ENERGY EFFICIENCY: THE SLIP SWITCH TO A NEW TRACK TOWARD COMPLIANCE WITH FEDERAL AIR REGULATIONS

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ABOUT ACEEE

ACEEE is a nonprofit organization that acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. For more information, see http://www.aceee.org. ACEEE fulfills its mission by:

- Conducting in-depth technical and policy assessments
- Advising policymakers and program managers
- Working collaboratively with businesses, public interest groups, and other organizations
- Organizing conferences and workshops
- Publishing books, conference proceedings, and reports
- Educating consumers and businesses

Projects are carried out by staff and selected energy efficiency experts from universities, national laboratories, and the private sector. Collaboration is key to ACEEE's success. We collaborate on projects and initiatives with dozens of organizations including federal and state agencies, utilities, research institutions, businesses, and public interest groups.

ACEEE is not a membership organization. Support for our work comes from a broad range of foundations, governmental organizations, research institutes, utilities, and corporations.

EXECUTIVE SUMMARY

Over the next decade a suite of federal regulations required under the Clean Air Act will impose compliance obligations and set standards for multiple air pollutants. These regulations will help the United States transition to a clean energy economy by creating a demand for low cost, rapidly deployable emissions reduction measures. Significant investment in the energy sector will be needed to update or replace old, unregulated coal-burning facilities and comply with federal air regulations in the next decade, creating a strong incentive to reduce compliance costs.

Energy efficiency has proven to be a least-cost resource when compared with new generation capacity. ACEEE's research has found that the average cost to a utility for energy efficiency measures is 2.5 cents per kilowatt-hour (kWh); in comparison, new generation sources can range from 6 to 15 cents per kWh. In addition, energy efficiency can be quickly deployed (as compared to permitting and construction of a new power plant) and there are vast quantities of untapped energy savings throughout the United States.

There are multiple opportunities for energy efficiency to play a role in federal air regulations. Whether energy efficiency is a means of direct compliance or a complementary tool to reduce the cost of compliance, energy efficiency has a role to play to ensure that we find the lowest cost approach to cleaning the air. Energy efficiency can be used in the upcoming Cross-State Air Pollution Rule (CSAPR), as part of the National Ambient Air Quality Standards (NAAQS) State Implementation Plan (SIP) process, and in the context of multiple permitting rules. This report is intended to serve as a guide to the opportunities where energy efficiency can be leveraged within these federal air regulations.

The world of air regulation is complex, filled with historical precedent, legal case law, technical modeling, and diverse stakeholders. This report is not a comprehensive resource; rather it provides short overviews of selected air regulations where energy efficiency could be a useful tool. It contains links and references that can be used to find additional detailed information. The report also provides examples of the experiences that some have had attempting to use energy efficiency in the context of these air regulations. Finally, the report concludes with a brief and preliminary discussion of potential actions that could help states and other stakeholders use energy efficiency, either as a tool or for direct compliance with federal air regulations. While this is an ambitious range of topics to cover in one report, it is our intent that this document will facilitate further discussion on these topics and serve as a framework from which states, policymakers, advocates, and other stakeholders can identify which opportunities are most applicable to them and plans of action to achieve clean air at the lowest cost to ratepayers and shareholders.

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BACKGROUND

The missions of utility and air pollution regulators have evolved separately and differ greatly from one another. Historically, cooperation between these two regulatory groups has been somewhat limited in spite of the fact that they have mutual interests where collaboration could help the two bodies advance their respective agendas.

Investor-owned utilities providing electric services are regulated by state public utility commissions (PUCs). Historically, the primary responsibility of PUCs has been to set electricity rates that utilities may charge for services. PUCs also engage in resource planning with utilities to ensure that electricity is reliably supplied and that there is enough generation capacity to meet consumer demand. Investor-owned utilities are regulated monopolies so their investment decisions and spending are subject to PUC approval. The Mission Statement of the Oregon PUC is a good example of the role of PUCs across the country:

"Ensure that safe and reliable utility services are provided to consumers at just and reasonable rates while fostering the use of competitive markets to achieve these objectives" (PUC 2009).

In short, PUCs tend to focus on electric reliability and rates. For many states, regulations, approaches, and even vocabulary have evolved to reflect these goals and focus the efforts of the PUCs.

