programs and policies that it wishes to include in the WOE demonstration.
2) Ensure that the EE/RE programs and policies will be in place for the duration of the planning period in question, benefitting that area's ability to attain.
3) Perform a calculation of emission reductions expected from the policies and programs and.
4) Ensure that the EE/RE emission reductions included in the WOE demonstration are not accounted for as part of the other two pathways to avoid double counting.

Process Issues Including Expected Level Of Effort, Other Resources Needed, And Stakeholders Involved

Process issues associated with this option are not significant. Quantification of emissions reductions associated with a state's EE/RE programs and policies may require some interaction with energy experts at the state level. But inclusion of EE/RE programs and policies does not make them federally enforceable so coordination with the state energy officials will not be necessary on that issue.

SECTION H.2: WOE EE/RE ANALYSIS AND DOCUMENTATION

States need to quantify the expected emissions reductions from the EE/RE programs and policies included in the WOE demonstration that are expected to benefit air quality in the nonattainment area in question. EPA has several tools available that can help states to quantify the benefits of EE/RE policies that are described in Appendix E. In addition, EPA is providing energy savings estimates for state-mandated EE policies that could be used is a WOE demonstration (see Appendix G).

Documentation for this pathway is minimal in comparison to the other two pathways and should include the following:

- Statement that program will be in effect for duration of planning period and that its emissions reductions are not double counted.
- Brief description of a simplified technique (such as the Tier Four approach described in Appendix F) for quantifying emissions reductions showing that the

[49] There are many reasons why a state, tribal or local agency may not be able to quantify emissions reductions or model a specific EE/RE policy. The state, tribal or local agency may lack sufficient resources or the benefits may be too small to justify the effort.

policies are likely to produce emission reductions in the attainment planning timeframe for the nonattainment area in question.

Appendix I: EPA's Draft Methodology for Estimating Energy Impacts of EE/RE Policies

SECTION I.1: INTRODUCTION

To help state, tribal or local agencies examine the role for EE/RE policies and programs in their SIPs/TIPs, EPA developed a draft methodology and estimated the electric-sector impacts of existing energy efficiency and renewable energy (EE/RE) policies. EPA's draft methods and analysis covers "on the books" EE/RE policies that are adopted in law and codified in rule or order, but that are not reflected in the Energy Information Administration's Annual Energy Outlook (AEO) 2010 electricity demand projections. Electric sector impacts are provided for the following policies:

- Energy efficiency policies that require reductions in electricity consumption in key end-use sectors (residential, commercial and industrial)
- Renewable Portfolio Standard (RPS) policies that increase renewable energy generation or sales beyond what is already captured in AEO 2010

EPA anticipates that its methods and impact estimates may be useful to state, tribal or local agencies preparing SIP/TIP submittals to meet the National Ambient Air Quality Standards (NAAQS) for ozone and other pollutants.

This appendix describes the methodology EPA used to develop those energy savings estimates, provides an overview of the information EPA is making available, and outlines potential uses for the information. For more details on the projected impacts of state EE/RE policies refer to: http://www.epa.gov/statelocalclimate/state/statepolicies.html.

SECTION I.2: OVERVIEW OF PROCESS

EPA undertook the following process steps to determine which "on the books" EE/RE policies are not explicitly accounted for in AEO 2010 reference case forecast.

- Step One: Understand Annual Energy Outlook 2010 Reference Case Forecast (AEO 2010).
- Step Two: Identify key state EE/RE policies not explicitly included in AEO 2010 and collect relevant design details.
- Step Three: Develop analytical methods to estimate incremental[50] impacts of EE/RE policies relative to AEO 2010 reference case forecast.

[50] Incremental impacts of EE/RE policies relative to AEO 2010 refers to the impacts not captured within AEO 2010, taking into account any embedded impacts reflected in the forecast

Step One: Understand EE/RE Policy Assumptions In Annual Energy Outlook 2010 Reference Case Forecast (AEO 2010)

To understand the EE/RE policy assumptions included in the AEO 2010 forecast, EPA reviewed the Energy Information Administration's (EIA) documentation for the AEO 2010 reference case forecast and talked with EIA staff. EPA found that AEO 2010 explicitly includes the impacts of a number of existing EE/RE policies, including:

- Federal Appliance Standards[51]
  10 Residential & 10 Commercial Appliance Categories
- Federal Funding
  State Energy Program (SEP) and Energy Efficiency Community Block Grant (EECBG), Weatherization Program, Green Schools and Smart Grid Expenditures. (E.g., through the American Recovery and Reinvestment Act (ARRA))[52]
- Building Codes[53]
  All States adopt and enforce:
  IECC 2006 Code by 2011 and IECC 2009 Code by 2018 ASHRAE 90.1-2007 by 2018
- Renewable Energy Portfolio Standards (RPS)[54]
  30 States and D.C. Effective as of Sept. 2009

Step Two: Identify Key "On The Books" State EE/RE Policies Not Explicitly Included In AEO 2010 And Review Relevant Design Details

Based on EPA's review described in Section I.2.a, EPA identified four key "on the books" state EE/RE polices not explicitly included in AEO 2010 reference case forecast. EPA focused its analysis on EE/RE policies that are currently in regulation, statute or state public utility commission order that require parties to acquire energy efficiency and/or renewable energy or commit to funding levels for programs aimed at acquiring EE. The EE/RE policies listed below are the set of "on the books" state EE/RE policies EPA identified for this analysis.

State Energy Efficiency Policies:

- Energy Efficiency Resource Standards (EERS)
- Rate Payer-funded EE programs
- Regional Greenhouse Gas Initiative Funded EE programs

State Renewable Energy Policies:

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[51] U.S. Energy Information Administration (2010). Assumptions to the Annual Energy Outlook 2010: With Projections to 2035, Appendix A. p. 170-185

[52] U.S. Energy Information Administration (2010). Annual Energy Outlook 2010: With Projections to 2035. p. 8-10.

[53] Ibid pg. 8

[54] See full list at: U.S. Energy Information Administration (2010). Annual Energy Outlook 2010: With Projections to 2035. p. 14-17

- Renewable Energy Portfolio Standards (RPS) Policies that were adopted or updated between September 2009 and December 2010.

After identifying the applicable EE/RE policies, EPA scanned the 50 states to determine which states have adopted the aforementioned state EE/RE policies as of December 31, 2010. Once EPA identified the applicable states, EPA reviewed the relevant design details for each state EE/RE policy using publically available information, such as, state legislation, state rules and regulations, commission orders and summary results from ACEEE[55], Lawrence Berkeley National Laboratory[56] and Consortium for Energy Efficiency[57].

Step Three: Develop Analytical Methods To Estimate Incremental[58] Impacts Of EE/RE Policies Relative To AEO 2010 Reference Case Forecast

Once EPA understood the state-level policy characteristics, EPA developed analytical methods to estimate the impacts of the "on the books" EE/RE policies. The analytical methods EPA developed generated projected impacts of estimated annual energy savings and generation for 2010-2020, peak impacts and hourly load impact curves for 2010, 2012, 2015 and 2020 for the four identified state EE/RE policies.

SECTION I.3: OVERVIEW OF EPA'S DRAFT METHODOLOGY AND ANALYTICAL STEPS

EPA applied the following key analytical steps to estimate the projected impacts of state "on the books" EE/RE Policies.

Analytical Steps for annual energy savings of EE Policies:

- Step One: Generate a baseline (i.e., business as usual or (BAU)) forecast of state electricity sales consistent with AEO 2010 regional forecasts. (see Section I.3.a)
- Step Two: Estimate projected impacts of key state EE policies already embedded in AEO 2010 forecast of electricity sales. (see Section I.3.b)
- Step Three: Estimate projected energy efficiency savings from key "on the books" EE policies (see Section I.3.c)
    - Energy Efficiency Resources Standards (EERS) (25 states)
    - Rate-payer funding commitments to EE Programs
        - Public Benefits Funds (3 states)
    - Regional Greenhouse Gas Initiative (RGGI) allowance auction revenue for EE Programs (3 states)
- Step Four: Generate state-adjusted energy forecast that reflects the energy savings not captured in (i.e., incremental to) AEO 2010. (see Section I.3.d)

Analytical Steps for peak demand savings of EE Policies

[55] ACEEE (2010)
[56] Ernest Orlando Lawrence Berkeley National Laboratory (LBNL) (2009)
[57] Consortium for Energy Efficiency (CEE) (2010)

- Step One: Estimate projected peak demand savings for the years 2010, 2012, 2015 and 2020. (see Section I.4)
- Step Two: Generate load impact curves that represent typical hourly changes in load from energy efficiency programs under consideration. (see Section I.4.a)

Analytical Steps for RE Policies:

- Step One: Estimate renewable energy generation from RPS policies adopted or revised between September 2009 and December 2010. (see Section I.5)
- Step Two: Generate state-adjusted forecast and aggregate state-adjusted forecast to facilitate modeling regional RPS impacts. (see Section I.5.a)

EPA's Draft Methodology For Generating A Baseline (I.E., Business As Usual Or (BAU)) Forecast Of State Electricity Sales To Represent AEO 2010 Regional Forecasts

State-level baseline sales intended to represent the *AEO2010* regional forecast[59] were developed using 2009 historical state sales data from the Energy Information Administration (EIA)[60] as the starting point, and then applying the electricity sales growth rates from *AEO2010*. *AEO2010*-based 'annual average growth rates' (AAGR) were calculated for each Electricity Market Module (EMM) region across the 2009-2035 forecast period. These regional growth rates were then applied to the 2009 historical sales for each state lying predominantly within the EMM region[61]. The 2009-2035 AAGR was used to forecast sales for 2010-2035. shows the EMM region to which each state was mapped and the AAGRs that were used to forecast its sales.

Table I.1: EMM Region Mapping and *AEO2010*-Based Sales Growth Rates by State

State	EMM Region	AAGR[1] (2009-2035)
Arizona	RA	1.4%
Arkansas	SERC	1.0%
California	CA	1.0%
Colorado	RA	1.4%
Connecticut	NE	1.3%
Delaware	MAAC	0.9%
Florida	FL	1.2%
Hawaii	HI[2]	1.0%
Illinois	MAIN	1.0%
Indiana	ECAR	1.0%
Iowa	MAPP	1.1%
Maine	NE	1.3%

[59] Note that *AEO2010* does not include state-level forecasts, so incremental impacts are calculated against the Business-As-Usual Electricity Sales Forecast developed as described in Section 0.3.b.
[60] EIA (2010e), Table 2
[61] EIA maps states to EMM regions for regional modeling of RPSs. This mapping was followed where possible; states without precedent were assigned to EMM regions based on population distributions.

State	EMM Region	AAGR[1] (2009-2035)
Maryland	MAAC	0.9%
Massachusetts	NE	1.3%
Michigan	ECAR	1.0%
Minnesota	MAPP	1.1%
Montana	NWP	1.1%
Nebraska	MAPP	1.1%
New Hampshire	NE	1.3%
New Jersey	MAAC	0.9%
New Mexico	RA	1.4%
New York	NY	0.7%
Ohio	ECAR	1.0%
Oregon	NWP	1.1%
Pennsylvania	MAAC	0.9%
Rhode Island	NE	1.3%
Texas	ERCOT	0.9%
Vermont	NE	1.3%
Washington	NWP	1.1%
Wisconsin	MAPP	1.1%

EPA's Draft Methodology For Estimating Energy Savings Of EE State Policies Embedded In AEO 2010.

AEO2010 does not explicitly include the impacts of state energy efficiency policies such as EERSs, ratepayer-funded EE programs and RGGI-funded EE programs. However, AEO2010 results could implicitly reflect these programs to the extent that forecast parameters are calibrated to historical data and individual programs could have already been in place for several past years. AEO2010 also accounts for future energy efficiency improvements, which could be partly attributed to these key state EE policies. Some portion of the savings from EE policies may therefore be embedded in the AEO2010 forecast and the AEO2010-based state-level BAU forecast. These embedded savings were estimated for each state and subtracted from its total EE policy savings to estimate the impacts that are incremental to AEO2010. Embedded savings were only applied for years in which states see savings from EE policies and, to the extent possible, were only calculated for entities that are required to implement the EE policies under consideration.

