United States
Environmental Protection
Agency

Office of Air and Radiation

August 2004

GUIDANCE ON STATE IMPLEMENTATION PLAN (SIP) CREDITS FOR EMISSION REDUCTIONS FROM ELECTRIC-SECTOR ENERGY EFFICIENCY AND RENEWABLE ENERGY MEASURES

GUIDANCE ON STATE IMPLEMENTATION PLAN (SIP) CREDITS FOR EMISSION REDUCTIONS FROM ELECTRIC-SECTOR ENERGY EFFICIENCY AND RENEWABLE ENERGY MEASURES

Prepared by the

Air Quality Strategies and Standards Division
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

and

Global Programs Division
Office of Atmospheric Programs
U.S. Environmental Protection Agency
Washington, DC 20460

August 2004

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

CAA	Clean Air Act
CACPS	Clean Air and Climate Protection Software
CAMD	Clean Air Markets Division
CFR	Code of Federal Regulations
CHP	Combined Heat and Power
DR NEMO	Distributed Resources Net Emissions Model
eGRID	Emissions & Generation Resource Integrated Database
EGU(s)	Electric generating unit(s)
IPM	Integrated Planning Model
KWh	Kilowatt-hour
lb	Pounds
lbs/KWh	Pounds per kilowatt-hour
LAER	Lowest Achievable Emission Rate
MW	Megawatt
MWh	Megawatt-hour
NAAQS	National Ambient Air Quality Standards
NOx	Nitrogen Oxides
OTC	Ozone Transport Commission
PROSYM	Proprietary Hourly Power System Evaluation Model
RFP	Reasonable Further Progress
ROP	Rate of Progress
SCR	Selective Catalytic Reduction
SCRAM	Support Center for Regulatory Models
SNCR	Selective Non-Catalytic Reduction
SIP(s)	State Implementation Plan(s)

Guidance on State Implementation Plan (SIP) Credits for Emission Reductions from Electric-Sector Energy Efficiency or Renewable Energy Measures

(Note: as used in this document, the terms "you" and "your" refer to a State or States and the terms "we", "us" and "our" refer to EPA.)

Section A: Background and General Information

1. Why have we developed this guidance?

We recognize that areas of the country continue to experience challenges in meeting air quality standards. Many areas still have to adopt and implement additional measures to meet the State Implementation Plan requirements for attainment, reasonable further progress (RFP), rate of progress (ROP) or maintenance requirements. Some areas have implemented most available traditional emission control strategies and want to try new types of pollutant reduction strategies to attain or maintain the national ambient air quality standards (NAAQS). The EPA supports and wishes to promote the testing of promising new pollution reduction strategies such as energy efficiency and renewable energy measures within the air quality planning process.

Energy efficiency and renewable energy measures have many benefits. Energy efficiency measures reduce the demand for electricity and renewable energy can supply energy from non- or less- polluting sources. These measures can save money, have other economic benefits, reduce dependence on foreign sources of fuel, increase the reliability of the electricity grid, enhance energy security, and, most importantly for air quality purposes, reduce air emissions from electric generating power plants. Energy efficiency and renewable energy inherently prevent pollution from occurring. Additionally, in many areas, the peak demand for electricity frequently coincides with periods of poor air quality. It is therefore important to encourage and reward greater application of energy efficiency and renewable energy measures and incorporate the emission reductions that these measures will accrue into the air quality planning process.

There are various reasons (as discussed in this guidance) why it can be difficult to accurately estimate the amount of emission reductions from energy efficiency or renewable energy measures that impact air quality in a specific nonattainment area. As of the date of this document, only Dallas-Ft. Worth and Washington D.C. have proposed explicit emission reductions from energy efficiency or renewable energy as a control measure in submissions to EPA as part of their State Implementation Plans (SIPs). However, other areas may have incorporated energy efficiency assumptions as adjustments to growth projections against baseline emissions from electric generating units (EGUs). These adjustments may have been based on specific planned energy efficiency or renewable energy measures, or on generic estimates of reduced demand due to future energy efficiency or renewable energy measures.

We have developed this guidance to provide a readily available procedure to quantify and validate emission reductions from specific energy efficiency and renewable energy measures and have these reductions applied to SIPs through future rulemaking for purposes of ROP, RFP, attainment demonstrations and maintenance plans.

2. **What does it mean that this is guidance and not a regulation?**

The Clean Air Act (CAA) and implementing regulations at 40 CFR Part 51 contain legally binding requirements. This guidance document does not supercede, change or substitute for those provisions or provisions of any existing federal or State regulations, including those of an approved SIP, nor is it a regulation itself. Thus, it does not impose binding, enforceable requirements on any party, and may not apply to a particular situation based upon the circumstances. The EPA and State decision makers retain the discretion where appropriate to adopt approaches to the approval of SIP measures on a case-by-case basis that differ from this guidance. Any final decisions by EPA regarding a particular SIP measure will only be made based on the statute and regulations in the context of EPA rulemaking on a submitted SIP revision. Therefore, interested parties are free to raise questions and objections about the appropriateness of the application of this guidance to a particular situation. EPA will, and States should, consider whether or not the recommendations in this guidance are appropriate in that situation. This guidance is a living document and may be revised periodically without public notice. The EPA welcomes public comments on this document at any time and will consider 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 measure.

3. **What is meant by SIP credit for the purpose of this guidance?**

The term "SIP credit" as used in this guidance means emission reductions, achieved by using technologies or strategies, used by a State for the purpose of meeting emission reduction requirements in its reasonable further progress (RFP), rate of progress (ROP), attainment or maintenance strategy.

This document focuses primarily on NOx emission reductions as a means of achieving the NAAQS for ozone. However, emission reductions from energy efficiency and renewable energy measures may be used for compliance with SIP provisions for other air quality standards, such as PM-10 and PM-2.5, and regional haze.

4. **How does this guidance relate to our guidance on "Incorporating Voluntary and Emerging Measures in a SIP"?**

If you use this guidance, you should also follow the procedures outlined in EPA's guidance titled " Incorporating Voluntary and Emerging Measures in a SIP." That guidance was established to encourage development of voluntary and promising "nontraditional measures", including energy efficiency/renewable energy measures, by:

(A) Providing some flexibility in meeting established SIP requirements for enforceability and quantification;

(B) Providing a clear process by which new approaches can be developed and evaluated;

(C) Establishing appropriate limitations which govern the conditions under which these new approaches can be applied; and

(D) Providing provisional pollutant reduction credit up front for attainment, RFP, ROP or maintenance requirements to encourage the substantial investment required to implement many new pollutant reduction approaches.

That guidance lays out a basic methodology for approving nontraditional measures through notice-and-comment rulemaking where a State can:

(A) Develop a reasonable methodology to estimate emission or pollutant reductions impacting a nonattainment area,

(B) Run the measure for a specified period of time,

(C) Evaluate how well the measure worked in reducing the pollutant or emission levels, and

(D) Timely make up any shortfall between estimated and actual reductions.

5. **What types of projects would qualify for SIP credits under this guidance?**

Electric-sector energy efficiency and renewable energy projects, initiatives or measures that will result in quantifiable reductions in emissions at existing fossil fuel-fired electric generating units and will improve air quality in a nonattainment area.

6. **What are some examples of specific energy efficiency or renewable energy projects?**

Such projects could include, but are not necessarily limited to, the following:

(A) Demand side management energy efficiency projects, such as:

(1) Programs to replace existing electrical devices with more energy efficient devices (for example, lights, appliances, air conditioners, pumps, etc.) including ENERGY STAR rated products; or

(2) Programs related to design, construction or reconstruction which by themselves do not use energy, but result in energy savings. For example, reflective roofs, double pane windows, increased insulation, and building codes containing these requirements.