The pursuit of reliability and reasonable rates led many PUCs to approve or order ratepayer-funded energy efficiency programs starting in the 1980s. The number of states with utility energy efficiency programs has grown over the past three decades so that they are now a standard part of the utility regulatory process in almost every state. In 2010 the national total for efficiency program spending for electric utilities across all states was over $4.5 billion and nearly all states reported energy efficiency spending (Sciortino et al. 2011).

AIR REGULATIONS FOR UTILITY REGULATORS

The Clean Air Act is implemented by the U.S. Environmental Protection Agency (EPA) and defines the agency's responsibilities for protecting and improving the nation's air quality. EPA's mission is to protect human health and the environment. To achieve this mission, EPA implements a variety of programs that focus on:

- reducing outdoor, or "ambient", concentrations of air pollutants that form smog, haze, particle pollution, and acid rain—and harm public health and welfare;
- reducing emissions of toxic air pollutants that are known to, or are suspected of, causing cancer or other serious health effects; and
- reducing greenhouse gas (GHG) emissions that contribute to climate change.

Under the Clean Air Act, EPA sets maximum concentrations of certain pollutants that can be present in the air via the National Ambient Air Quality Standards (NAAQS). Areas where the air does not meet allowable limits for a common air pollutant are called "nonattainment" areas.

States usually do much of the planning for cleaning up common air pollutants. They develop plans, called State Implementation Plans (SIP), to reduce air pollutants to allowable levels.

In addition to the SIP process, EPA and states use permit systems that set limits on the emissions of individual polluting sources such as power plants, factories, and other pollution sources.

Ambient standards, source-specific emission limits, and technology requirements are typical "command and control" approaches to air regulation. In contrast, market-based regulation, such as cap-and-trade, caps pollution and allows greater flexibility of compliance options by polluting sources.

Adapted from EPA's Web site:

- http://www.epa.gov/air/caa/
- http://www.epa.gov/air/peg/elements.html
- http://www.epa.gov/air/peg/cleanup.html

The first Clean Air Act was passed in 1963[1] and was significantly expanded in 1970.[2] During this time there was an increasing national consciousness of the importance of environmental regulations, and states had compliance and enforcement obligations under the Clean Air Act. Most states and many localities established an agency or office to manage air quality and regulate air pollution. These state agencies, often named a "Department of Environmental Protection" (DEP) or a "Department of Natural Resources" (DNR), employ people to protect public health by regulating pollution emitted by activities in the state. The mission statement of the South Dakota Department of Environment and Natural Resources (DENR) is representative:

"The mission of DENR is to protect public health and the environment by providing environmental monitoring and natural resource assessment, technical and financial assistance for environmental projects, and environmental regulatory services; all done in a manner to protect South Dakota's environment and natural resources for today and tomorrow…" (DENR 2011).

The processes, approaches, and vocabulary in state DEPs have evolved to uphold and ensure public health and welfare.

Both PUCs and DEPs have had success in achieving their individual missions. The modern electric grid has reliably met consumer demand for millions of customers across the U.S. States have also made great strides in improving air quality over the last 40 years (EPA 2010c).

PUCs and DEPs have separate, but not mutually exclusive goals. In particular, energy efficiency is good for cost-effectively ensuring reliability while protecting the environment. Reducing power generation reduces pollutants associated with the generation of electricity, such as mercury, nitrogen oxides, sulfur dioxide, particulates, and greenhouse gases. Recognizing this connection, the EPA encouraged states to use energy efficiency as an air pollution control measure as early as 1995 (EPA 1999b). Since then the EPA has continued to provide opportunities for states and electric generating units to use efficiency as a

UTILITY REGULATION FOR AIR REGULATORS

Most electricity and natural gas customers in the United States are served by investor-owned utilities (IOUs), which are private companies owned by shareholders. The rates IOUs charge customers are regulated because of the monopoly status granted them as a "public" utility. Under traditional rate regulation, Public Utility Commissions (PUCs) determine the revenues that an IOU is authorized to recover from customers. An IOU's authorized revenues include fixed costs (e.g., personnel) and variable costs (e.g., fuel), plus a rate of return on capital investments (e.g., power plants).

In most states, PUCs require utilities to implement energy efficiency programs. These end-use efficiency programs are often referred to as "demand-side management" (DSM) programs, which are defined as:

"The planning, implementation, and monitoring of utility activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of electricity demand. It refers to only energy and load-shape modifying activities that are undertaken in response to utility-administered programs. It does not refer to energy and load-shape changes arising from the normal operation of the marketplace or from government-mandated energy efficiency standards" (source: EIA Glossary http://www.eia.doe.gov/glossary/index.cfm).