The methodology used to develop estimates of embedded savings for this analysis is a variation of the method used in LBNL (2009), which, lacking better information, assumes that the growth rates derived from the AEO forecast implicitly account for a continuation of 50 percent of historical levels of savings. Embedded savings for each state were quantified using the following three steps:

1) Step One: Estimating Historical Savings for Entities that Implement key state EE policies[62]

[62] EERS, Rate-payer funded EE programs and RGGI funded EE programs

- Total first-year electricity savings from existing and new programs in 2006, 2007 and 2008 were obtained from ACEEE (2008, 2009b, 2010).[63]
- For states that have EERSs with a total sales basis, or have no EERSs but have ratepayer- or RGGI-funded programs, savings for entities that implement the EE policies were taken to be equal to the total incremental savings for each historical year.
- For states that have EERSs with a basis other than total electricity sales, savings for entities that implement the EE policies were estimated as follows:
    - Utilities not affected by an EE policy in each state and their savings for 2006, 2007 and 2008 were identified from EIA-861 utility-level data (EIA 2007a, EIA 2008a, EIA 2009a).
    - If the identified utilities had service areas in only one state, all their savings were assumed to take place in that state
    - If the identified utilities had service areas in multiple states and they were either (a) affected by EE policies in all states, or (b) not affected by EE policies in any state in which they had a service area, their savings were apportioned to states in proportion to 2009 utility sales in each state.
    - If the identified utilities had service areas in multiple states and they were affected by these policies in some but not all states in which they had a service area, then all savings were assumed to take place in the states in which they were affected by EE policies. Savings were apportioned to these states in proportion to 2009 utility sales (EIA 2010e) in each state.
    - Savings for entities that implement EE policies were estimated as the total first-year electricity savings for the state minus any savings from unaffected utilities that were apportioned to the state.

2) Step Two: Estimating the Weighted Average of Historical Savings as a Share of Sales for 2006-2008

Historical savings from the previous step were divided by historical sales to estimate a weighted average savings rate. Annual electricity sales data for 2006-2008 for each state were obtained from EIA-861 state-level datasets (EIA 2007b, EIA 2008b, EIA 2009b). The weighted average (*m*) of historical savings for entities that implement EE policies as a share of state sales was calculated as:

$m = \Sigma X(\mathrm{t}) / \Sigma Y(\mathrm{t})$

Where:
t goes from 2006 to 2008,
X is the savings for entities that implement EE policies, and
Y is the annual electricity sales.

[63] ACEEE estimates state-level EE savings using utility-level data from EIA-861 and information from a state-by-state survey conducted by ACEEE.

3) <u>Step Three</u>: Estimating Embedded Savings for Each Future Year

The weighted average of historical savings as a share of sales for 2006-2008 (*m*) is multiplied by 50 percent to yield embedded savings as a share (*n*) of baseline sales for each future year:

$n = m * 50\%$

Table I.2 presents the estimated embedded savings as shares of baseline sales. Embedded savings were calculated as:

$F(t) = n * B(t)$
$E(t) = F(t) + F(t\text{-}1) + \ldots + F(t\text{-}L\text{+}1)$

Where:
F is the annual first-year embedded energy savings,
B is the baseline total sales, *L* is the measure lifetime, and
E is the cumulative embedded energy savings.

Table I.2: Energy Efficiency Savings Estimated to be Embedded in *AEO2010*

State	Savings Estimated to be Embedded in *AEO2010* (% of BAU Sales in Each Year)
Arizona	0.14%
Arkansas	0.02%
California	0.48%
Colorado	0.12%
Connecticut	0.54%
Delaware	0.00%
Florida	0.06%
Hawaii	0.63%
Illinois	0.00%
Indiana	0.01%
Iowa	0.34%
Maine	0.36%
Maryland	0.02%
Massachusetts	0.39%
Michigan	0.00%
Minnesota	0.34%
Montana	0.18%
Nebraska	0.01%
New Hampshire	0.33%
New Jersey	0.18%
New Mexico	0.05%
New York	0.21%
Ohio	0.01%

State	Savings Estimated to be Embedded in *AEO2010*
Oregon	0.34%
Pennsylvania	0.00%
Rhode Island	0.47%
Texas	0.06%
Vermont	0.91%
Washington	0.35%
Wisconsin	0.31%
Developed by ICF International based on data from:	
ACEEE (2008), Table 6; ACEEE (2009b), Table 6; ACEEE (2010), Table 8	
EIA (2007a), File3; EIA (2008a), File3; EIA (2009a), File3; EIA (2007b), Table 2; EIA (2008b), Table 2; EIA (2009b), Table 2; EIA (2010e), Table 2	

EPA's Draft Methodology For Estimating Projected Energy Efficiency Savings From Energy Efficiency Policies

State-level energy efficiency savings were estimated from EERSs, ratepayer-funded programs, and RGGI-funded programs. Because these categories were not mutually exclusive, double-counting of energy savings for states with EERSs was avoided by treating EERS targets as overall goals that include savings from individual ratepayer-funded and RGGI-funded programs. Qualifying individual programs were not identified as being incremental to the EERS target, so each state for which savings are reported has either EERS savings, or ratepayer- and/or RGGI-funded savings. To review EPA's estimates of EE policies refer to:
http://www.epa.gov/statelocalclimate/state/statepolicies.html

First-year electricity savings expected to occur in each year, and cumulative savings from EE measures implemented in the current year and past years, were estimated for each energy efficiency policy category. Cumulative savings were calculated using state-specific measure lifetimes (as available from ACEEE (2009a), see Table I.3 below) assuming no decay of savings during measure life. A default lifetime of 13 years was used where state-specific assumptions were not available. No further first-year savings were estimated beyond the requirements found in each state's policy period, and the forecast reverts to the *AEO2010*, which includes improved technology and efficiency in the long term.

Table I.3: Measure Lifetime by State

State	Measure Lifetime (Yrs)
Connecticut	13
Iowa	15
Massachusetts	13
Minnesota	13
Nevada	13

State	Measure Lifetime (Yrs)
New Jersey	14
New Mexico	9
New York	15
Oregon	12
Rhode Island	11
Texas	13
Vermont	13
Wisconsin	12
Default	13
Source:	
ACEEE (2009a), Table 1	

Energy Efficiency Resource Standards

An Energy Efficiency Resource Standard (EERS) is a policy mechanism that sets targets for energy savings over a specified time frame from end-use energy efficiency programs operated by utilities or other program administrators. State-level screening revealed that 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 (IOUs), while others have mandated targets based on total sales or some other subset of total sales.

Energy savings for each state were estimated using formulas specific to the state's EERS, as shown below. The appropriate sales basis for each state was identified and, if the basis was not total sales, baseline forecasts of sales of affected utilities only were developed using 2009 utility-level sales data from EIA[64] and *AEO2010*-based growth rates[65]. Full achievement of EERS targets was assumed for all years in the compliance period for all states, except for those with EERSs that have cost/rate caps. Savings were not estimated for purely voluntary EERSs such as Virginia's EERS.

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

1) <u>EERS with Annual First-Year Energy Efficiency Savings Targets Specified in Percent Terms</u>

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

Where:
r is the annual first-year percent savings target,

[64] EIA (2010c)
[65] See

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 *AEO2010* forecast,
I is the cumulative savings incremental to *AEO2010* forecast, and
Z is the adjusted sales after application of cumulative incremental savings.

2) <u>EERS with Annual First-Year Energy Efficiency Savings Targets Specified in Absolute Terms</u>

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

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 *AEO2010* forecast,
I is the cumulative savings incremental to *AEO2010* forecast, and
Z is the adjusted sales after application of cumulative incremental savings

3) <u>EERS with Cumulative Energy Efficiency Savings Targets Specified in Percent Terms</u>

$A(t) = C(t) – C(t-1) + A(t-L)$

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

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

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 *AEO2010* forecast,

I is the cumulative savings incremental to *AEO2010* forecast, and
Z is the adjusted sales after application of cumulative incremental savings

4) <u>EERS with Cumulative Energy Efficiency Savings Targets Specified in Absolute Terms</u>

$A(t) = C(t) - C(t\text{-}1) + A(t\text{-}L)$

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

If $C(t)$ not available,
$Z(t)$ 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 *AEO2010* forecast,
I is the cumulative savings incremental to *AEO2010* forecast, and
Z is the adjusted sales after application of cumulative incremental savings

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

1) <u>Combined EERS and RPS</u>: Nevada and North Carolina have EERSs that are combined with their RPSs. Savings from these combined policies were assumed to be included in *AEO2010*.

2) <u>Compliance Type and Cost/Rate Caps</u>: Two states – Illinois and Texas – include cost/rate caps in their EERS rules. Without a bottom-up economic analysis for all possible programs and supply-side resources, it was not possible to evaluate the impacts of these caps on the achievement of EERS targets. As an alternative, savings for these states were estimated based on savings reported for previous years and estimated for future years in utility filings[66] and energy efficiency studies[67].

[66] AEP TCC (2010), AEP TNC (2010), Ameren Illinois (2010), CenterPoint (2010), ComEd (2010), EPE (2010), Entergy (2010), Oncor (2010), SWEPCO (2010), TNMP (2010), Xcel (2010)
[67] Good Company Associates (2010)

3) <u>"All Cost-effective Energy Efficiency" Targets</u>: Six states – Connecticut, Massachusetts, New Mexico, Rhode Island, Vermont and Washington – require utilities (or other EE program administrators) to implement all cost-effective energy efficiency. In states with an "all cost-effective EE" target and available numerical goals, the numerical goals were used (i.e., New Mexico). In states with an "all cost effective EE" target without numerical goals through 2020, tailored approaches based on utility plans[68] and resource potential studies[69] were applied to estimate savings.

Rate-Payer Funded Commitments To EE Programs With An Established Public Benefits Fund Policy

Energy efficiency savings were estimated for ratepayer-funded programs in states that have established dedicated public benefits funds for such programs. Data for ratepayer-funded programs are mainly available in terms of program expenditures, so savings were calculated using estimates of energy savings per program dollar spent. For each state with qualifying programs, information on annual program funding for 2010 was obtained from state publications[70] or utility surveys[71], and funding for each future year in the time period was projected as equal to the funding for 2010[72]. Estimates of levelized costs of saved energy (LCSE) were available for some states from ACEEE (2009a). 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 (CRF), and estimates that the average LCSE across the states included in the report is $0.025/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. The average LCSE of $0.025/kWh was used as the default LCSE where state-

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[68] CT Utilities (2010), MDPU (2010), National Grid (2008), EERMC (2010), VEIC (2009)
[69] KEMA (2010), NWPCC(2010)
[70] NHEU (2009), NJ BPU (2009)
[71] CEE (2010)
[72] In the case of New Jersey, total funding data for the NJ Clean Energy Program™ were available for 2010, 2011 and 2012. Though the share of total funding that is projected to be spent on energy efficiency ranges from about 77 percent to 85 percent in these three years (NJ BPU 2008), a conservative assumption was made that only 50 percent of total funding will be allocated to energy efficiency programs. Energy efficiency funding for each future year in the time period was projected as equal to the funding for 2012.

specific estimates were not available. No decay of savings during measure life was assumed, so savings for each year during a measure's lifetime are equal to the lifetime savings averaged over the measure lifetime.

Table I.4: Levelized Cost of Saved Energy by State

State	LCSE ($/kWh)
California	$0.029
Connecticut	$0.028
Iowa	$0.017
Massachusetts	$0.031
Minnesota	$0.021
Nevada	$0.019
New Jersey	$0.026
New Mexico	$0.033
New York	$0.019
Oregon	$0.016
Rhode Island	$0.030
Texas	$0.017
Vermont	$0.027
Wisconsin	$0.033
Default (Simple Average)	$0.025
Note: LCSE is based on program administrator costs, not on total resource costs. Source: ACEEE (2009a), Table 1	

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

$CRF = (d * (1+d)^L)/((1+d)^L - 1)$
$A(\mathrm{t})$[73] $= (F(\mathrm{t}) * CRF)/LCSE(\mathrm{t})$
$C(\mathrm{t}) = A(\mathrm{t}) + A(\mathrm{t}-1) + \ldots + A(\mathrm{t}-L+1)$

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, and
C is the cumulative energy savings.