(B) Supply-side measures, which include new and innovative initiatives to increase the efficiency or decrease the emissions from electricity generation. This could include projects such as the following:

(1) Combined heat and power (CHP) projects,

(2) Fuel cell power generation, or

(3) Renewable energy projects, such as:

(a) Wind powered generation,

(b) Solar powered generation, or

(c) Use of biofuels that emit less air pollution than traditional fuels.

Different States define renewable energy differently for different purposes and programs, and include different fuels and technologies. Energy sources that are considered to be renewable can include: wind, solar thermal, solar photovoltaic, tidal, wave, ocean thermal, small hydroelectric, low-impact hydroelectric, geothermal, fuel cells that use renewably derived hydrogen, digester gas, and other bio-fuels. No matter how renewable energy is defined in your State, the important aspect to consider as a SIP measure is any associated emissions with the fuel source and/or technology employed.

Programs and policies that require or otherwise bring about these measures include, but are not limited to: system benefit charge programs, renewable portfolio standards, emissions portfolio standards, output-based emission limits, green power purchasing requirements, energy efficient equipment purchasing requirements, enhanced building codes (for example, Green Building Programs), and others, such as incentives to install CHP.

7. What types of emission source categories could be targeted for emission reductions under this guidance?

This guidance may be used to quantify emission reductions at any type of existing source that generates electricity, such as:

(A) Fossil fuel (for example, coal, oil or gas) fired electricity generating units,

(B) Small distributed generation units, or

(C) Emergency/standby generators.

8. What are basic Clean Air Act requirements for crediting emission reductions in a SIP?

In order to be approved as a measure providing additional emission reduction in a SIP, a measure reducing emissions from electricity generation cannot interfere with other requirements of the CAA, would need to be consistent with SIP attainment, maintenance or RFP/ROP requirements, and provide emission reductions that are:

(A) **Quantifiable** - The 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 criteria. 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.

(B) **Surplus** - 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 (for a further discussion see page 9, (D) Cap and trade programs).

(C) **Enforceable** - Measures that reduce emissions from electricity generation may be:

(1) Enforceable directly against a source;

(2) Enforceable against another party responsible for the energy efficiency or renewable energy activity; or

(3) Included under our voluntary measures policy.

We believe that most measures you may consider under this 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 distance between the measure 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:

(a) They are independently verifiable;

(b) Violations are defined;

(c) Those liable for violations can be identified;

(d) You and EPA maintain the ability to apply penalties and secure appropriate corrective actions where applicable;

(e) Citizens have access to all the emissions-related information obtained from the source;

(f) Citizens can file suits against the source for violations; and

(g) 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:

(a) The activity or measure is independently verifiable;

(b) Violations are defined;

(c) Those liable for violations can be identified;

(d) You and EPA maintain the ability to apply penalties and secure appropriate corrective actions where applicable;

(e) Citizens have access to all the required activity information from the responsible party;

(f) Citizens can file suits against the responsible party for violations; and

(g) The activity or measure is practicably enforceable in accordance with EPA guidance on practicable enforceability.

If included under EPA's January 19, 2001, Stationary Source Voluntary Measures Final Policy ("Voluntary Measures Policy"), the reductions are not enforceable against the source or a responsible party and the State is responsible for assuring that the reductions credited in the SIP occur.[1] An example of a voluntary measure might be a program to encourage builders or homeowners to install energy efficient windows.

If a SIP revision is approved under the Voluntary Measures Policy, the State is responsible for assuring that the reductions credited in the SIP occur. The State would need to make an enforceable SIP commitment to monitor, assess and report on the emission reductions

---

[1] EPA's more recent policy document on " Incorporating Voluntary and Emerging Measures in a SIP" subsumes (but does not modify) the policy and guidance contained in the January 19, 2001, Stationary Source Voluntary Measures Final Policy.

resulting from the voluntary measure and to remedy any shortfalls from forecasted emission reductions in a timely manner. Further, the total of all voluntary measures (including voluntary energy efficiency and renewable energy measures) may not exceed 3 percent of the total reductions needed to meet any requirements for RFP/ROP, attainment or maintenance as described under the policy. If you wish to have a SIP revision approved under the Voluntary Measures Policy consult that policy for further information. A copy of EPA's guidance on voluntary measures is available at the following web site:
http://www.epa.gov/ttn/oarpg/t1pgm.html
http://www.epa.gov/ttn/oarpg/t1/memoranda/coverpol.pdf

(D) **Permanent** - The 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.

In some cases, the amount of emission reductions provided for energy efficiency measures may change over time, but still be permanent. For instance, as new emission standards for EGUs are implemented, any electricity savings from energy efficiency will displace less emissions than before the new emission standards take effect. This does not mean the reductions are not permanent, but simply that the amount of the reduction resulting from the measure will decrease over time. Similarly, for some measures, the energy savings resulting from an initial implementation may also be variable over time. For example, wind turbines will operate at different capacity factors during different seasons, energy use related to weather can vary with aberrations from normal weather patterns, and the energy savings from some energy-efficient technologies will degrade slightly over time. In each of these examples, the energy savings (and therefore the emission reductions) may vary over different time periods, but the appropriate level of emissions reduction can be relied upon during the entire term of the SIP submission if the factors are addressed (for example, using the wind turbine capacity factor during the season in which the SIP is focusing, normalizing for weather in the period during which baseline energy use is examined, and accounting for expected energy performance degradations).

9. Why is it difficult to calculate emission reductions from energy efficiency or renewable energy measures for SIP purposes?

The quantification of emission reductions for SIP purposes from energy efficiency or renewable energy measures presents some special and unique challenges. Electricity is generated at many different EGUs across the United States. Electricity is also consumed by virtually every business and household in the country. Since 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.

Thus, if a State or area establishes an energy efficiency or renewable energy program designed to either reduce the consumption of electricity or generate electricity with fewer emissions, there can be considerable uncertainty as to where the reduced demand from energy efficiency or displaced energy from a renewable source will actually show up as reduced electrical generation and reduced EGU emissions. The uncertainty in being able to determine the exact location of the displaced emissions raises two significant issues in quantifying emission reductions for SIP purposes. However, this uncertainty is not an insurmountable barrier to obtaining SIP credit, especially given much of the uncertainty that may already exist in the projected emission baseline for EGUs.

First, the estimation of where the energy generation changes will take place will affect the overall emission reductions of the measure. Each EGU has a different emission rate. Emissions from an EGU are dependent on a variety of factors and will vary significantly from one EGU to another. Some of the more important factors include: the type of fuel or energy source (for example, coal, oil, gas, wind, solar, hydro, nuclear, geothermal), and, in the case of fossil fuels, the type of process used to generate electricity (for example, steam-electric unit, simple-cycle turbine, combined cycle unit) and the emissions controls in place at the EGU. Therefore, different EGUs, even when they are of the same type, may not produce the same amount of emissions per unit of electricity produced. Additionally, it is important to recognize how the units are dispatched. Each EGU is part of a larger electric grid system. Electric demand within the system varies on a real-time basis. Generally, units that can generate electricity at the least cost are dispatched first. These units are commonly called “baseload” units and usually operate most of the time, unless there is a planned or forced outage. Some baseload EGUs are older units that have relatively few air pollution controls. Because baseload EGUs generally operate regardless of the electricity demand, energy efficiency and renewable energy measures more likely reduce the operation of other EGUs and less likely reduce the operation of baseload units. Other units are dispatchable or load-following units that are able to be turned on and off occasionally in response to demand and usually operate during moderate to peak load periods. Finally there are peak-load units which tend to be the most expensive to operate and also tend to have low generation efficiencies and less air pollution control. Peaking units are typically the types of facilities that are most likely to be impacted by the types of energy efficiency measures that tend to help reduce peak loads on hot summer days (for example, energy-efficient air conditioners). Understanding how the electric grid operates in your area is the first important step in making educated decisions about which units would be affected by a certain energy efficiency or renewable energy measure. The better you can estimate at which power plants a measure will likely affect generation and the better you can forecast the emission rates at those powerplants, the better the emission estimate you will have for the SIP submission. Finally, to the extent that energy efficiency and renewable energy measures reduce the need for the installation of new EGUs, the measures would displace relatively low emissions from new plants, which are required to install state-of-the-art air pollution control technology.