Examples of energy efficiency measures that may be included in a DSM program include: upgraded insulation, energy efficient appliances and lighting, and adjusting a boiler's controls to optimize performance.

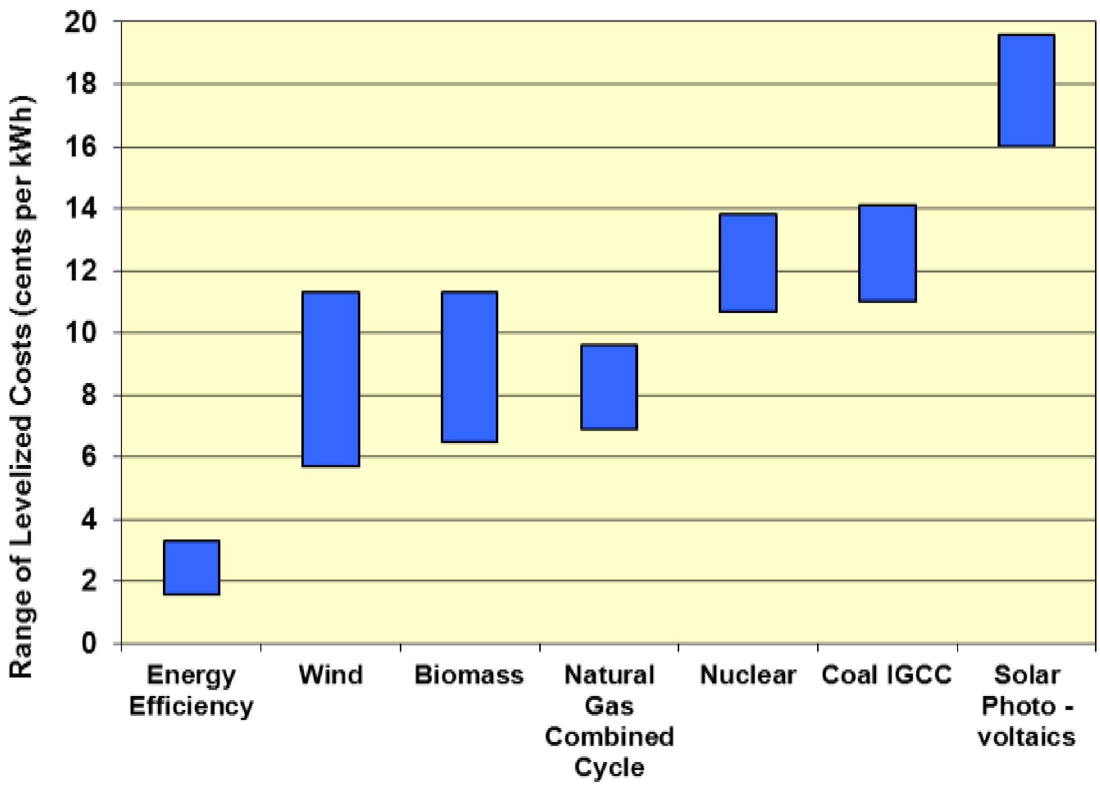
The success of an efficiency measure is often evaluated, measured, and verified using standard industry practices that utility regulators must approve. This process is referred to as EM&V.

[1] *Clean Air Act of 1963,* Public Law 88-206, 77 Stat. 392, 1963-12-17
[2] *Clean Air Act Extension of 1970.* Public Law 91-604. 84 Stat.1676. 1970-12-31.

tool for complying with air regulations. Efficiency can be deployed quickly and cost effectively. Furthermore, there is a vast potential for energy savings in the United States. Productive investments in energy efficiency can reduce our energy consumption by 40 to 60 percent by 2050 (Laitner et al. 2012). In spite of all of these attributes, states rarely use energy efficiency as a tool to comply with the EPA's regulations.

Over the next decade a suite of federal air regulations will impose compliance obligations for multiple pollutants on emission sources. These air regulations create a demand for low cost and rapidly deployable emissions reduction measures. Investment of $70–180 billion will be needed to comply with federal air regulations in the next decade, creating a strong incentive to reduce compliance costs (Celebi et al. 2010). Energy efficiency has proven to be a least-cost resource when compared with new generation capacity. ACEEE's research has found that the average cost to a utility for energy efficiency measures is 2.5 cents per kilowatt-hour (kWh); in comparison, new generation sources can range from 6 to 15 cents per kWh—see Figure 1 (Friedrich et al. 2009; Lazard 2009).