[73] In the case of New Hampshire, lifetime savings estimates were available from NHEU (2009) so they were not estimated using this formula.

Some special considerations and areas of improvement in the methodology are:

1) Ratepayer-funded energy savings for Montana are understated in this analysis because funding data were available for only some of their utility programs. More comprehensive data about Montana's program funding are needed to improve the savings estimates for these states.
2) Additional information about forecasted funding will also assist in refining the savings estimates for future program years.

RGGI-Funded EE programs

Savings from RGGI-funded energy efficiency programs were estimated for three states – Delaware, New Hampshire and New Jersey. The other seven RGGI states have EERSs, and RGGI-funded energy efficiency improvements count towards their EERS goals.

RGGI-funded savings were also estimated using state-level estimates of program funding and costs of saved energy. Total RGGI proceeds available to each state in each year during the policy period were estimated using forecasted allowance prices and CO_2 emissions.[74] RGGI Signatory States have agreed that at least 25 percent of their shares of RGGI auction proceeds will be allocated for a consumer benefit or a strategic energy purpose,[75] and to date states have allocated 52 percent of proceeds to improve energy efficiency[76]. Proceeds are allocated according to state laws, and Delaware, New Hampshire and New Jersey have explicitly adjustable allocations[77] or have recently diverted RGGI proceeds for purposes other than renewable energy, energy efficiency and direct consumer assistance[78].

In order to be conservative in projections of future EE funding from RGGI proceeds, an assumption was made that 25 percent of each state's proceeds in each year are used to fund energy efficiency programs. Based on information from ACEEE (2009a), an LCSE of $0.026/kWh was used for New Jersey.

Consistent with the assumptions used to estimate savings from ratepayer-funded programs, a default LCSE of $0.025/kWh was used for Delaware and New Hampshire, and a discount rate of 5 percent was used for all states. No decay of savings during measure life was assumed, so savings for each year during a measure's lifetime are equal to the lifetime savings averaged over the measure lifetime.

Energy savings from RGGI-funded programs in each year (t) were estimated using the following formulas:

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

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[74] ICF (2010)
[75] RGGI (2005)
[76] RGGI (2011)
[77] Delaware State Senate (2008)
[78] Nashua Telegraph (2010)

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, and
C is the cumulative energy savings.

Some special considerations and areas of improvement in the methodology are:

1) Two RGGI Signatory States, New York and Maryland, have EERSs in place through 2015. RGGI-funded energy efficiency savings in these states would count towards EERS goals until 2015, and then would continue as stand-alone programs in years past 2015. Savings past 2015 were not estimated, however, because there was no way to separate savings embedded in *AEO2010* to isolate the share tied specifically to programs funded by RGGI. Without quantified embedded savings, incremental RGGI-savings could not be calculated.
2) The share of RGGI proceeds allocated to energy efficiency programs varies across states. Detailed information on anticipated funding will help improve estimates of future savings.

EPA's Draft Methodology For Generating State-Adjusted Forecast That Reflects Energy Savings Incremental To AEO2010

Energy savings that are estimated as incremental to *AEO2010* were estimated by subtracting cumulative savings embedded in *AEO2010* from total savings from EERSs, ratepayer-funded programs and RGGI-funded programs:

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

Where:
C is the cumulative energy savings,
E is the cumulative savings embedded in the *AEO2010* forecast and
I is the cumulative savings incremental to *AEO2010* forecast.

The State-Adjusted Case Electricity Sales Forecast includes the impact of energy efficiency savings that are incremental to the Reference Case (Business-As-Usual). 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 *AEO2010* forecast.

SECTION I.4: EPA'S DRAFT METHODOLOGY FOR ESTIMATING PROJECTED PEAK DEMAND SAVINGS OF EE POLICIES

State-level peak savings were estimated as the hourly load impact of energy efficiency programs during the state's peak hour.[79] In the absence of state-specific information on the timing of the peak, the peak hour for each state was assumed to be the same as the peak hour for the Integrated Planning Model (IPM) region[80] in which it largely sits (based on population) in EPA's Base Case.

Table I.5 presents the state-to-region mapping that was used. Since the load shape data used in EPA's Base Case were available for 2007, the peak hour for each year of interest was also shifted based on the first day of the year in the same manner as in Step 3 above. For each state, the peak hour for each year was then identified on the load impact curve for that year, and the corresponding hourly impact was taken to be the peak savings.

Table I.5: EPA Base Case Region Mapping for IPM

State	IPM Region
Arizona	AZNM
Arkansas	ENTG
California	CA-S
Colorado	RMPA
Connecticut	NENG
Delaware	MACE
Florida	FRCC
Hawaii	HAWI
Illinois	COMD
Indiana	RFCO
Iowa	MRO
Maine	NENG
Maryland	MACS
Massachusetts	NENG
Michigan	MECS
Minnesota	MRO
Montana	NWPE
Nebraska	MRO
New Hampshire	NENG
New Jersey	MACE
New Mexico	AZNM
New York	NYC

[79] It was assumed that EE programs do not shift the peak, and a dynamic analysis of peak demand was not performed.

[80] "Model region" refers to the geographic regions defined for the "EPA Base Case using IPM® v.4.10," a projection of electricity sector activity that takes into account only those Federal and state air emission laws and regulations whose provisions were either in effect or enacted and clearly delineated at the time the base case was finalized in August 2010. The peak hour is taken from load shapes used in EPA's Base Case using IPM®, which are compiled by aggregating EIA-714 data to the model region level.

State	IPM Region
Ohio	RFCO
Oregon	PNW
Pennsylvania	MACE
Rhode Island	NENG
Texas	ERCT
Vermont	NENG
Washington	PNW
Wisconsin	WUMS
Developed by ICF International based on:	
US EPA (2010), Introduction	

EPA's Draft Methodology For Generating Load Impact Curves Of EE Policies

The approach for developing load impact curves was based on previous work performed by ICF International for EPA in 2009. Through this project, ICF developed regional sectoral load impact shapes to represent typical hourly load impacts from energy efficiency programs. Residential sector and commercial sector impact shapes were estimated for each of the nine Census Divisions and industrial sector impact shapes were estimated for each of the four Census Regions. The shapes of the impacts were based on region- and sector-specific energy efficiency program mixes that were developed independently by ICF. These program mixes were not intended to represent any particular set of programs in place, but were generic, driven by considerations including cost-effectiveness to the consumer, which varied mainly due to regional building population and climate. To see the results of EPA's draft estimates refer to http://www.epa.gov/statelocalclimate/state/statepolicies.html

The regional sectoral energy efficiency load impact shapes previously developed were scaled based on state sectoral savings shares and total incremental savings in order to develop load impact curves for this analysis. The implicit assumption was that the energy efficiency measures being modeled in aggregate mirror the bundled measures underlying the original load shapes. Load impact curves for each state were developed for 2010, 2012, 2015 and 2020 using the following steps.

1) Estimating Sectoral Shares of Energy Efficiency Savings
    a. The average (O) of national sectoral savings[81] (X) as a share of national sectoral sales[82] (Y) for 2007-2009 was calculated for the residential (r), commercial (c) and industrial (i) sectors.

$$O_{r,n} = ((X_{r,n,2007}/Y_{r,n,2007}) + (X_{r,n,2008}/Y_{r,n,2008}) + (X_{r,n,2009}/Y_{r,n,2009}))/3$$
$$O_{c,n} = ((X_{c,n,2007}/Y_{c,n,2007}) + (X_{c,n,2008}/Y_{c,n,2008}) + (X_{c,n,2009}/Y_{c,n,2009}))/3$$
$$O_{i,n} = ((X_{i,n,2007}/Y_{i,n,2007}) + (X_{i,n,2008}/Y_{i,n,2008}) + (X_{i,n,2009}/Y_{i,n,2009}))/3$$

    b. Sectoral sales (Y) in 2009 as a share (P) of total residential, commercial and industrial sales in 2009 were calculated for each state (s).

[81] EIA 2008a, EIA 2009a, EIA 2010c
[82] EIA 2008b, EIA 2009b, EIA 2010e

$P_{r,s} = Y_{r,s,2009}/(Y_{r,s,2009} + Y_{c,s,2009} + Y_{i,s,2009})$
$P_{c,s} = Y_{c,s,2009}/(Y_{r,s,2009} + Y_{c,s,2009} + Y_{i,s,2009})$
$P_{i,s} = Y_{c,s,2009}/(Y_{r,s,2009} + Y_{c,s,2009} + Y_{i,s,2009})$

c. Sectoral shares of energy efficiency savings (Q) in each state were calculated as:

$Q_{r,s} = (P_{r,s} * O_{r,n})/(P_{r,s} * O_{r,n} + P_{c,s} * O_{c,n} + P_{i,s} * O_{i,n})$
$Q_{c,s} = (P_{c,s} * O_{c,n})/(P_{r,s} * O_{r,n} + P_{c,s} * O_{c,n} + P_{i,s} * O_{i,n})$
$Q_{i,s} = (P_{i,s} * O_{i,n})/(P_{r,s} * O_{r,n} + P_{c,s} * O_{c,n} + P_{i,s} * O_{i,n})$

Savings shares for each state are presented in Table I.6.

Table I.6: Sectoral Shares of Savings

State	Share of Savings (%)		
	Residential	Commercial	Industrial
Arizona	50.6%	43.3%	6.1%
Arkansas	51.2%	33.0%	15.8%
California	40.4%	52.0%	7.6%
Colorado	42.1%	46.2%	11.7%
Connecticut	47.4%	47.7%	4.9%
Delaware	46.6%	43.0%	10.5%
Florida	55.1%	42.0%	2.9%
Hawaii	40.2%	42.6%	17.2%
Illinois	41.4%	44.9%	13.8%
Indiana	46.2%	32.1%	21.7%
Iowa	43.7%	35.6%	20.6%
Maine	47.1%	42.0%	10.9%
Maryland	47.0%	49.7%	3.3%
Massachusetts	45.9%	40.0%	14.0%
Michigan	41.7%	45.9%	12.4%
Minnesota	43.8%	42.3%	13.9%
Montana	43.3%	41.4%	15.4%
Nebraska	44.0%	40.6%	15.4%
New Hampshire	47.5%	45.5%	7.0%
New Jersey	40.7%	55.0%	4.3%
New Mexico	38.0%	48.7%	13.3%
New York	38.6%	57.6%	3.8%
Ohio	45.8%	38.6%	15.7%
Oregon	50.5%	38.9%	10.7%
Pennsylvania	46.9%	39.3%	13.7%
Rhode Island	43.1%	51.7%	5.2%

State	Share of Savings (%) Residential	Commercial	Industrial
Texas	46.8%	40.8%	12.4%
Vermont	47.0%	42.1%	10.9%
Washington	49.8%	38.9%	11.3%
Wisconsin	42.1%	42.2%	15.6%
Developed by ICF International based on data from:			
EIA (2008a), File3; EIA (2009a), File3; EIA (2010c), File3			
EIA (2008b), Table 2; EIA (2009b), Table 2; EIA (2010e), Table 2			

2) <u>Scaling Based on Sectoral Savings Shares for Each State</u>
    a. The regional residential and commercial hourly EE impact shapes for Census Region and the industrial shape for the Census Division in which the state lies were selected.
    b. The selected regional sectoral load impact shapes were scaled using the appropriate sectoral shares of energy efficiency savings (*Q*) estimated in Step (1) to develop scaled sectoral 8760 hourly load impacts for each state.
    c. The scaled residential, commercial and industrial 8760-hour load impacts were summed by hour to get the total hourly load impact shape of energy savings for the state (this is still normalized to base 1).
3) <u>Shifting Based on First Day of the Year and Accounting for Leap Years</u>
    a. The original load impact shapes were developed for a year that began on a Sunday.
    b. The first day of each year of interest was identified, and the load impact shapes were reconciled by determining the least number of days between that day and Sunday.

e.g. 2010 begins on a Friday, and Friday is two days before Sunday
2020 begins on a Wednesday, and Wednesday is three days after Sunday

    c. For each year of interest, the total hourly load impact shape for the state was shifted ahead or behind by the least number of days to ensure that the first day of the load impact shape corresponded with the first day of the year.
    d. Two years of interest, 2012 and 2020, are leap years. The last day of each of these years was not included in the analysis to ensure consistency across years.
4) <u>Scaling based on Total Incremental Savings for Each State</u>
    a. For each year, the shifted and scaled hourly load impacts were scaled once more by multiplying them with the total cumulative incremental savings estimated for that year. The resulting 8760 hourly load impacts sum to the total cumulative incremental savings and represent the load impact shape for the year.