Second, even if the energy efficiency saving itself is clearly shown to occur in a nonattainment area, unless you are able to determine where the displacement of electrical generation will likely occur as a result of measures, 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) 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.

In addition, the air quality benefit of a very small energy efficiency or renewable energy measure may be indeterminable or insignificant, and therefore may not be worth pursuing. However, the combined effect of multiple small measures may provide a substantial air quality benefit.

Some other complicating factors can include:

(A) The nature of the integrated electric grid

Even where there is reasonable certainty that a measure will reduce power demands in a nonattainment area, a specific EGU located within that area may continue to produce power and merely sell it elsewhere on the grid.

(B) Deregulation

The effect of deregulation may play a role in how much power is produced, where it is produced and where the power can be distributed. The broader the area that a utility's EGU services, the less likely the EGU will be affected by local scale energy efficiency measures.

(C) Pollution control requirements

Pollution control requirements which will lower future EGU emissions, such as the NOx SIP Call, will decrease the amount of pollution produced per kilowatt-hour and may require the emission reductions assigned to an energy efficiency or renewable energy measure to be reduced over time.

(D) Cap and trade programs

Attempting to obtain SIP credit for emission reductions for energy efficiency or renewable energy measures when a cap and trade program exists can present a significant challenge. Cap and trade programs require a designated category of sources, such as EGUs, to reduce and limit their collective emissions. Such programs offer an alternative mechanism to the source-specific, rate-based mechanism traditionally used in SIPs. Cap and trade programs are enforced through the issuance of a limited number of allowances (authorizations to emit) that are equal to the emissions cap. Through trading and banking of these allowances, individual sources can vary their emissions as long as the aggregate emissions of all sources does not exceed the allowances issued. By limiting total mass emissions for the category of sources, cap and trade programs automatically account for any action that reduces emissions, including energy efficiency and renewable energy. This attribute exists because cap and trade programs effectively decouple emissions from electricity demand. Since a cap and trade program intrinsically accounts for energy efficiency and renewable energy, it is challenging to also provide specific SIP credit for these same actions.

The emission allowances assigned to an areas EGUs typically become an emissions level that is applied to the SIP for ROP, RFP, attainment or maintenance purposes. States make reasonable assumptions about how power plants will operate in the future, including the distribution of future emissions and emission reductions at individual EGUs that are subject to the cap. For example, in the case of the NOx SIP Call, a State could project that the emissions of the EGUs subject to the cap will be those that EPA calculated in its multi-state modeling effort[2]. A state also could project that the emissions of the EGUs subject to the cap will be no more than the number of allowances the State allocates, even though power plants may be able to purchase out of State allowances to comply with the program. In another example, a State could base future year emission projects by reducing emission rates at each plant by a certain formula until the emissions from all of the facilities subject to the cap and trade program equal the total number of allowances the State allocates. EPA believes that the first example is probably the best way to project emissions from capped sources in the SIP. The other examples use assumptions that may be acceptable even though the trading component of the program creates uncertainty in the distribution of the emission reductions among all of the units that are subject to the cap and trade program. The flexibility of a cap and trade program makes it difficult to establish the baseline (or what would have happened) at a specific source from which surplus reductions must be determined.

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.

---

[2] The results are available online at http://www.epa.gov/airmarkets/fednox/126ipm.html

Since there are relatively few nonattainment areas that have implemented their own individual cap and trade programs, this issue would seem to be relatively limited in scope. However, with the implementation of the NOx SIP Call (which establishes a regional cap and trade program) this issue essentially applies to much of the eastern half of the U.S.

10. **Considering the uncertainties associated with electricity generation, how can we quantify or credit emission reductions from energy efficiency or renewable energy measures?**

All SIP measures have some level of uncertainty, whether it comes from the uncertainty associated with the emissions factors for certain sources, the level of compliance with existing SIP measures, or the modeling for an attainment demonstration. The issue is how to best apply assumptions and tools to reduce the uncertainty to a manageable factor. Toward this end, there are a variety of tools and techniques available to estimate energy savings and to model the generation and use of electricity. Some of these tools can be applied to estimate energy savings and the pollution reduction impacts of energy efficiency or renewable energy projects.

We recognize that there will likely always be some level of uncertainty regarding the exact quantity and location of emission reductions resulting from energy efficiency or renewable energy measures. However, in many cases we also believe that you can apply existing tools with sufficient rigor to be able to quantify estimated emission reductions with acceptable certainty to allow the reductions to be credited. By using conservative assumptions, appropriate discount factors or verification techniques, emission reduction estimates from energy efficiency or renewable energy measures can be appropriately applied for SIP purposes.

Section B: Step-by-Step Procedure for Quantifying SIP Credits

11. **What is the procedure for determining the amount of SIP credit generated by an energy efficiency or renewable energy measure?**

For the purposes of this guidance, the potential for SIP credit occurs when a measure is expected to reduce the emissions of an EGU below its projected emission level in the SIP. The reduction in emissions could be as a result of energy efficiency actions to reduce the amount of energy that would have otherwise been used, or renewable energy projects used to generate energy with fewer overall emissions.

The recommended procedure for determining the amount of SIP credit generated by an energy efficiency measure or renewable energy project follows four basic steps. The type of information required and analyses necessary to fulfill each step (for example, data, modeling, record keeping, etc.) will vary according to the nature of the project. In practice, depending on the project, some steps may be more or less difficult to accomplish than others. The general steps are as follows:

STEP 1 - 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 following provides a more detailed discussion of each of these steps:

STEP 1 - *Estimate the energy savings or amount of energy generation that will be displaced by the new generator.*

12. **What is the purpose of STEP 1?**

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 measure. Energy savings can result in reductions in current energy demand, future demand, or both. For energy efficiency, the purpose of this step is to determine what the energy saving impacts of the specific energy efficiency measure(s) will be. For example, if a State required all State buildings to switch to high efficiency air conditioning, how much energy would that save?

For renewable energy, the purpose of this step is to determine how much energy would be displaced by the renewable energy project, for example, a wind farm. In general, for renewable sources, the answer would be the total amount of energy provided to the grid by the renewable energy source. The same is true for less polluting sources of new energy, such as cogeneration and fuel cells. Any estimates of emissions associated with renewable energy generation should also be made.

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

13. **For energy efficiency measures, how is the amount of energy saved determined?**

Although each energy efficiency measure will have individual factors to be taken into account, the general approach is as follows:

(A) Determine the existing baseline of energy usage for the activity subject to the energy efficient measure.

(B) Determine the projected energy usage for the fully implemented measure.

(C) Subtract 2) from 1). The result yields the projected energy savings due to the energy efficiency measure.

For example, if a city decided to replace all its existing street lighting or traffic lights with more energy efficient lighting, it would need to 1) calculate the baseline energy use of its existing street lights by calculating the number of existing street lights times energy used per light per hour times the annual hours of operation, then 2) calculate the energy which would be used by new, more efficient lighting, then 3) subtract the results in step (2) from step (1). It is important to note that this is a very simplified example and that other factors may also need to be taken into account. Such factors could include: a phase in period for the equipment, a change in hours of operation, normalizing for weather during the baseline energy use period, or other relevant factors which could affect energy consumption.