Figure 1: Levelized Utility Cost of New Electricity Resources



In addition to providing cost-effective emission reductions, energy efficiency helps to maintain and improve the reliability of the electrical grid by:

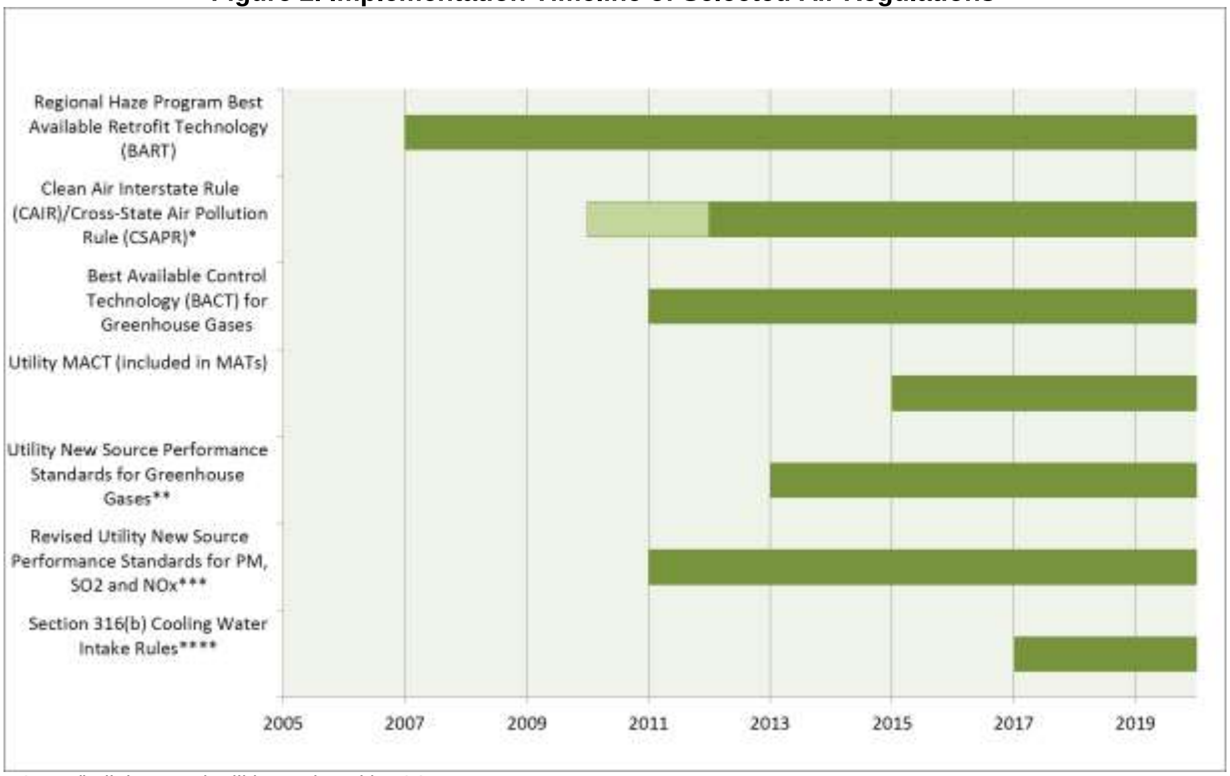
1) reducing demand and the need to deploy peaking generation resources; and
2) reducing the load and stress imposed on various points in the power distribution network.

Energy efficiency is a tool that states and utilities can't afford to overlook. This report discusses opportunities to use energy efficiency to achieve environmental goals either through direct compliance or by lower compliance costs (a "complementary policy" approach). It discusses past experiences using these opportunities, and concludes with recommendations for ensuring that energy efficiency can be the low cost, rapid solution that will benefit both ratepayers and utilities while helping states meet their environmental requirements.

OPPORTUNITIES AND EXPERIENCE

Upcoming federal air regulations will require action from states and polluting sources over the course of the next decade. Figure 2 shows some of the major regulations and significant implementation deadlines impacting electric utilities. The graphic demonstrates that the power sector is facing near-term deadlines for multiple pollutants.