EPA's Draft Methodology For Estimating RE Sales From RPS Beyond What Is Captured In AEO2010

The *AEO2010* Reference Case incorporates RPSs or substantively similar laws in place at the time of forecast development. Six states' RPSs[83] were included in this analysis because they were known to have been excluded from *AEO2010* or revised since the time of *AEO2010* forecast development.

RPS targets as a percent of total sales were available for each year in the policy period for California, Colorado, Delaware and Massachusetts. These were applied to the State-Adjusted Case Electricity Sales forecasts for the respective states to estimate required renewable energy sales. In the case of Hawaii, where RPS targets were only available for 2010, 2015, 2020 and 2030, sales in intervening years were estimated by interpolation.

Since New York's RPS allows existing renewables to count toward the goal, the state's renewable sales in 2015 were estimated using available data on 2004 renewable sales[84] and the incremental sales needed to meet the 30 percent target[85]. Sales in intervening years were estimated by interpolation. For all states, RPS requirements were frozen in percent terms for the years after the RPS policy period.

SECTION I.5: EPA'S DRAFT METHODOLOGY FOR GENERATING STATE-ADJUSTED FORECAST AND AGGREGATING IT TO FACILITATE MODELING REGIONAL RPS IMPACTS

Since the *AEO2010* forecast is developed based on regional inputs, mandatory RPS targets from the various states are aggregated to the regional level in order to represent them in NEMS. The amount of renewable generation required in each state is estimated based on the state's RPS targets, compliance schedules, and projected sales growth. Though some states could be split across two or more regions, each state's required renewable generation is assigned to a single NERC region based on EIA expert judgment of factors such as predominant load locations and locations of RPS-eligible renewable resources. Required renewable generation for all assigned states is then summed to the NERC region level and used to determine regional renewable generation shares of total sales. Hawaii's RPS, which sets the state's renewable mandate at 20 percent by 2020, is not modeled in *AEO2010* because NEMS provides electricity market projections for the continental US only.

Table I.7 presents some of the state-level RPS targets used by EIA to facilitate aggregate regional modeling of impacts; adjustments made for regional modeling may cause discrepancies between these targets and the actual RPS policies. Targets are presented only for the six states for which incremental RPS requirements were estimated, as described in the next section.

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[83] California, Colorado, Delaware, Hawaii, Massachusetts, New York

[84] NY PSC (2004)

[85] NY PSC (2009)

Table I.7: RPS Requirements Used to Model Regional RPS Impacts for *AEO2010*

State	State RPS Targets (1000 GWh)			
	2010	**2012**	**2015**	**2020**
California	39.06	43.03	48.24	58.78
Colorado	1.70	3.54	5.49	7.88
Delaware	0.49	0.79	1.24	1.91
Hawaii[1]	NA	NA	NA	NA
Massachusetts	1.34	1.92	2.76	4.29
New York	24.98	26.64	28.59	29.40
Note:				
[1] *AEO2010* provides a forecast for the continental U.S. only, so impacts of Hawaii's RPS are not included in *AEO2010*.				
Source:				
EIA (2010f) (included with permission)				

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Appendix J: State Examples and Opportunities

SECTION J.1 – STATES THAT ADDRESSED CLEAN ENERGY IN THEIR SIPS FOR THE 1997 OZONE NAAQS

Background

Leading up to the ozone State Implementation Plan (SIP) revisions due in 2007, several states pursuing additional emissions reductions took steps to factor their clean energy initiatives into air quality plans. These jurisdictions established multi-stakeholder working groups to analyze the emissions benefits of efficiency and renewables (EE/RE), and to specify the policy mechanisms involved with this new approach. Key drivers for these efforts included impending regulatory deadlines and significant financial assistance provided under DOE's "Clean Energy/Air Quality Integration Initiative." The Initiative was active from 2005-2007 and focused on four states: Illinois, Texas, Louisiana, and New Jersey. Two other jurisdictions – Connecticut and the metropolitan Washington, D.C. region – independently took steps to quantify their emissions reductions.

Summary

State experience to-date has produced mixed results, both in terms of estimated air quality impacts and policy outcomes. In all cases, states found that analyzing the effects of EE/RE on air quality is time and resource intensive, and that available modeling/quantitative tools do not always produce the level of certainty that state and federal air agencies desire. Furthermore, experience shows that many different parties – e.g., DEPs, SEOs, EE/RE administrators, EPA regional offices, OAQPS, technical consultants, etc – need to be engaged over extended periods of time for states to achieve their goals.

In terms of policy outcomes, the following jurisdictions were successful in including clean energy in their air quality plans:

1. DC Region (via the MWCOG) – voluntary control measures in 1 hour and 8 hour ozone SIPs
2. TX and Shreveport, LA – voluntary control measure in 8 hour ozone early-action compact SIP revision
3. CT – weight of evidence in 8 hour ozone SIP

NJ and IL also convened working groups to evaluate clean energy/air quality opportunities, but ultimately decided not to include EE/RE resources in their plans.

One question that cannot be conclusively answered from state experience is whether the relevant EE/RE projects are "additional." This is because the SIP is intended to capture all pollution mitigation activities, regardless of whether the actions were originated within the SIP process. As a result, state agencies are not required to specify whether clean energy projects would have happened anyway. A secondary issue revolves around whether reduced electric demand would create emission reductions in the presence of a cap and trade program.

State Examples

This section highlights examples of states that have taken steps to include clean energy in their SIPs. In all cases, the states took the following general approach to quantifying the impacts of clean energy on air quality:

- Determining the amount, type, and location of electric generation that would be displaced by EE/RE measures being pursued in the jurisdiction
- Estimating the annual and summer ozone season NOx emission rates from power plants serving the state/region
- Determining the impact on annual and ozone-season NOx emissions
- Resolving policy barriers to incorporating reductions into state air quality plans

EE/RE In A Voluntary Control Measure Bundle

Texas: A stakeholder group in Texas was established to explore the impact of recent clean energy legislation – Senate Bill 5 (SB5) and Senate Bill 7 (SB7) – on air quality, and assess how the impacts could be incorporated into its ozone SIP. Key stakeholders included the TX Commission on Environmental Quality (TCEQ), Texas State Energy Conservation Office (SECO), and federal agencies, with analytic support from Texas A&M Energy Systems Lab. The clean energy measures evaluated included requirements for utilities to offset 10% of load growth through EE, clean vehicle incentives, and a requirement for new buildings to meet the state's new energy performance standards, including better weather-stripping, more efficient air conditioners, and stricter insulation guidelines. With EPA regulatory approval in 2007, the state included EE/RE in the SIP as a voluntary control measure.

TX ozone transport SIP, search for "efficiency":
http://www.tceq.state.tx.us/assets/public/implementation/air/sip/transport/041608SIP_ADOPTION.pdf
(html page with above link: http://www.tceq.state.tx.us/implementation/air/sip/sipplans.html)

DC Region: In 2004, Montgomery County, MD led a multi-county buying group to purchase wind power and undertook a first-of-its-kind analysis to estimate its effect on air quality. The reductions were ultimately included in the Maryland SIP, which was approved by EPA in 2005. Building on this success, Metropolitan Washington Council of Governments developed a regional air quality plan for the eight-hour ozone standard for the DC Region non-attainment area that also included clean energy provisions. This 2007 MWCOG air quality plan increased municipal RE purchases fourfold from 2004 to 2009 – with commitments to purchase 123 million kWh of renewable energy certificates annually – and included the installation of LED traffic lights in place of conventional incandescent lights. The plan was adopted by Virginia, Maryland, and the District of Columbia and the respective ozone SIPs were approved by the EPA regions in 2007.

DC Region 8 hour ozone SIP, see p. 126:

http://www.mwcog.org/uploads/pub-documents/9FhcXg20070525084306.pdf (html page with above link: http://www.mwcog.org/environment/air/SIP/default.asp)

Shreveport, LA: As part of its SIP revisions for the purpose of attaining and maintaining the 8-hour ozone standard, the Louisiana Department of Environmental Quality (DEQ) submitted an Early Action Compact SIP for the Shreveport area to EPA in 2004. The SIP included the emission reductions expected to be achieved from performance contracting at 33 municipal buildings in Shreveport. The performance contract was estimated to have saved 9,121 MWh of electricity per year with NOx emission reductions of 0.041 tons per ozone season-day. The city arrived at this figure after employing several different methods to determine the emissions avoided through its programs. EPA Region 6 published approval of this SIP revision in August, 2005.

Shreveport Early Action Compact, see p. 3:
http://www.deq.louisiana.gov/portal/Portals/0/AirQualityAssessment/Planning/SIP/Progress%20Report%206-30-04.pdf (html page with above link: http://www.deq.louisiana.gov/portal/Default.aspx?tabid=2311)

States Using EE/RE In A Weight Of Evidence Finding

Connecticut: In Connecticut, the Department of Environmental Protection (DEP) – a member of the Ozone Transport Commission – wanted to know if the EE programs managed by Connecticut Light and Power and the United Illuminating Company could reduce electricity consumption and NOx emissions on "high electricity demand days." The DEP worked with other OTC states to analyze the mix of power plants used to meet peak demand and determined that many had the highest emission rates in the region. The OTC team also found that peakload electricity demand on the hottest days was growing two to three times faster than baseload demand. With this information, CT DEP established a team of technical experts to analyze the effect that EE/RE projects – including high efficiency air conditioners, compact fluorescent lighting, and solar photovoltaic energy – were having on NOx emissions at critical/peak times. The results were included as "weight of evidence" in the 8-hour ozone SIP and submitted to the EPA region in June 2007.

CT 8 hour ozone SIP, see page 31:
http://www.ct.gov/dep/lib/dep/air/regulations/proposed_and_reports/section_8.pdf (html page with above link: http://www.ct.gov/dep/cwp/view.asp?a=2684&q=385886&depNav_GID=1619)

SECTION J.2: STATES THAT ARE CONSIDERING INCORPORATING EE/RE PROGRAMS AND POLICIES IN THEIR SIPS FOR THE REVISED OZONE NAAQS

There are several states now exploring opportunities for incorporating EE/RE into their forthcoming ozone SIPs. Three of these states are featured in this appendix:

- Connecticut
- New Mexico
- Maryland

The three states are at the early stages of the SIP process and their efforts have involved (or will need to involve) at least three activities that include:

- Initiating collaboration with key state entities responsible for air and energy decisions
- Understanding and identifying EE/RE policies and programs to be included in the SIP, as well as estimating the magnitude of potential air emissions benefits
- Understanding pathways available for incorporating EE/RE programs and policies into SIPs

State Of Connecticut

Connecticut's experience is used in this section to illustrate one state's approach to addressing these steps. Background information is provided in Attachment A on the state's EE/RE policies and programs. Other states can use this experience to inform their own efforts to incorporate EE/RE into SIPs.

Background

On January 6, 2010, EPA proposed a rule to strengthen the primary and secondary NAAQS for ground level ozone. This effort proposed a tightening of the ozone NAAQS down to a level within the range of 60 – 70 parts per billion (ppb). Such a standard would require additional stringent control measures on ozone precursor emissions of VOC and NOx.