There are several quantification protocols that may be useful in framing what information you may need to collect to make an estimate of the energy savings. One commonly used protocol is the International Performance Measurement and Verification Protocol. There are three individual documents that may be useful:

(A) Concepts and Options for Determining Energy and Water Savings Volume I, Revised March 2002

(B) Concepts and Options for Determining Energy Savings in New Construction, Volume III, April 2003

(C) Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications, August 2003

Each of these documents may be downloaded from http://www.ipmvp.org. Some of the concepts in estimating energy savings described in these documents may be useful in your endeavor to estimate energy savings from a particular measure. These protocols are designed to estimate savings from individual projects, which generally go into a level of detail that is greater than what would be needed to estimate energy savings from entire programs or policies. It is important to note that the use of these or any other specific protocols is not required by this guidance. They are cited for reference purposes only.

14. **How should the SIP baseline be taken into account in developing estimates of SIP credit for energy efficiency and renewable energy?**

The SIP baseline consists of the current inventory of emissions in the SIP plus any assumptions regarding growth, or reduction in growth, of an industrial sector and its affect on emissions. If a State considers certain energy efficiency or renewable energy activities 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, and "credited" in the SIP, as part of the projected baseline emissions. Consequently, to avoid double counting, additional SIP credit should not be granted for those activities already considered in a State's projection of future baseline emissions for EGUs. In other words, if the State applied certain energy efficiency or renewable energy measures in its projected EGU emissions baseline, EPA believes that it could not receive additional SIP credit for those same measures, since the effect of the measure has already been accounted for in the baseline. A State may seek SIP credit for energy efficiency or renewable energy measures beyond what are already included in the baseline assumptions. A State may do so by either changing the projected emissions baseline (if the opportunity to do so is present), or by applying the energy efficiency or renewable energy activity as a control measure.

15. **What analytical tools and other resources are available to help quantify energy saved?**

There are currently a variety of tools and information sources available to help quantify energy saved from energy efficiency, and others are being developed. A compilation of analytical tools and resources available as of the date of this document is contained in Appendix A.

16. **How is the amount of renewable energy generation estimated?**

Intermittent renewable resources, such as solar and wind resources have predictable seasonal capacity factors. Your counterparts at the State Energy Office will likely be able to assist you if this is a critical component of the estimation.

STEP 2 - *Convert the energy impact of a project or initiative into an estimated emissions reduction.*

17. **What is the purpose of STEP 2?**

This is a critical step in the process. The purpose of this step is to estimate the amount and locations of emission reductions likely to occur from the measure. The typical unit of SIP credit is tons per day of emissions reduced. By converting the energy impact into emissions reduced, the amount of potential SIP credit can be determined. The actual amount of appropriate SIP credit, however, is determined in the next step, STEP 3.

18. **How do you convert energy savings to emission reductions?**

There are two parts to converting energy savings into emission reductions. First, you estimate which facilities will likely reduce their energy output as a result of the measure. Second, you determine the emission rate in pounds per kilowatt-hour of those facilities. The emission reductions can then be calculated by multiplying the reduction in the facility(s) energy output by the emission rate per kilowatt-hour of the displaced facilities.

The amount of emission reductions that will occur from the measure is directly tied to the emission rate of the facilities at which the energy is displaced. However, the way in which any individual facility may be impacted by an energy efficiency or renewable energy measure may not be able to be determined exactly. Consequently, surrogate approaches, such as dispatch models or other assumptions based on historical or projected information may need to be utilized to estimate the most likely grouping of facilities that would be impacted. Once the models and assumptions are applied to determine the likely impacted facilities, the potential emission reductions can be calculated by using an average emission factor for each affected facility or grouping of facilities where energy displacement is expected to occur.

Generally, there are energy losses that occur between the point of electricity generation and the point at which energy is consumed. These losses are commonly called "line losses." Therefore, if one reduces demand of electricity by one kilowatt hour, then more than one kilowatt-hour of electricity generation is displaced. If you have a good estimate of line losses between the location of the energy savings and the locations of the affected fossil fuel fired generation, then that information may be used. If you do not have such information, then EPA believes making the assumption that one kilowatt-hour of energy demand savings would reduce electricity generation by one kilowatt hour is a reasonable approach.

If the measure is a renewable energy measure, you should account for any emissions from the renewable energy sources that may occur when estimating the emission reductions from the measure. For example, if CHP projects are part of the measure, then you should not only account for the emission reductions from the reduced use of the grid power units, but also the emissions of the CHP projects. For CHP applications EPA's Combined Heat and Power Partnership[3] can assist with this part of the estimation.

19. **How is the location of the displaced energy determined?**

Typically the location of the emission reduction is determined by the use of a model which assesses how the energy sector will react to the displaced energy. These energy models approximate how electricity generating units are dispatched. Some examples of these types of models include the Integrated Planning Model (IPM) owned and operated by ICF Consulting, the Proprietary Hourly Power System Evaluation Model (PROSYM) model licensed by the Henwood Energy Services, and the Distributed Resources Net Emissions Model (DR NEMO) owned and operated by the Center for Clean Air Policy. These are sophisticated models which require significant resources to input data into and run the models. Other approaches can also be used which rely on more simplified assumptions as long as they provide a reasonable approximation of reality. For example, a method being considered in Texas and other areas of the country uses plant level capacity factor data as published in Emissions & Generation Resource Integrated Database (eGRID)[4] as a surrogate for dispatch.

Some tools have been created that estimate the emission reductions from energy efficiency and renewable energy projects, but do not specify any geographic distribution of the

---

[3] http://www.epa.gov/chp/

[4] EPA's Emissions & Generation Resource Integrated Database (eGRID) is available online at http://www.epa.gov/cleanenergy/egrid/

emission reductions. For example, Synapse energy systems created the OTC Emission Reduction Workbook 2.1 which provides emission factors based on PROSYM model runs for the northeastern portion of the United States[5]. Another example is the Clean Air and Climate Protection Software (CACPS). eGRID also provides several emission factors for various geographic areas that have been used to estimate the emissions benefits of various energy efficiency and renewable energy projects and measures. Although these tools do not estimate any geographic distribution of the emission reductions, they may provide information useful in an overall methodology that has a component that establishes a reasonable geographic distribution of the emission reductions.

Although dispatch models are available for use, as discussed, there may be other reasonable methods to distribute the generation displacement to all plants that would likely be affected by the energy efficiency or renewable energy measure. Consequently, EPA believes that you do not need to necessarily run a dispatch model in order to estimate the locations of the emission reductions expected from a measure.

20. **What sources of information can provide data for model inputs?**

Some models, or model runs may already have the necessary information to evaluate the emissions consequences resulting from the energy displacement, except for the displaced energy input. Although the actual data requirements will vary from model to model, some sources of general information which can provide data for model input include:

(A) Our Clean Air Markets Division (CAMD) Database, which can be used to obtain unit-specific emission factors;

(B) Emissions and Generation Resource Integrated Database (eGRID) which can provide useful information on all electric generating units in the United States that have a rated capacity of 1 MW or greater;

(C) Emission factors which can be obtained from State emission inventories (actual or projected), AP-42, source-specific emission factors in permits;

(D) ENERGY STAR Program benchmarking tools that could be used to estimate emission reductions in certain cases; and

(E) National Renewable Energy Lab's biomass factors.

---

[5] The OTC workbook and Excel file are available on the Ozone Transport Commission's website http://otcair.org in the documents section.

21. **What are some important factors and variables that can affect the likely location of displaced emissions?**

The actual factors and their relative importance will vary by project and location. In general, the following types of considerations can have a significant influence on where emission reductions will occur:

(A) The extent and nature of deregulation in the area in which the project or initiative will take place.

(B) Grid or other transmission-related constraints on the movement of energy.

(C) Existence of non-grid sources.

(D) The extent to which the area may be a net importer or exporter of energy.