Since EPA issued the first ozone NAAQS in the 1970s, Connecticut has developed and implemented many VOC and NOx air pollution control strategies applicable to both stationary and mobile sources in order to protect the public health of its citizens. During this time, Connecticut implemented the most cost effective emission control programs. As EPA continues to strengthen the ozone NAAQS, it becomes more challenging to identify and implement highly cost effective emission control strategies. In light of this challenge, early in 2010 the Connecticut Department of Environmental Protection (DEP) expressed an interest to EPA New England in exploring the use of emission reductions associated with the state's EE and RE programs in the state's air quality planning documents, such as the State Implementation Plan (SIP) for air quality, in the same manner as emission reductions from more traditional air pollution control regulations might be used. As noted earlier in this document, Connecticut cited emission reductions from these programs within its WOE submittal made within its attainment demonstration for EPA's 1997 8-hour ozone standard. Given the demonstrated ability of EE and RE programs towards meeting air quality goals, DEP intends to rely more heavily on the benefits of these programs in future attainment demonstrations, such that the impact from the state's EE/RE programs will be directly factored into the future year modeling effort. DEP is also considering the incorporation of some EE/RE components into the SIP as control measures.

Initiate Collaboration Among Key State Entities Responsible For Air And Energy Decisions

To help ensure that the appropriate state entities are involved in joint air and energy decisions, Connecticut has taken concrete actions to foster collaboration across agencies. These partnerships assist in addressing the complex policy and analytic questions that cut across traditional agency responsibilities for improving air quality and expanding the use of clean energy. Examples of such questions include: how to identify the appropriate SIP pathway, what method to use to estimate the energy impacts from EE/RE, and how to quantify the resulting air quality improvement.

Over the past several years, the DEP has established formal lines of communication with the Connecticut Department of Public Utility Control (DPUC). For example, the DEP is a member of the state's Energy Conservation Management Board (ECMB), the Clean Energy Fund, and the Connecticut Energy Advisory Board. These ties are important, because the DPUC is primarily responsible for oversight of Connecticut's EE and RE programs, including implementation, monitoring and enforcement. Each of these programs is discussed separately below. In addition, the state continues to engage with USEPA on the key state-federal issues that will arise if Connecticut formally moves ahead to incorporate EE/RE into its SIP.

Understand And Identify EE/RE Policies And Programs To Be Included In The SIP

Connecticut has several existing laws requiring electric utilities to meet minimum percentages of the state's energy needs with zero-emissions energy efficiency and renewable energy. On the renewable energy side, a "renewable portfolio standard" (RPS) policy requires that electricity distribution companies (Connecticut Light and Power Company and United Illuminating Company) obtain a minimum percentage of their retail load from renewable energy. The policy became law in 2005 with a minimum requirement of 4.5% in that year, increasing to 27% of the state's retail electricity load by 2020. To ensure compliance, CTDPUC conducts evaluations compliance of the RPS each year through an administrative docket process. It imposes fines or other corrective actions if compliance is not shown.

On the efficiency side, Connecticut has over twenty years of experience with EE programs. The Connecticut Energy Efficiency Fund (CEEF) is capitalized by a surcharge of $0.003 per kilowatt-hour (3 mills per kWh) on utility customers' electric bills. Each of the two utilities administers and implements efficiency programs with monies from its ratepayer fund, in accordance with a comprehensive plan approved by the Connecticut Department of Public Utility Control (DPUC). Additional sources of funding for the CEEF in 2009 included the Regional Greenhouse Gas Initiative (RGGI), the Forward Capacity Market (FCM), Class III Renewable Credits, and the American Recovery and Reinvestment Act (ARRA).

The two utilities are authorized to implement the following types of energy efficiency programs:

- Conservation and load-management programs, including programs that benefit low-income individuals
- Research, development, and commercialization of products or processes that are more energy-efficient than those generally available

- Development of markets for such products and processes
- Support for energy-use assessment, real-time monitoring systems, engineering studies and services related to new construction or major building renovation
- Indoor air-quality programs relating to energy conservation
- Joint fuel-conservation initiatives programs targeted at reducing consumption of more than one fuel resource
- Public education regarding conservation.

To ensure that savings impacts are "real," the CTDPUC conducts an annual review and evaluation of the EE programs implemented by the state's electricity suppliers. Connecticut agencies are currently in the process of determining which of the above activities are suitable for incorporation into the SIP. Connecticut is also reviewing its options for quantifying the emission reduction impact from these measures.

Understand Pathways Available For Incorporating EE/RE Programs And Policies Into SIPs

Connecticut's past experience using clean energy in an air-planning context (via its attainment demonstration for EPA's 1997 8-hour ozone standard) provides a head start in defining and addressing important analytic and policy challenges. To address current air quality challenges, CTDEP and its partners are now working to identify the state's options for:

- Including EE/RE policies and programs in future attainment demonstrations
- Factoring the impact of EE/RE programs directly into future year modeling efforts
- Adopting EE/RE in the SIP as a control measure.

As the state proceeds, examples of key issues that the State of Connecticut will need to address should it pursue the control strategy pathway are included in the USEPA, Region 1 letter to the state (Attachment B). These issues include what energy-impacts data to use, how to gauge the impact that EE programs have during high electricity demand days (days typically correlated with high ozone episodes), and how to calculate air quality impacts at the appropriate level of detail. This letter outlines the state's strategy moving forward and raises several outstanding questions for the state to answer. While uncertainties remain, Connecticut's letter can be used to inform the work of other states and jurisdictions interested in taking a similar approach.

State Of New Mexico

The State of New Mexico Department of the Environment and the City of Albuquerque have expressed an early interest in possibly incorporating New Mexico's EE/RE policies and programs into a potential, future SIP for the forthcoming, revised ozone NAAQS. Currently, there are no ozone nonattainment areas in New Mexico and it is uncertain whether the state will have any under the revised ozone NAAQS. Depending on ozone area designations and the level of the standard, the state could possibly have three to seven new nonattainment areas.

Background

The USEPA has held preliminary meetings with the state to help EPA and state air staff and managers both better understand and identify New Mexico's EE/RE policies and programs and estimate the magnitude of potential air emissions benefits from those policies and programs. The state and EPA have also discussed the need for interaction between state air staff and state energy officials. The USEPA has also explored with the state the pathways available for incorporating EE/RE programs and policies and programs into SIPs.

Initiate Collaboration Among Key State Entities Responsible For Air And Energy Decisions

New Mexico is a state with a very predominant urban area (Albuquerque-Bernalillo County), with which cooperation is very important. Especially since, for New Mexico the home-rule status of the City of Albuquerque-Bernalillo County is responsible for its own SIP revision. The State and Albuquerque-Bernalillo may choose to act together in any ozone SIP technical analyses, so that the entire State can be analyzed as one for purposes of electric sector EE/RE policies and programs. With Albuquerque-Bernalillo constituting such a large percentage of the State's total population, this cooperative treatment might benefit both entities.

Understand And Identify EE/RE Policies And Programs To Be Included In The SIP

The state of New Mexico has three primary EE/RE policies:

- The Renewable Energy Act requires investor-owned electric utilities to produce or buy increasing amounts of renewable energy, starting at 5 percent by 2011 and increasing to 20 percent by 2020.
- The Efficient Use of Energy Act requires that public utilities, distribution cooperative utilities and municipal utilities include cost-effective energy efficiency and load management investments in their energy resource portfolios. In 2008, the statute was amended to include a State Energy Efficiency Resource Standard (EERS) in which public utilities must acquire all cost-effective and achievable energy efficiency and load management resources available in their service territories.
- The Energy Efficiency and Renewable Energy Bond Act authorizes up to $20 million in bonds to finance energy efficiency and renewable energy improvements in state government and school buildings.

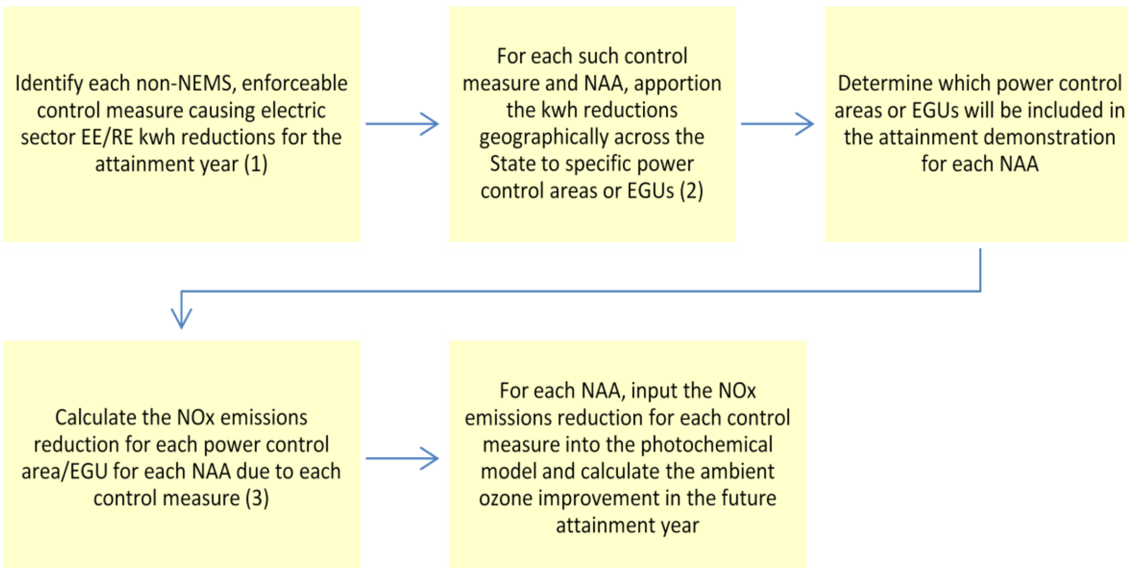
Attachment C provides more detail on New Mexico's EE/RE policies.

Understand Pathways Available For Incorporating EE/RE Programs And Policies Into SIPs

With respect to potential EE/RE SIP demonstrations for a State such as New Mexico, it is unclear what the State and Albuquerque will choose to do with regard to electric sector EE/RE policies and programs in an ozone SIP revision.

Below are two control measure examples that could apply to a state like New Mexico. It should be noted that no New Mexico counties are currently designated ozone nonattainment, so these examples are provided for illustrative purposes only.
The first example is a general control measure approach. Figure J.1 conceptually illustrates the steps that would apply generically, while Table J.1 provides an example for Albuquerque-Bernalillo.

Figure J.1: Steps for New Mexico Analysis



(1) A total kwh estimate is first made for each measure. The State and City may choose to calculate a seasonal ozone day kwh reduction. Note that these EE/REe measures can occur in a different geographic area of the State but still decrease emissions from EGUs in the nonattainment area.
(2) EPA can provide guidance on suggested techniques, which may be based on electricity dispatch models.
(3) For each control measure, individual power control area or EGU NOx emission factors would be multiplied by the kwh reduced at each power control area (PCA)/EGU.

The second example in Table J.1 illustrates a more specific, hypothetical accounting of EE/RE NOx reductions for Albuquerque-Bernalillo County alone. In this example, four separate EE/RE measures are quantified to determine their impacts on reducing NOx emissions in the state and ultimately ambient ozone in the nonattainment area. Some of these measures are ones adopted by New Mexico and highlighted in Attachment C to this appendix. Not all of these NOx emissions reductions would occur within Albuquerque-Bernalillo County. Also note in this example it is assumed that seven EGUs are impacted by these various measures, but NOx emissions from only EGUs 1-5 are determined to impact ozone levels in Albuquerque-Bernalillo.

Table J.1: Hypothetical Example for Albuquerque-Bernalillo

EE/RE Measure (1)	Resulting Electricity Reductions	NOx Reduction at PCA/EGU (2) (tons/ozone season day)
LED retrofits for traffic lights (in NAA)	1 million kwh	EGU 1: 0.1, EGU 2: 0.2, EGU 3: 0.05
State Renewable Energy Tax Credit (Corporate) (in NAA)	2 million kwh	EGU 1: 0.2, EGU 2: 0.05, EGU 3: 0.2, EGU 4: 0.3
Building Tax Credit (in NAA)	1 million kwh	EGU 2: 0.05, EGU 4: 0.25
State Renewable Energy Production Tax Credit (Corporate) in County A (outside NAA)	10 million kwh	EGU 4:2.0, EGU 5:1.0, EGU 6: 2.0, EGU 7:1.5

(1) In concert with the State, EE/RE control measures can include not only those that actually occur in Albuquerque-Bernalillo but also those that occur in outlying areas but that cause a reduction in emissions from EGUs that impact Albuquerque-Bernalillo
(2) In this example only EGUs 1-5 affect ozone concentrations in the Albuquerque-Bernalillo NAA. Therefore, emissions reductions from only EGUs 1-5 would be input into the photochemical model to assess the ambient ozone reductions due to the electric sector EE/RE measures.

State Of Maryland

Background

Under a revised, more stringent ozone standard, almost all of Maryland will likely measure air quality that results in being designated nonattainment, which will pose challenges as the state seeks additional reductions in ozone precursors. In addition, Maryland also recently adopted legislation that requires the state to develop a climate action plan to reduce greenhouse gas emissions 25 percent by the year 2020. Coordinated multi-pollutant planning and the implementation of synergistic strategies will be necessary to successfully meet these two challenges. .

Understand And Identify EE/RE Policies And Programs To Be Included In The SIP

Maryland currently has several pieces of legislation intended to provide a substantial start toward these goals (see Attachment B for a greater description):

- The Healthy Air Act which required coal-fired power plants in Maryland to reduce NOx by 75%, SO2 by 85%, and mercury by 90%, and
- Participation in the Regional Greenhouse Gas Initiative to reduce CO2 emissions.
- The EmPOWER Maryland Energy Efficiency Act of 2008 is designed to reduce per capita electricity use by Maryland consumers by 15 percent in 2015.
- The accelerated RPS standard 20% of electricity from renewable resources by 2022.

Understand Pathways Available For Incorporating EE/RE Programs And Policies Into SIPs

Maryland anticipates that a significant weight of evidence demonstration will be necessary in the next round of ozone SIPs to supplement conventional photochemical modeling. At this time, Maryland believes that emission reductions for energy efficiency may be a key element needed to show attainment.

To separate the emission reductions that should be attributed to energy efficiency policies/programs compared to programs that control emissions through specific caps, Maryland has contracted with NESCAUM to run an integrated framework of models. The NE-MARKAL (New England MARKet ALlocation model), initiative, which began through a collaboration between NESCAUM and the U.S. EPA Office of Research and Development in 2003, has resulted in the development of a least-cost optimized linear programming (LP) model which is tailored specifically to the energy infrastructure of several Northeast states.[86] NE-MARKAL is a data-rich analytical framework for examining energy policy options and their resultant impact on energy services in the region. The model serves as the centerpiece of the integrated policy analysis framework developed at NESCAUM which aids in developing a comprehensive understanding of technology, economic, environmental and public health consequences of air quality protection initiatives.

How the NE-MARKAL model works:

- The NE-MARKAL model can accept Maryland-specific inputs for spending on planned energy efficiency programs and combine them with the mandated caps for NOx, SO2, mercury and CO2 and the Maryland clean car program.
- Emissions outputs from NE-MARKAL can then be inputted into the Community Multiscale Air Quality (CMAQ) model to estimate the NOx air quality benefits from the caps as well as from the energy efficiency programs and displaced fossil fuel use due to the RPS standards.
- Financial outputs from NE-MARKAL can be imported into the Regional Economic Models, Inc (REMI) model to estimate economic benefits from these programs such as gross state product, jobs and disposable income.
- Finally, the outputs can be input into the Benefits Mapping and Analysis Program (BENMAP) model to estimate health benefits from all the programs (see Figure I.1).

The results of combined strategy runs from the economic energy model NE-MARKAL and CMAQ can be compared to results obtained from conventional strategy runs of CMAQ alone to assess the benefits of adding energy efficiency benefits versus the benefits estimated for the implementation of caps alone.

Working with NESCAUM, Maryland has completed Phase I which including:

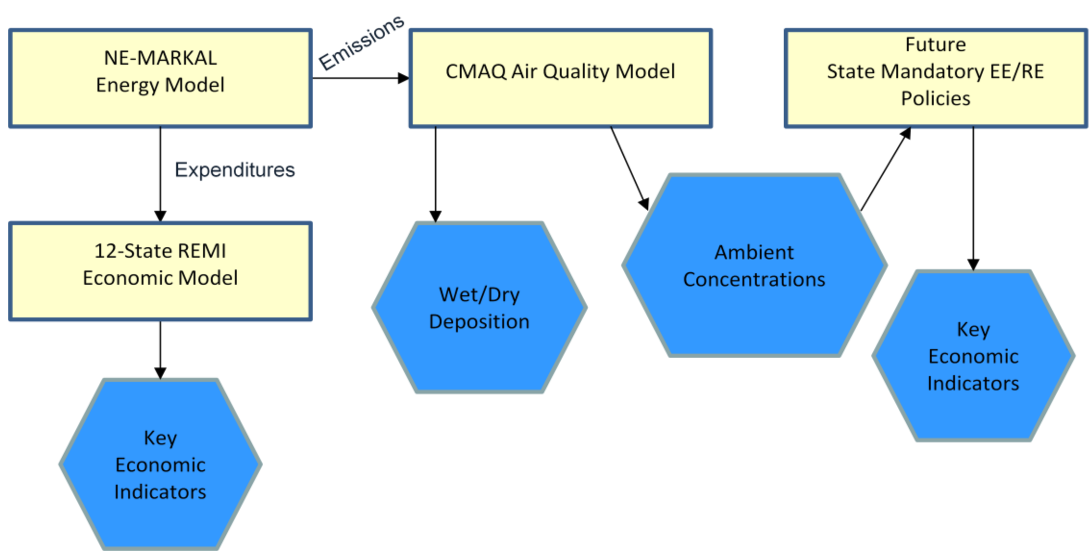
[86] http://www.nescaum.org/topics/ne-markal-model

- A Maryland specific calibration of the NE-MARKAL model
- An independent assessment for the impacts of RGGI and Maryland Clean Cars

This type of scenario analysis serves to identify the magnitude of climate, air quality and energy impacts relative to the other strategies under examination.

In Phase II, Maryland proposes to identify interactions between the strategies that may lead to climate, air quality and energy outcomes that differ from an analysis that examines only one strategy at a time.

Figure J.2: Key Pieces of NESCAUM Multi-Pollutant Framework



SECTION J.3: OPPORTUNITIES TO REDUCE ELECTRICITY CONSUMPTION AND NOX EMISSIONS FROM EPA'S STORM WATER RULES

EPA's Office of Water (OW) is proposing new storm water mitigation regulations in late 2011. After OW takes public comments, they plan to finalize these regulations in 2012. Compliance measures for these new regulations are expected to rely heavily on best practices for "green infrastructure," a series of actions and technologies that encourage natural processes to accommodate and minimize storm water runoff. (See examples below) These kinds of measures can directly result in reducing electricity consumption and NOx emissions in the following ways:

- Reduce municipal electricity demand due to less frequent pumping, (easiest to quantify and attribute to NOx emission reductions);
- Obviating construction of conventional, artificial storm water channeling, processing, and controlled discharge systems;

- Reduction in electricity demand for cooling in buildings near green infrastructure-implementation areas; and
- Reduction in photochemical generation potential due to cooling of urban core.

A recent report for the Philadelphia metropolitan area is an excellent resource that can help locals and states interested in pursuing NOx SIP reductions in this way.[87]

EPA stands ready to work with any interested state or local agency in investigating the potential for NOx reductions due to storm water compliance activities.

Green Infrastructure Measure Examples

- Increasing vegetated surfaces in developed areas,
- Swales,
- Water gardens,
- Holding ponds,
- Permeable pavements,

[87] "A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia Watersheds, Stratus Consulting," http://www.michigan.gov/documents/dnr/TBL.AssessmentGreenVsTraditionalStormwaterMgt_293337_7.pdf , 2009.

ATTACHMENT A: STATE OF CONNECTICUT EE/RE POLICIES AND PROGRAMS

RE Policies and Programs

Connecticut's renewable portfolio standard (RPS) is a mandatory program implemented pursuant to state legislation. The RPS program began in 1998 as part of the electric deregulation initiative, and requires that electricity suppliers obtain a minimum percentage of their retail load from renewable sources. The minimum percent requirement was 4.5 % in 2005, and it increases each year until 2020, at which point 27% of the state's retail electricity load must come from renewables sources. CTDPUC evaluates each electricity supplier's compliance with the RPS requirement each year through an administrative docket process, and imposes fines or other corrective actions if compliance is not shown. To date, Connecticut's electricity suppliers have been able to meet their obligations every year but one, and the DPUC imposed substantial monetary fines for each MWh shortfall in meeting the required RPS. Under CT's RPS program, there is a requirement for a quarterly truing up and an annual report. The CT DPUC requires EDCs to look back to see if the RPS minimum percentage requirement was met. If it has not been met, then the DPUC requires the LDC to pay a fee or essentially a fine. In 2006, 15 companies distributed or supplied electricity to CT customers. Eight of the 15 entities did not "serve" any load in that year. Of the seven companies that did, four met the Class I percentage requirement, while three did not. As a consequence, the three companies paid fees totaling $3.5 million.

Given the established track record and the enforcement of the program at the state level, Connecticut is exploring ways to rely on the emission reductions from its RPS program in the next SIP necessary to meet EPA's reconsidered ozone standard, which is expected to be announced in July, 2011. Utilizing RPS in air quality plans is complicated by the fact that electricity suppliers may demonstrate compliance with the RPS through the purchase of renewable energy credits (RECs) from out of state renewable energy generators, whereas the federal Clean Air Act requires that reductions relied on for RFP or attainment must come from within the nonattainment area. Connecticut intends to work with the region's Independent System Operator, the ISO-New England, to analyze which electric generating units (EGUs) are likely to ramp down as more "must-take" renewable energy resources are made available. A key aspect of this analysis will be predicting the location of future renewable energy resources in New England, and identifying the fossil-fuel fired units that either shut-down or operate less due to the increased electricity produced from renewable resources.

Under CT's RPS program the renewable power generally can come from the New England or NY power pools, although the statutory region includes New England states, NY, PA, NJ, MD, DE. All of these states have RPS programs except VT.

EE Policies and Programs

Connecticut has over twenty years of experience with EE programs. Even before the restructuring of the electric power industry that occurred in 1998, electric utilities in Fairfield County used EE programs to supplement energy generation and to help mitigate transmission constraints. These early successes were then developed into statewide programs when, in 1998, the state's legislature established the Connecticut Energy Efficiency Fund and created the ECMB. These programs are funded primarily by ratepayers but are supplemented with funds from other sources such as proceeds from the auction of allowances in the Regional Greenhouse Gas Initiative program. The CEEF is funded by a surcharge of $0.003 per kilowatt-hour (3 mills per kWh) on Connecticut Light and Power (CL&P) and United Illuminating (UI) customers' electric bills. Each of the two utilities administers and implements efficiency programs with monies from its ratepayer fund, in accordance with a comprehensive plan approved by the Connecticut Department of Public Utility Control (DPUC). The utilities develop their plans with advice and assistance from the state's Energy Conservation Management Board (ECMB). Additional sources of funding for the CEEF in 2009 included the Regional Greenhouse Gas Initiative (RGGI), the Forward Capacity Market (FCM), Class III Renewable Credits, and the American Recovery and Reinvestment Act (ARRA).