(E) The timing of the energy displacement.

(F) The existence of a cap and trade program.

(G) The quantity of the energy displacement.

22. **What important factors can affect the emission rate of an electric generating unit?**

(A) Existing and future requirements on emissions from the EGU. For example, what are the current and future emission limitations and requirements for the EGU?

(B) The air pollution controls (or absence of controls) in place at a facility. For example, does the unit utilize selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), or low NOx burners to control its emissions?

(C) The fuel burned by the EGU. For example, does the unit burn coal, oil, or natural gas?

(D) The electricity generation process of an EGU. For example, is it a fossil fuel fired steam electric unit, a simple or combined cycle turbine, or internal combustion engine?

(E) The efficiency of the unit and whether there are multiple outputs, for example, useful thermal heat and electricity.

23. **How can a cap and trade program affect the relationship between the generation of electricity and emissions of electric generating units?**

Since a cap and trade program establishes an allowance system for EGUs, the decision of an individual EGU on how to comply with the program is typically made on an economic basis, whatever is most cost effective for the facility. If a facility would emit more than the number of allowances it currently owns, then it can comply either by operating fewer hours, by applying a control technology to reduce emissions, or by purchasing allowances from the market. The presence of cap and trade systems can complicate the estimation of emission reductions from energy efficiency and renewable energy projects and measure. The more energy efficiency and renewable energy that takes place in a geographic area that is under a cap and trade program, the easier it will be for the EGUs to collectively meet the cap. Theoretically, if an EGU produces less electricity due to some energy efficiency or renewables energy measure being implemented, the EGU could still emit up to the number of allowances it holds with a higher emission rate, or it could sell the allowances to another unit which could then use the additional allowances to emit more than it otherwise would. Energy efficiency or renewable energy measures theoretically become one additional mechanism by which EGUs can comply with the cap and trade program. The cap and trade program establishes an emissions cap no matter how much generation is required from the EGUs subject to the program. In reality the situation may be slightly different than this theoretical discussion of a perfect allowance market in which excess allowances are immediately translated into business decisions concerning whether to install/operate controls or purchase allowances to comply with the cap and trade program.

Some models, such as IPM, have the ability to account for cap and trade programs in their economic assumptions to estimate at which facilities emissions would be most likely to be displaced. Other estimation methods may need to address how cap and trade systems may affect the emissions reductions outside of any modeling or emissions calculation methodologies.

One important way to address the cap and trade program was mentioned earlier in this document. Some assurance that the estimated emission reductions will not be swept away by the theoretical cap and trade program mechanics mentioned above can be provided by retiring a commensurate number of allowances that accounts for the emission reductions expected from the measure. States that wish to retire allowances in order to render energy efficiency or renewable energy measures “surplus” for SIP credit will need to establish a mechanism to do so within their regulatory framework to implement the cap and trade program in their State. One way is to draw such allowances from a set-aside. States may also consider other means to obtain and retire allowances to obtain SIP credit for energy efficiency and renewable energy measures, such as through enforcement actions. Absent a mechanism to retire allowances or create a set-aside, it may be difficult to claim surplus reductions in areas operating under a cap-and-trade program.

24. How can the SIP credit from an energy efficiency or renewable energy measure in the NOx SIP Call area be determined?

One approach to providing SIP credit for attainment demonstration purposes for emission reductions from energy efficiency and renewable energy measures affecting SIP Call covered power plants is to perform a basic analysis to estimate the emission reductions affecting the nonattainment area and then retire SIP Call allowances, as previously discussed. Any origin of the allowances for retirement would be acceptable. For example, the allowances may originate from a set-aside for energy efficiency or renewable energy.[6] States without allowance set-asides will need to establish a mechanism by which allowances will be retired.

Another type of approach is to undertake a rigorous technical analysis to quantify and demonstrate the benefit of the measure within the nonattainment area. Such an approach should clearly demonstrate that emission reductions would occur in the area as a result of the measures by considering how both the electricity and allowance markets function. This type of approach could avoid the need to retire allowances, if the analysis demonstrates that power plant emissions in the area decrease despite the allowance system and the ability of power plants to sell electricity to other area. However, even with this rigorous analysis, the ability to avoid retiring allowances would be unlikely if allowances were integral to quantifying utility baseline emissions in the State's emission inventory used in its attainment demonstration.

If the area chooses allowance retirement as a means of ensuring that the emission reductions you estimate are surplus to those called for under the cap and trade program, then there are two options to determine the number of allowances the area would need to retire to account for the emission reductions being estimated for credit within the SIP. In either option, you will still need to establish that the energy efficiency or renewable energy measure will likely result in reduced generation in the nonattainment area, or in a surrounding area that impacts the air quality of the non-attainment area. EPA believes that SIP credit cannot be generated where the likelihood does not exist that the measures will in some manner reduce local generation and improve local air quality.

One allowance retirement option, and the most straightforward approach, would be for you to use the emission reduction estimate for the entire ozone season to determine the number of allowances to be retired to receive credit in the SIP. The SIP credit would be calculated by dividing the emission reduction estimate for the ozone season by the number of days in the ozone season (typically 153). The area would not need to determine exactly when during the ozone season the reductions would occur. This method spreads the reduction evenly across the ozone season. For example, if an area were to perform a basic analysis to estimate an emission reduction from energy efficiency and renewable energy measures of 31 tons during the entire ozone season from electric generating units in or affecting the non-attainment area, the area would estimate a daily emission reduction of 0.2 tons per day (31 tons divided by 153 days) if it retires the 31 allowances.

A second allowance retirement option would be available if you perform a more detailed technical analysis (for example, if you would evaluate hourly and or daily emission reduction

---

[6] EPA has provided guidance to States on how they could establish energy efficiency and renewable energy set-asides. Some States have created allowance set-asides under the SIP Call that encourage energy efficiency actions through the distribution of allowances to the project. As originally intended, these set-asides are a way that States can provide economic incentives to eligible projects. The value of those allowances is used to encourage actions which may result in ancillary environmental improvements and benefits. If set-asides are used to allocate allowances to eligible projects and the allowances remain in the market, there is no net effect on regional NOx emissions because the allowances are not retired.

estimates for the entire ozone season). Under this option an area would add up the hourly or daily emission reduction estimates within the applicable area for the entire trading period (specifically, May 1 through September 30), and convert this figure into tons per trading period. This estimated emission reduction for the entire trading period would be the basis for the number of allowances needed to be retired in order to obtain SIP credit. In this option, variable daily emission reductions estimates are not directly proportional to the emission reductions total throughout the trading period divided by the number of days within the trading period. For example, assume (as was done above) that the estimated emission reductions for the entire ozone season is 31 tons. This is still the number of allowances that would need to be retired for SIP credit. However, because the analysis differentiated the activities of the energy efficiency or renewable energy measure and/or the operations of the electric generating units throughout the ozone season (and hourly or daily emission reductions are available), a typical peak ozone season day emission reduction estimate or an episodic day emission reduction estimate can be drawn from the analysis. For the purpose of this example, assume the typical peak ozone season day reductions are estimated at 0.5 tons per day, and non-peak ozone season day reductions are estimated to be a smaller amount so that the total emission reductions estimated for the entire ozone season add up to 31 tons. In this case, because the effect on utility operations and emissions on a typical peak ozone day was evaluated in detail, the hypothetical area could take credit for 0.5 tons per typical ozone season day if it retires 31 tons of allowances, rather than the 0.2 tons of credit that would be available under the other allowance retirement option discussed in the previous paragraph.

25. **What are the types of distributed generation sources?**

There are two primary applications of distributed generation: peaking and base loaded. In peaking applications, the units typically come online during peak demand, and generally tend to be minor sources with high emission rates. However, base loaded applications of distributed generation, which are designed and installed to meet the base electric load (such as on-site CHP[7], wind and solar), tend to have better efficiencies and lower emission rates.