As with the state's RPS program, the DPUC conducts an annual review and evaluation of the EE programs implemented by the state's electricity suppliers. Connecticut is evaluating whether some of these programs may be suitable for incorporating into its SIP. Connecticut is also reviewing options for quantifying the emission reduction impact from these measures. With regard to quantification, the state may use as a starting point the somewhat conservative estimate of energy savings bid into and accepted by the ISO-New England's Forward Capacity Market. Additionally, the state is exploring how to gauge the impact that its EE programs have during high electricity demand days, as these days typically correlate well with high ozone episodes. Energy Efficiency Policy Connecticut's original electric-industry restructuring legislation (Public Act 98-28) was enacted in April 1998 and created the Connecticut Energy Efficiency Fund (CEEF). The mission of the CEEF is to advance the efficient use of energy, to reduce air pollution and negative environmental impacts, and to promote economic development and energy security.

How Does Connecticut Quantify Energy (kWh) Savings from Energy Efficiency?

Average Program Example

Take EE Measure	Define Method	Add and Subtract Secondary Benefits	Determine Confidence of Installation	Determine % of Time Units are Operating	Determine Coincidence with Peak (Summer and Winter)	Savings (kWh)
C&I Standard Lighting	Replaced lighting (kW_{old}-kW_{new}) + Occupancy Sensors 0.3[1] x ∑(# lights on sensor x wattage/light)	+ Un-needed Additional Cooling - Additional Heating Needed	41.67%[2]	∑(Hours of Operation per Operating Unit)	A) Occupancy Coincidence Factor. -Winter=0.13* -Summer=0.15* B) Lighting Coincidence Factor. -Winter=0.55* -Summer=0.70*	

[1] D. Maniccia B. Von Neida, and A. Tweed. An analysis of the energy and cost savings potential of occupancy sensors for commercial lighting systems Illuminating Engineering Society of North America 2000 Annual Conference: Proceedings. IESNA: New York, NY. Pp. 433-459

[2] R.A. Rundquist et al., Calculating Lighting and HVAC Interactions. *ASHRAE Journal*, November 1993

* Average winter coincidence factor of each sector calculated by the above

kWh Savings =>Emissions Averted

Define Method	SO_x	NO_x	CO_2
Emissions saved= (ISO Emissions Factor) x (2008 MWh-2009MWh)	X 1.51lbs/MWh =	X 0.52lbs/MWh=	X 890lbs/MWh =

Emissions Factors are from New England Averages of the ISO New England 2008 New England Electric Generator Air Emissions Report.

Connecticut Values from the above report are: SO_x= 0.42lbs/MWh; NO_x=0.47lbs/MWh; CO_2=740lbs/MWh

Letter from USEPA Region 1 to State of Connecticut

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MA 02109-3912

September 30, 2010

Anne Gobin, Chief
Bureau of Air Management
Connecticut Dept. of Environmental Protection
79 Elm Street
Hartford, Connecticut 06106-5127

Dear Ms. Gobin:

As you know, on January 6, 2010 EPA proposed to tighten the national ambient air quality standard (NAAQS) for ground level ozone. This letter is intended to convey to you our preliminary suggestions for how Connecticut could pursue expanded emission reduction credit from your state's energy efficiency and renewable energy programs within the SIP Connecticut will need to develop to meet this forthcoming standard.

Members of our respective staffs have met a number of times over the past several months to discuss the various aspects of Connecticut's energy efficiency (EE) and renewable energy (RE) legislation, and the merits of incorporating these programs into your SIP. Through these discussions, it has become clear that establishing linkages between Connecticut's EE/RE programs and your state's more established criteria pollutant air quality management planning process is desirable, appropriate and technically feasible. Therefore, we are providing you with our preliminary recommendations for the technical support materials we think should be assembled to document emission reductions from the fossil fuel fired electrical generating units in Connecticut due to implementation of these programs. Although the focus of our discussions has been on NOx emission reductions from EGUs and ozone SIPs, we believe this methodology can be used to determine emission reductions from other pollutants for SIPs as well.

In addition to our collaborative effort with Connecticut, you should also be aware that a larger effort is underway within EPA nationally to provide clarifying guidance on the incorporation of EE/RE measures in SIPs. As that develops, we will provide additional feedback as necessary.

In 2004, EPA published the following two documents that contain guidance for states seeking to incorporate emission reductions from EE/RE programs into their SIPs:

- "Guidance on SIP Credits from Emission Reductions from Electric-Sector Energy Efficiency and Renewable Energy Measures," and
- "Incorporating Emerging and Voluntary Measures in a SIP."

Pursuant to this guidance, energy efficiency and renewable energy programs were generally considered emerging measures. The guidance stated that, "Voluntary and emerging measures are limited to 6 percent of the total amount of emission reductions required for the rate-of-progress, reasonable further progress, attainment, or maintenance demonstration purposes." However, measures that can be shown to meet the federal Clean Air Act's requirements for approvable SIP measures are not subject to this limitation. Given Connecticut's considerable track record in implementing its legislatively mandated EE and RE programs, we believe that your state can pursue SIP credit from these programs as traditional measures such that they would not be subject to the 6 percent limitation. The Enclosure offers suggestions for how to document the emission reductions from these programs.

The incorporation of expanded emission reduction credit from Connecticut's energy efficiency and renewable energy programs represents a new and important aspect of your state's overall air quality management program, and we look forward to continuing to work with your staff to bring this to fruition. It is clear that the formal lines of communication that your agency has forged with your state's Department of Public Utility Control have been beneficial to Connecticut in this endeavor, and we encourage you to maintain this relationship in the future.

Please thank Rick Rodrigue, Paul Bodner, and Paul Farrell of you staff for the considerable amount of time, energy, and leadership that they are providing to meet this objective.

Sincerely,

David B. Conroy, Chief
Air Programs Branch

cc: Rick Rodrigue, CT-DEP
Paul Bodner, CT-DEP
Paul Farrell, CT-DEP

ENCLOSURE

Energy Efficiency (EE) and Renewable Energy (RE) in Connecticut's Ozone State Implementation Plan (SIP)

In order to meet federal Clean Air Act (CAA) requirements, emission control measures must be shown to be quantifiable, surplus, enforceable, and permanent. Each of these criteria are discussed below along with our suggestions for the information that Connecticut could gather to illustrate how its EE and RE programs meet these criteria.

Quantifiable: Pollution control measures submitted for inclusion within a SIP must be quantifiable and amenable to verification over time so that the level of emission reduction claimed can be tracked to see if it has actually been achieved.

Quantification of RE measures: Section 16-245(a) of the Connecticut General Statutes established a renewable portfolio standard mandate that requires electricity suppliers providing services to the state ensure that a portion of the electricity they make available is generated by renewable resources. The portion of electricity that must come from renewable resources is 14% for 2010, and this percent requirement increases each year through 2020. Connecticut's legislation also requires a quarterly truing up and an annual report that compels EGUs to confirm whether or not the RPS minimum percentage requirement was met.

The Connecticut Department of Public Utility Control (DPUC), in implementing this legislation, allows the renewable energy used to meet Connecticut's RPS requirements to come from within the state, within the ISO-New England control area, or from an adjacent power control area. This large geographic area from which Connecticut's electricity suppliers may seek renewable energy resources complicates the analysis of the NOx emissions that are avoided due to fossil fuel fired electrical generating units (EGUs) running less as renewable suppliers become available. However, we believe sufficient data exist that will allow Connecticut to gauge the impact of its RPS legislation on NOx emissions from the production of electricity in the area.

One method Connecticut could explore is analysis of the location and NOx emitting characteristics of the fossil fuel fired EGUs that have been able to reduce their output as renewable energy resources were made available on past days. The output based NOx emission rates for these units (e.g., units of lbs. NOx per megawatt-hour) can then be multiplied by the actual number of megawatt-hours of renewable electricity procured by the state's electricity suppliers. This method can provide an approximation of the NOx emissions avoided as a result of Connecticut's RPS program. Given the interconnectedness of the region's electricity grid, and the existence of RPS programs in neighboring states, it may be advantageous for Connecticut to approach ISO-New England, the regional transmission organization (RTO) that oversees operation of New England's electric power system, for assistance in performing this analysis.

A second quantification approach could entail review of dispatch modeling prepared by other entities such as ISO-New England, or if resources allow dispatch modeling tailored to this specific project, to provide an indication of how the dispatch of EGUs in the future will be affected by implementation of Connecticut's RPS program.

Quantification of EE measures: Over the past several years much work has been performed in the area of measurement and verification of the impact that energy efficiency programs have on electricity demand, and linkage of these savings to reductions in air pollutant emissions. For example, Connecticut's energy efficiency program requires documentation of estimated energy savings from the state's ratepayer funded EE program before and after energy efficiency programs are implemented.

More recently, ISO-New England took the significant step of allowing electricity savings from energy efficiency, distributed generation, load management, and load response to be bid into its forward capacity market (FCM). Market participants earn payments for the qualifying resources successfully bid into the market. The inclusion of energy efficiency in the FCM, which includes payments made by ISO-New England for the electricity savings represented by these measures, provides additional evidence that the calculated EE savings are real and also provides an additional accountability mechanism to ensure that they occur. We suggest that Connecticut DEP explore use of the amount of electricity savings bid in to the FCM by the state's electricity suppliers as a starting point in determining the amount of NOx emissions avoided from the state's EE programs. This could be supplemented with other readily available approximations of the electricity savings from energy efficiency measures such as those documented in the ISO-New England Regional System Plan, or in Connecticut's Integrated Resource Plan. As a side note, we also encourage Connecticut DEP to monitor the distributed generation resources in the state to ensure that these resources' participation in this market have a positive impact on air quality.

In addition to the above, an understanding of how the regional photochemical urban airshed modeling that will be used to support Connecticut's SIP treats state RPS standards is imperative to avoid double counting the impact of these measures on future year emissions from the EGU sector. EPA headquarters is currently looking into technical analyses it may be able to perform that will help shed light on this issue. EPA and CT-DEP should continue to work collaboratively on this effort as EPA's analysis is developed and refined.

Surplus: Emission reductions are considered surplus as long as they aren't otherwise used to meet attainment requirements in the SIP. Accordingly, Connecticut should ensure that it has a good understanding of the assumptions made in the electricity sector future year baseline modeling done to support its next ozone SIP. One manner of accounting for the NOx emission reductions from Connecticut's energy efficiency and renewable portfolio standards programs would be to ensure that the future baseline assumptions for the electricity sector in the state's modeled attainment demonstration accurately reflect the impact of the state's programs. Alternatively, Connecticut could take steps to ensure that the future year baseline modeling does not incorporate the impact from its EE/RE programs, and then determine their impact separately akin to how traditional control measure reductions are determined.

EPA recently proposed a rule to address air pollution transported from one state to another in the Eastern U.S. The proposed rule includes annual and ozone season NOx budgets for Connecticut. If this rule is finalized as it was proposed, NOx emissions from EGUs in Connecticut will be subject to emissions caps and will be allocated allowances to use as a means of demonstrating compliance with their obligations under the rule developed to implement this program. Connecticut should ensure that emission reductions which accrue from the implementation of its energy efficiency programs do not simply result in the freeing up of allowances that EGUs in the state can use or sell to other entities in need of allowances to cover their air emitting activity. One method for accomplishing that would be for the state to set aside allowances for EE/RE and then retire them as these measures come to fruition, but there may be other viable approaches that address this concern.

Enforceable: Emission reductions used to meet SIP RFP or attainment needs must be enforceable against a source, and the state and EPA must have the ability to apply penalties if deemed appropriated. Additionally, citizens must have access to the emissions related information obtained from the sources, and must be able to file suits against the source for violations.

In Connecticut's case, the state's renewable portfolio standards and energy efficiency programs are mandatory programs created by specific state legislation that is primarily implemented by the state's Department of Public Utility Control (DPUC). As we have discussed over the past several months, submittal of these programs for incorporation into the Connecticut State Implementation plan (SIP) will enable these programs to also become federally enforceable. This federal enforceability is key to EPA being able to provide expanded SIP credit for these programs. In the coming months, we envision that Connecticut DEP and EPA staff will be able to work out the details of the specific legislation and/or rules that should be submitted to EPA, as well as the development of any formal agreements between CT-DEP and CT-DPUC regarding overview and enforcement of these programs.

Permanent: The emission reductions expected from the state's EE/RE programs should continue through the term for which the credit is granted unless replaced by another measure, or the state demonstrates through a SIP revision that the measure is no longer necessary. With regard to Connecticut's renewable portfolio standards program, given that the state has adopted legislation for this program and has an established track record of oversight and enforcement for it, we believe the "permanent" criterion could be addressed by the state committing in the SIP to continued implementation of the program.

With regard to Connecticut's energy efficiency programs, the permanence of some programs, such as purchase programs for energy efficient equipment and products, would need to be addressed in that there is no guarantee that the purchased equipment/products, take steps to ensure that the future year baseline modeling does not incorporate the impact from its EE/RE programs, and then determine their impact separately akin to how traditional control measure reductions are determined.

EPA recently proposed a rule to address air pollution transported from one state to another in the Eastern U.S. The proposed rule includes annual and ozone season NOx budgets for Connecticut. If this rule is finalized as it was proposed, NOx emissions from EGUs in Connecticut will be subject to emissions caps and will be allocated allowances to use as a means of demonstrating compliance with their obligations under the rule developed to implement this program. Connecticut should ensure that emission reductions which accrue from the implementation of its energy efficiency programs do not simply result in the freeing up of allowances that EGUs in the state can use or sell to other entities in need of allowances to cover their air emitting activity. One method for accomplishing that would be for the state to set aside allowances for EE/RE and then retire them as these measures come to fruition, but there may be other viable approaches that address this concern.

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In Connecticut's case, the state's renewable portfolio standards and energy efficiency programs are mandatory programs created by specific state legislation that is primarily implemented by the state's Department of Public Utility Control (DPUC). As we have discussed over the past several months, submittal of these programs for incorporation into the Connecticut State Implementation plan (SIP) will enable these programs to also become federally enforceable. This federal enforceability is key to EPA being able to provide expanded SIP credit for these programs. In the coming months, we envision that Connecticut DEP and EPA staff will be able to work out the details of the specific legislation and/or rules that should be submitted to EPA, as well as the development of any formal agreements between CT-DEP and CT-DPUC regarding overview and enforcement of these programs.

Permanent: The emission reductions expected from the state's EE/RE programs should continue through the term for which the credit is granted unless replaced by another measure, or the state demonstrates through a SIP revision that the measure is no longer necessary. With regard to Connecticut's renewable portfolio standards program, given that the state has adopted legislation for this program and has an established track record of oversight and enforcement for it, we believe the "permanent" criterion could be addressed by the state committing in the SIP to continued implementation of the program.

With regard to Connecticut's energy efficiency programs, the permanence of some programs, such as purchase programs for energy efficient equipment and products, would need to be addressed in that there is no guarantee that the purchased equipment/products, would be replaced at the end of their useful lives with comparably efficient equipment. However, we believe the permanence of energy efficiency measures can be adequately demonstrated and will continue to work with staff from Connecticut DEP to address it. For example, from a broad perspective it seems reasonable to conclude that as technological innovations in this industry continue, future equipment replacements will likely take the form of comparable or improved equipment from an EE perspective. Additionally, Connecticut's ten plus years of experience with funding and implementation of its EE programs coupled with a SIP commitment to continue doing so should help address the permanence criterion.

ATTACHMENT B: STATE OF MARYLAND EE/RE POLICIES AND PROGRAMS

EmPower Maryland

EmPOWER Maryland, enacted in 2007, requires utilities and the MEA to reduce per capita peak demand and per capita electricity consumption in the state 15% by 2015. The utilities are in the process of implementing residential, commercial, and industrial sector programs to achieve the goal, and the MEA is implementing complementary programs, including:

- EmPOWER Maryland State Agency Loan Program (SALP): a loan program for state agencies to expand the use of energy performance contracts to make state buildings more efficient;
- EmPOWER Maryland Empowering Finance Initiative: a loan program targeted at helping residential consumers afford clean energy improvements
- EmPOWER Maryland Appliance and Lighting Rebate Programs: rebate programs to incentivize the purchase of energy efficient appliances and light bulbs
- EmPOWER Maryland Industrial and Commercial Programs: various programs targeting the industrial and commercial sector, including a loan program to help finance the cost of energy efficiency projects in commercial and industrial facilities and a program to provide Maryland industries access to informational resources, workshops, technical support and energy assessment opportunities
- EmPOWER Maryland Residential Initiatives: various programs, including a grant program in coordination with DHCD to conduct energy efficiency retrofits in apartment units to reduce energy bills for low and moderate income families

These EmPOWER Maryland programs incorporate several of the other policies recommended in the Maryland Climate Action Plan, including:

- RCI-2: Demand-Side Management Energy Efficiency Programs (captured by the utilities' peak demand programs)
- RCI-3: Low Cost Loans for Energy Efficiency (captured by EmPower Maryland SALP, EmPowering Finance and Industrial and Commercial Programs, described above)
- RCI-7: More Stringent Appliance/Equipment Efficiency Standards (captured by the EmPOWER Maryland Program Appliance and Lighting Rebate Programs, described above. MEA also continues to advocate for legislation for stronger standards.)
- RCI-11: Promotion and Incentives for Energy-Efficient Lighting (captured by the EmPOWER Maryland Program Appliance and Lighting Rebate Programs)

Renewable Portfolio Standards

The goal of Maryland's RPS is for the state to obtain 20% of its electricity from renewable resources by 2022, with intermediate targets of 7.5% by 2011 and 18% by 2020. To help Maryland reach these ambitious targets, MEA has focused on advocating for policies to promote renewable energy and on running programs to stimulate the renewable energy market.

This past year, MEA advocated for legislation, passed by the Maryland General Assembly, to amend the RPS to accelerate the solar RPS requirement in the near term (2011-2017), resulting in more incentives for solar development. MEA also advocated for legislation, passed by the Maryland General Assembly, to reauthorize the Maryland renewable energy production tax credit, offering up to $2.5 million to eligible taxpayers for the production of renewable electricity.

Through its residential renewables grant program, MEA awarded hundreds of grants (ranging from $1,000-10,000) to homeowners and businesses to offset the cost of installing wind, geothermal and solar PV systems. Demand has increased from 200 systems a year to 200 systems a month, even with significantly reduced incentives.

MEA also developed and implemented Project Sunburst, a program offering rebates of up to $1,000 per KW of solar PV capacity installed on public buildings. The program will incentivize the building of about 10 MW of solar in Maryland over the next year, more than doubling current capacity in the state.

In addition, leading by example, MEA and DGS partnered with the University System to launch the Generating Clean Horizons Initiative, which resulted in Power Purchase Agreements with 3 new, utility scale renewable developments (65 MW of onshore wind and 17 MW of thin film solar).

To promote all different types of renewables, MEA has a program manager dedicated to biomass, biofuels and electric vehicles; a program manager dedicated to wind; and two program managers dedicated to solar. These program managers focus on providing support for the development and adoption of their respective technologies.

Finally, MEA administered the renewable energy production tax credit. Over the past three years, more than $5 million in these credits have been claimed.

As demonstrated above, MEA's efforts to help the state reach the RPS goal incorporate several of the other policies recommended in the Maryland Climate Action Plan, including:

- ES-1: Promotion of Renewable Resources
- ES-2: Technology-focused Initiatives for Electricity Supply
- ES-5: Clean Distributed Generation

Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative is a market-based carbon dioxide (CO2) cap and trade program designed to reduce CO2 emissions from fossil fuel-fired power plants. The program will be implemented by the participating states in January 2009. As there are no technological controls available to reduce CO2 emissions, the program provides for the sale of a determined quantity of CO2 allowances. Electric generators will be required to purchase one CO_2 allowance for every ton of CO_2 emitted. The proceeds will be used to fund energy efficiency programs, resulting in reduced CO2 emissions achieved through reduced electrical demand. These regulations will apply to fossil fuel-fired generating units over 25 megawatts.

Regional reduction targets have been agreed upon as a two-phase regional emissions cap:

- 2009 through 2015: Hold regional emissions constant at current levels (about 150 million tons carbon dioxide), with a built-in review of the RGGI program no later than 2015.
- 2015 - 2020: Reduce emissions by 10% below current levels

Maryland Clean Car Program

The Maryland Clean Cars Program required adoption of the California clean car program for implementation beginning in MD in model year 2011. The implementing regulations were originally adopted in 2007 and updated in both 2009 and 2010. The following legislation passed in 2010 created incentives for the purchase of advanced technology vehicles that are required by the Clean Car Program:

- HB 469 (SB281) Motor Vehicle Excise Tax – Tax Credit for Electric Vehicles – provides credit against the motor vehicle excise tax for qualified vehicles.

- HB 674 (SB) High Occupancy Vehicle (HOV) Lanes – Use by Plug–In Vehicles – allows qualified vehicles access to HOV lanes without the required minimum occupancy.

The Maryland Clean Cars Act of 2007 required MDE to adopt regulations implementing the California Clean Car Program. Maryland's implementing regulations adopted, through incorporation by reference, the applicable California regulations. The California program is a dynamic, changing program in which many of the relevant California regulations are continuously updated. To retain the California program, Maryland must remain consistent with their regulations, hence when California updates its regulations, Maryland has to update our regulations. The Maryland regulations were updated in 2009 and 2010.

ATTACHMENT C: STATE OF NEW MEXICO'S EE/RE POLICIES AND PROGRAMS

New Mexico has three primary EE/RE policies. First, the state has a renewable portfolio standard. In March 2007 the state added new requirements to the state's Renewable Portfolio Standard, which formerly required utilities to get 10 percent of their electricity needs by 2011 from renewables. Under the new law, regulated electric utilities must have renewables meet 15 percent of their electricity needs by 2015 and 20 percent by 2020. Rural electric cooperatives must have renewable energy for 5 percent of their electricity needs by 2015, increasing to 10 percent by 2020. Renewable energy can come from new hydropower facilities, from fuel cells that are not fossil-fueled, and from biomass, solar, wind, and geothermal resources.

Second, the state requires that IOU's must offer a voluntary renewable energy program to their customers. In addition to and within the total portfolio percentage requirements, utilities must design their public utility procurement plans to achieve a fully diversified renewable energy portfolio no later than January 1, 2011, as follows:
A diversity requirement for IOU's as % of total RPS requirement:

- No less than *20% Wind*
- No less than *20% Solar*
- No less than *10% Other technologies*
- No less than *1.5% Distributed Generation (2011-2014) and 3% Distributed Generation by 2015*

Third, enacted in 2005, New Mexico's Efficient Use of Energy Act (Section 62-17-1 NMSA 1978) requires that public utilities, distribution cooperative utilities and municipal utilities include cost-effective energy efficiency and load management investments in their energy resource portfolios and that any regulatory disincentives that may exist to public utility investments in cost-effective energy efficiency and load management are eliminated.

In 2008, the statute was amended to include a State Energy Efficiency Resource Standard (EERS). Under this amendment public utilities providing electricity and natural gas service to New Mexico customers shall, subject to commission approval, acquire all cost-effective and achievable energy efficiency and load management resources available in their service territories. This requirement, however, for public utilities providing electricity service, shall not be less than savings of five percent of 2005 total retail kilowatt-hour sales to New Mexico customers in calendar year 2014 and ten percent of 2005 total retail kilowatt-hour sales to New Mexico customers in 2020 as a result of energy efficiency and load management programs implemented starting in 2007.
Energy Efficiency and Renewable Energy Bond Act (Sections 6-21D-1 through 6-21D-10 NMSA 1978)

Energy Efficiency and Renewable Energy Bond Act (Sections 6-21D-1 through 6-21D-10 NMSA 1978) authorizes up to $20 million in bonds to finance energy efficiency and renewable energy improvements in state government and school buildings. State agencies or school districts may request an energy assessment from the New Mexico Energy, Minerals and Natural Resources Department to identify specific energy saving measures. Combined heat and power and waste heat recovery systems are eligible for funding. Bonds are to be paid back by realized energy savings.

The state also has an array of financial to support these programs. The governor has also signed a number of Executive Orders in support of energy efficiency and renewable energy in state government and to create a climate action plan.