26. **How does the extent to which an area may be a net importer or exporter of energy influence the relationship between utilization and emission reductions?**

In general, the more energy that an area import from, or exports to, areas outside the nonattainment area, the less impact that energy efficiency will have on emission reductions in

---

[7] In the case of CHP they also meet the base thermal load needs of a host site, and typically run the maximum number of hours per year at the highest possible efficiency. Because of this operating profile, the site meets it's peak demand through either purchasing electricity from the grid and/ or implementing energy efficiency measures that help reduce peak loads on hot summer days. Therefore, baseloaded CHP distributed generation can complement other energy efficiency measures. In addition, in many states even small baseloaded CHP plants are required to meet stringent emissions requirements.

the nonattainment area. This is because more of the reduced emissions from less electricity generation will occur outside the nonattainment area airshed. Areas that export energy may not reduce their output even where energy efficiency measures decrease local demand. The energy not consumed locally may be sold elsewhere on the grid. Areas should consider the local import/export status of the area in determining the anticipated emissions reductions from an energy efficiency or renewable energy measure.

STEP 3 - ***Determine the impact from the estimated emission reduction on air quality in the nonattainment area.***

27. **What is the purpose of STEP 3?**

SIP credit can only be given for those emissions reductions that will improve the air quality in the nonattainment area. In this step the actual amount of potential credit is determined by evaluating the extent to which reductions will improve air quality in the nonattainment area.

28. **What are the threshold factors for impacting air quality in a nonattainment area?**

The basic Clean Air Act requirements which any emissions reduction must meet to be used as SIP credit are discussed in detail in Section I. SIP credit cannot be given to estimated reductions in emissions which do not meet these basic programmatic statutory and regulatory requirements.

29. **How is the air quality impact of emission reductions projected to occur within the nonattainment area determined?**

Emissions reductions occurring within a nonattainment area are generally assumed to directly benefit the nonattainment area and no additional air quality impact analysis is necessary.

30. **How is the amount of SIP credit determined for reductions projected to occur in the nonattainment area?**

The amount of SIP credit is the total amount of the emissions reduction which meet the basic Clean Air Act requirements for creditable reductions. Specifically (as discussed in detail in Section I), in order to be approved as a measure providing additional emission reduction in a SIP, a measure reducing utility emissions cannot interfere with other requirements of the Clean Air Act (CAA), would need to be consistent with applicable SIP attainment, maintenance or RFP/ROP requirements, and provide emission reductions that are quantifiable, surplus, enforceable, and permanent.

31. **Can emission reductions outside a nonattainment area impact the nonattainment area's air quality?**

Emission reductions which occur outside a nonattainment area may be eligible for SIP credit where the benefit of the reductions to the nonattainment area can be demonstrated and, as required of all reductions, meet the basic Clean Air Act requirements for the crediting of such reductions for SIP credits. In most cases, benefits will arise from reductions upwind of, and in close proximity to, the nonattainment area.

32. **How is the air quality impact from reductions outside the nonattainment area determined?**

Air quality modeling is normally used to determine the impact on a nonattainment area of emissions from outside the area. Air quality models that may be used for this purpose include dispersion and photochemical models (such as the Urban Airshed Model (UAM-V) and the Comprehensive Air Quality Model with Extensions (CAMx)). For more information on air quality models, please refer to EPA's Support Center for Regulatory Models (SCRAM) website at http://www.epa.gov/ttn/scram/.

STEP 4 - ***Provide a mechanism to validate or evaluate the effectiveness of the project or measure.***

33. **What is the purpose of STEP 4?**

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.

34. **What type of validation or evaluation process is appropriate for SIP credit to be granted?**

At a minimum, sufficient information should be made available to verify that the project or measure was implemented as proposed. For instance, if a State estimated energy savings from a program to provide incentives for changeover to more energy efficient air conditioners, then the most basic evaluation would be to determine if the incentive program was fully implemented. The next step would be to determine participation and project energy savings based on participation. A final step would be to evaluate the assumptions used to predict where the emissions were reduced. For example, where appropriate, the validation process could include a review of the total electricity used or generated before and after a measure is implemented, or an evaluation for any anticipated change in dispatch resulting from a measure.

In almost all cases, specific monitoring, record keeping and reporting requirements will be necessary to quantify the actual amount of SIP credit generated. This information will vary according to the nature of the project and initiative. The actual level of detail and necessary information will be affected by such things as the method used to determine the credit, as well as the magnitude and location of the credit generated and the tools available to track and monitor discrete results.

35. **What are some examples of specific measures which could be used to validate or evaluate effectiveness of a measure in achieving the estimated emission reductions?**

EPA's Office of Atmospheric Programs is currently developing a Monitoring and Verification guidance for use with energy efficiency and renewable energy set aside programs. A copy of that guidance will be available on EPA's website when it is issued. For information on the current status of the guidance, please contact Art Diem at 202-343-9340 or diem.art@epa.gov.

36. **What happens if the validation or evaluation shows results different than the initial emission reductions estimated?**

The State is responsible for assuring that the reductions credited to the SIP occur. As part of the process to gain approval of emissions reductions credit in a SIP attainment or ROP demonstration, the State would need to make an enforceable SIP commitment to monitor, assess and report on the emission reductions resulting from the measure and to remedy any shortfalls from forecasted emission reductions in a timely manner. In the circumstance where the actual emission reductions achieved is more than the amount projected, credit for the additional emission reductions may be taken.

37. **Are there some cases, or examples, of circumstances where it is not appropriate to apply emission reductions from energy efficiency or renewable energy for SIP purposes? In other words, what basic criteria could disqualify a project up front from generating SIP credits**?

(A) Projects that are already accounted for in the SIP attainment demonstration would not qualify for additional SIP credit.

(B) To be creditable, emissions that are being reduced must be included in the inventory used for the attainment demonstration.

(C) To be creditable, the emissions being reduced must be shown to impact the nonattainment area. This may be accomplished through airshed or dispersion modeling or some other methodology, if it can be clearly justified.

Section C: The SIP Process for Crediting Reductions in Emissions from Energy Efficiency and/or Renewable Energy Measures

38. **What should a State submit to EPA to support the incorporation of an energy efficiency or renewable energy measure to reduce emissions in a SIP?**

(A) Identify and describe the measure to reduce emissions;

(B) Provide a rationale supporting the methodology associated with the quantification and verification of the emission reductions from the energy efficiency or renewable energy measure;

(C) Include projections of emission or pollutant reductions attributable to the measure, along with relevant technical support documentation;

(D) Show that the sum of all voluntary or emerging measures does not exceed the percent limit under our policy for " Incorporating Voluntary and Emerging Measures in a SIP."

(E) Contain enforceable requirements to implement, track, and monitor the measure;

(F) Provide a plan to monitor, evaluate, and report the resulting emissions effect of the measure;

(G) Commit to remedy any SIP shortfall in a timely manner as described above if the measure does not achieve projected emission reductions; and

(H) Meet all other applicable requirements for SIP revisions under sections 110 and 172 of the CAA.

Section D: Contact Information

39. **Who should you contact for additional information?**

State agencies, the regulated community and members of the public with questions concerning a case-specific application of this guidance should contact the EPA Regional Office with responsibility for air quality planning in the area where SIP credit is being sought.

For general questions regarding the quantification of emissions reductions, please contact Art Diem of EPA's Office of Atmospheric Programs at 202-343-9340 or diem.art@epa.gov.

For general questions concerning the process for crediting of emissions reductions, please contact David Solomon of EPA's Office of Air Quality Planning and Standards at 919-541-5375 or solomon.david@epa.gov.

Appendix A: TOOLS AND RESOURCES

There are several models which are available to aide in predicting how electric generating systems may react to changes in load. These models typically are a key component of any method used to estimate emission changes due to load and demand changes from energy efficiency and renewable energy measures. The models generally fall into two categories: planning models and dispatch models. Planning models' strengths are in their analysis of capacity additions and usually focus on longer time frames than dispatch models. Dispatch models' strengths are related to how they predict which plants are dispatched at a particular moment of time for a given generation fleet, and usually focus on a particular grid and shorter time frames than planning models.

The following list contains examples of planning models, dispatch models, and resources and references.

Planning Models

1. Integrated Planning Model (IPM) – owned and operated by ICF
   National Planning Model. Used in NOx SIP Call analysis and by WRAP for EE/RE measures for Regional Haze Goals. Integrates allowance market into analysis.
   http://www.icfconsulting.com/markets/energy/ipm.asp

2. DOE's National Energy Modeling System (NEMS),
   http://www.eia.doe.gov/oiaf/aeo/overview/

3. MARKAL model
   http://www.nescaum.org/projects/ne-markal/index.html

Dispatch Models

4. Proprietary Hourly Power System Evaluation Model (PROSYM) model – licensed by the Henwood Energy Services.
   Chronological dispatch model. Used by Synapse Energy for OTC Workbook.
   http://www.hesinet.com/enerprise-index.html

5. GE MAPPS –
   Chronological dispatch model.

6. ELFIN – proprietary product of the Environmental Defense Fund
   Load duration curve dispatch simulation model
   EDF Experts on ELFIN Model:
   http://www.environmentaldefense.org/bysubject.cfm#elfin

7. PROMOD – licenced by New Energy Associates
   Frequently used by the electric utility industry.
   PROMOD IV website.
   http://www.newenergyassoc.com/products/promod/promod_detail.html

8. Distributed Resources Net Emissions Model (DR NEMO) owned and operated by the Center for Clean Air Policy. Used for analysis of public benefit charge funds in New York and Illinois.

Additional Resources and References

9. eGRID – EPA's Emissions and Generation Resource Integrated Database. Contains historical information that is used by many analyses.
http://www.epa.gov/cleanenergy/egrid/index.htm

10. CEM data – Data sets and publications from the Clean Air Markets Division of EPA
http://cfpub.epa.gov/gdm/index.cfm?fuseaction=iss.progressresults

11. OTC Emission Reduction Workbook, Released November 12, 2002 – Based on PROSYM Modeling.
http://www.otcair.org/document.asp?fview=Report#

12. STAPPA/ALAPCO's Clean Air Climate Protection Software (CACPS)
http://www.cleanairworld.org/software.html

13. NREL's Hybrid Optimization model
http://www.nrel.gov/homer

14. Resource Systems Group used in MD SIP for Montgomery County Wind Purchase.
http://www.rsginc.com/energy/studies.htm

15. Quantification of Environmental Benefits For Wisconsin's Focus on Energy Pilot Program
http://www.doa.state.wi.us/docs_view2.asp?docid=1701

16. "Estimating the Emission Reduction Benefits of Renewable Electricity and Energy Efficiency in North America: Experience and Methods" prepared by Synapse Energy Economics, et al. for the Commission for Environmental Cooperation, September 22, 2003
http://www.cec.org/files/pdf/ECONOMY/Experience&Methods-2e_EN.pdf
or
http://www.synapse-energy.com/Downloads/Synapse-report-cec-displacement-background.pdf

17. Renewable Energy Modeling Series – This web page includes presentations and summaries related to how energy models incorporate renewable energy.
http://www.epa.gov/cleanenergy/renew_series.htm

18. US Department of Energy's Efficiency and Renewable Energy Web Site
http://www.eere.energy.gov/

19. The National Renewable Energy Lab (NREL)
http://www.nrel.gov

20. Clean Air Through Energy Efficiency, 2003 Texas SB5 Report from the State Energy Conservation Office (SCO).
http://www.seco.cpa.state.tx.us/sb5report2003.pdf

21. Renewable Energy Systems Laboratory at Texas A & M University's Emissions Reduction Calculator
http://www.cooltexasbuildings.net/cooler_buildings/residential/ESL.htm

22. Western Regional Air Partnership, Air Pollution Prevention Forum
http://www.wrapair.org/forums/ap2/index.html

Appendix B: EXAMPLE QUANTIFICATION

This example is provided for illustrative purposes only and is not intended to represent an official EPA position on the information presented

Wind Energy Purchase

BACKGROUND

In this example, the area has quantified the amount of SIP credit by using a dispatch methodology. The method used data available from publicly accessible federal databases, as well as actual data obtained from utilities that would be predicted to be affected by the wind generator. The emission reductions are to be credited for rate of progress and attainment demonstrations purposes.

Local governments in a nonattainment area have committed to purchasing wind energy for a term of 5 years. The wind energy is required to originate from a facility having proximity to the nonattainment area such that NOx emissions would be displaced in the nonattainment area. The provider of the wind energy is to report the actual amount of wind energy purchased by the county under its contract. Because the area is in a cap and trade region, the purchaser will permanently retire allowances in an amount equal to the proposed SIP credit calculated on an ozone season basis.

TECHNIQUE USED TO ESTIMATE EMISSION REDUCTIONS

The calculation method begins by estimating which power plants would reduce their operations when the Backbone Mountain wind farm location in Garrett County, Maryland comes online. The estimated electricity generation at the wind energy power plant was based on an estimated schedule of the wind power production for the summer ozone season (by time of day, week, and month), actual wind anemometer measurements and actual meteorological data. The Backbone Mountain facility is located within a 50 mile radius of the only current wind farm in the area (Mountaineer Plant) and proposed facilities in the Allegheny Mountains. Emission reductions associated with generation occurring at these two wind facilities are expected to be similar. The annual capacity factor for this analysis is estimated at 37 percent and the summer season capacity factor of the wind facility is estimated at 20 percent.

The prospective calculation used actual dispatch information and actual and real renewable plant specifications. Dispatch information from plants located in the PJM[8] West power control area were used to estimate which plants would be affected by the wind power generation. The analysis resulted in energy displacement occurring at 10 facilities (3 facilities in Maryland, 6 facilities in West Virginia, and one facility in Pennsylvania). Generation data was

---

[8] PJM Interconnection is the Independent System Operator and Regional Transmission Organization that coordinates the movement of electricity in all or parts of Delaware, Illinois, Maryland, New Jersey, Ohio, Pennsylvania, Virginia, West Virginia and the District of Columbia.

taken from the most recent U.S. Energy Information Administration data from these plants. The emission rate information was taken from the most recent continuous emission monitors information reported to the U.S. Environmental Protection Agency. The estimated generation-weighed emission rate of the displaced electricity was 5.72 pounds of NOx per MWh.

Taking a conservative approach, the amount of proposed SIP credit was one half of the calculated emission reductions. Additionally, a retrospective analysis of power plant activities after the new wind energy plants come online will be performed.

PROJECTED REDUCTIONS

The described program is expected to purchase a total 30.3 MWh of wind power energy annually, with a projected reduction (to be used as SIP credit) of 0.05 tons per day of NOx during the ozone season.

REFERENCES

Plan to Improve Air Quality in the Washington, DC-MD-VA Region: State Implementation Plan (SIP) "Severe Area Sip" Demonstrating Rate of Progress for 2002 and 2005; Revision to 1990 Base Year Emissions; and Severe Area Attainment Demonstration for The Washington DC-MD-VA Nonattainment Area, February 19, 2004, pp. 7-77 through 7-80; Appendix J, pp. J-20, J-23, J-71 through J-76.

For further information please contact Christopher Cripps at (215) 814-2179 or Marilyn Powers at (215) 814 2308 of EPA's Region 3 office.

Appendix C: EXAMPLE QUANTIFICATION

This example is provided for illustrative purposes only and is not intended to represent an official EPA position on the information presented

Dallas Texas Energy Efficiency Proposal

BACKGROUND

The Texas Commission on Environmental Quality submitted a SIP revision (see references below) to EPA in March 2003 for the Dallas/Fort Worth Area attainment demonstration for the ozone National Ambient Air Quality Standards. Among the control measures in the plan are energy efficiency measures required under State Senate Bills 5 and 7.

Senate Bill 5 requires each political subdivision in 41 counties (which are nonattainment areas or near nonattainment areas) to submit plans to the Texas State Energy Conservation Office to reduce electricity consumption by 5percent per year for five years, beginning January 1, 2002. Senate Bill 7 and Chapter 25 of the Public Utility Commission of Texas' rules require retail electricity providers to implement energy efficiency measures that will reduce annual growth in electricity demand by ten percent by January 1, 2004 and each year thereafter. The energy savings resulting from the SB 7 and SB 5 measures are expected to achieve reductions of NOx emissions from electricity generators.

TECHNIQUE USED TO ESTIMATE EMISSION REDUCTIONS

The emission reduction estimates for the proposed Dallas Fort Worth SIP revision included reductions expected to occur within the four non-attainment counties (Denton, Collin, Dallas, and Tarrant) and the eight near nonattainment counties (Johnson, Ellis, Kaufman, Parker, Rockwall, Hunt, Hood, and Henderson). The EPA's Office of Atmospheric Programs, in coordination with the Texas Commission on Environmental Quality (TCEQ), Electric Reliability Council of Texas (ERCOT) and Public Utilities Commission (PUC), developed a methodology for quantifying NOx emission reductions resulting from the energy savings due to anticipated energy efficiency measures. The methodology considered the amount of expected energy savings (kWh) in different areas of the State above original SIP baseline assumptions. The result was an estimate of the emission reductions at each power plant within the ERCOT region. The reductions for each power plant were then summed for each county.

A major source of the data used was contained in the EPA's Emissions and Generation Resource Integrated Database (eGRID)[9]. eGRID is a comprehensive data base of information on the environmental attributes of the U.S. electric power system, and provides emissions and resource mix data for every power plant, electric generating company, State, and region of the U.S. power grid. At each of these levels, eGRID reports data on emissions of sulfur dioxide, nitrogen oxide, mercury, and carbon dioxide, as well as power plant operating data such as heat input, generating capacity, and net generation. The data base is assembled from a variety of data

---

[9] eGRID is available at http://www.epa.gov/cleanenergy/egrid

collected by the EPA, the Energy Information Administration (EIA), and Federal Energy Regulatory Commission (FERC). Major electronic data sources include EPA's Emissions Tracking System/Continuous Emissions Monitoring (ETS/CEM), National Air Pollutant Emission Trends (NET) fossil fuel steam component, EPA Electric Utility Steam Generating Units Hazardous Air Pollutant Emission Study: 1999 Mercury Information Collection Effort Data Base, EIA Forms EIA-759, -767, -860A, -860B, and -861, and FERC Forms FERC-423 and -714.

One basic assumption included in the analysis was that no electricity is imported into or exported out of the ERCOT region, although, in reality, some electricity is imported into or exported out of the ERCOT North America Electric Reliability Council (NERC) region. However, the amount that is exchanged is relatively small. For example, in 1998, 1,193,479 MWh was imported from the Southwest Power Pool (SPP) and 1,004,568 MWh was exported into SPP, resulting in a net interchange of 188,911 MWh. In comparison, 296,042,502 MWh was generated within the ERCOT region in the same year. Therefore, the amount of electricity imported into and exported out of the ERCOT region is less than one-half of a percent of the electricity generated within the ERCOT region.

The first step in the analysis estimated how much electricity generation would be curtailed in each service territory for a given amount of electricity demand savings occurring in a particular service territory. Within the ERCOT region there are several power control areas. These power control areas are related to the service territories mentioned above and electricity flows between these power control areas. The amount of electricity generated in each of these power control areas varies greatly, as do the fuel sources and emission characteristics of electricity generated. The eGRID database contains information about how much electricity was exchanged between each power control area within the ERCOT region in 1998. This information, along with the amount of electricity generated within each power control area, was used to determine where the electricity originates. For cases where two adjacent power control areas reported different quantities of exchanged electricity, the method relied on the average of the two values. The method also presumed that the proportions of electricity originating from each power control area in 1998 will remain the same in 2007. The annual generation and the annual interchange of electricity was configured into simultaneous equations, even though the electricity is not exchanged simultaneously.

The next step in the analysis was to estimate the location of electricity generation reductions to the power plant level within each particular power control area. eGRID power plant level data for all of the generators in the ERCOT region was used in this step. Electric generating units that are expected to be retired by 2007 were removed from the calculation. New generating units and expected operating characteristics (annual generation, capacity factor, and emission rates) were added to the eGRID power plant level data.

Next, how much of each power plant's generation could potentially be affected by energy efficiency measures was estimated. Instead of using dispatch modeling, these values were determined by using the power plant's fuel type and capacity factor. First, the generation from nuclear and hydroelectric power plants are assumed to not be affected by energy efficiency measures. Nuclear units are normally baseloaded units (among the first units to be dispatched to accommodate electricity demand) and hydroelectric power plants usually generate electricity whenever adequate water supplies are available. Capacity factor is a measure of a power plant's generation relative to its maximum capacity over a given period of time and is generally a value between 0 and 1. eGRID lists power plant specific capacity factors on an annual basis. In the analysis, power plants that have a capacity factor of 0.8 or greater are considered to be baseloaded units and none of their generation would be affected by energy efficiency measures. Power plants that have a capacity factor of 0.2 or less are considered to be "peaking" units and all of their generation could be affected by energy efficiency measures. Power plants with capacity factors between 0.2 and 0.8 are considered to have a portion of their generation possibly affected by energy efficiency measure.

Based on the previous steps, one can then distribute the amount of energy efficiency to each of the control areas and to each of the power plants with the power control areas. Within each power control area, all of the generation that could be affected by energy efficiency measures is summed. Each power plant's potential reduction in generation is then divided by this total amount, expressing the figures as a percent of the power control area total. This procedure presumes that there are no transmission constraints within each power control area. The information from the previous steps are combined so that the generation reductions for each power plant within ERCOT is determined for a given amount of electricity demand savings that is implemented in a particular service territory.

Each power plant's emission factor for NOx is applied to the generation reduction to determine the emission reduction, with eGRID the primary source of data for this step. The final step is to add up the power plant level estimated emission reduction data into countywide totals.

The emission reduction analysis will be refined as part of the mid-course review process, with the proposed tonnage associated with energy efficiency measures to be based on the most recent available given inputs. The commission also expects the inputs to be updated prior to adoption if more information becomes available. Change in input parameters could result in a change in the projected emission reduction.

PROJECTED REDUCTIONS

The Senate Bill 5 measures are estimated to reduce electricity use by 401,772 MWh in 2007 in the San Antonio, Reliant, and TNMP service Areas. The Senate Bill 7 measures are estimated to reduce electricity use by 510,383 MWh in 2007 in the AEP West, Reliant, TNMP, and TXU-ONCOR Service Areas. As of the date of this document, the total resulting NOx reductions estimated to occur in the12 counties composing the Dallas-Fort Worth non-attainment area and near-non-attainment area is 0.7 tons per day in 2007.

REFERENCES

Revisions to the State Implementation Plan (SIP) for the Control of Ozone Air Pollution Attainment Demonstration for the Dallas/fort Worth Ozone Nonattainment Area, Rule Log No. 2002-070a-sip-ai, March 5, 2003
http://www.tnrcc.state.tx.us/oprd/sips/mar2003dfw.html#revision