Figure 2. Implementation Timeline of Selected Air Regulations



* CAIR (in light green) will be replaced by CSAPR
** EPA is scheduled to finalize NSPS for greenhouse gases in 2012. The compliance deadline here is an estimation.
*** Revised NSPS for SO2, NOx and PM affect units that begin construction, modification, or reconstruction after May 3, 2011.
**** A cooling water intake rule (Section 316(b) is yet to be finalized. The compliance deadline here is an estimation.
***** SIP Deadlines for 8-Hour Ozone National Ambient Air Quality Standards (NAAQS) are likely to also be occurring during this timeframe. The Clean Air Act (CAA), Section 110, requires states with areas that fail to meet the national ambient air quality standards (NAAQS) to develop a State Implementation Plan (SIP) describing how the state will attain and maintain the NAAQS. SIPs can be required for updated standards put in place for any of six criteria pollutant.

The EPA and Congress explicitly provided for energy efficiency as a means for meeting certain air emission requirements over 20 years ago (EPA, 1999b). However, states and electric utilities have had limited success incorporating efficiency using these opportunities.

While there are a variety of ways energy efficiency can be used to help states and utilities meet their federal air quality obligations, we focus on opportunities where energy efficiency can be used as a tool within cap-and-trade programs, permitting of stationary sources, and State Implementation Plans (SIPs). This section provides a brief overview of these three areas, including examples of the experience and challenges that have arisen in the application of these opportunities.

Cap and Trade

For several decades the EPA and states have used a market- or incentive-based approach to air regulation called “cap and trade.” A cap-and-trade approach places a limit (i.e., the “cap”) on the amount of pollution emitted from regulated sources within a defined region and set of facilities. While an entity within the group of regulated sources does not have a specific limit on how much it may emit under the cap, it must obtain rights to a portion of the cap that is at least equal to its actual emissions.[3] A regulated source obtains a share of the authorized cap by owning "allowances," which are a fraction of the cap. Each allowance thus represents a ton (or some other measure) of the regulated pollutant. Buying and selling ownership of allowances is the "trade" part of a cap-and-trade program. At the conclusion of a predetermined time period (e.g., a year or a season), the regulated source complies with the regulation by submitting allowances to the regulator in an amount equal to its emissions during the same time period.

One opportunity for end-use energy efficiency to be used in a cap-and-trade approach occurs when the allowances are made available in the market. In some cases the allowances are allocated to polluting sources based on the amount of fuel (such as coal or natural gas) each source consumes, often referred to as an "input-based" approach. Such an approach treats polluting sources the same, regardless of how effectively they use the fuel they consume. An allocation approach that rewards efficient use of resources is based on the amount of electricity that is generated by a source instead of the amount of fuel consumed by the source, called an "output-based" approach. By using the latter, regulators could award allowances to end-use efficiency projects based on the amount of demand for electric generation that is satisfied through the efficiency measure. An output-based approach accounts for all of the useful energy output from a pollution source, and can include heat (thermal), electric, and end-use efficiency. Output-based allocation has been used in some instances, such as the Connecticut NO_x SIP Call allocation to baseline electric generating units; however, it has not been widely adopted by states.[4]

States in the Regional Greenhouse Gas Initiative (RGGI) program, an electricity sector cap-and-trade program for greenhouse gases in ten Northeastern states, have used an auction approach to allocate allowances. Under an allowance auction approach, energy efficiency can be an attractive tool to reduce compliance costs because efficiency projects meet demand through reduced emissions and therefore reduce the number of allowances that need to be purchased by a utility. Auctions have the added benefit of generating income for states. In the RGGI program, $952 million in proceeds have been generated for states through the 14 auctions that have taken place since 2008 (RGGI 2011a). Many of the revenues generated have been used to fund energy efficiency programs that further reduce emissions. A recent analysis found that efficiency measures funded by RGGI proceeds will save customers in RGGI states nearly $1.1 billion on electricity bills, and an additional $174 million on natural gas and heating oil bills, for a total of $1.3 billion in savings over the next decade (Hibbard et al. 2011).

A second way to include end-use energy efficiency in a cap-and-trade approach is through a set-aside mechanism. The cap in many cap-and-trade programs limits emissions from multiple states. In some of these programs, the total cap is divided between states. Each state's share of the cap is referred to as its "budget." A state will generally have flexibility in how it allocates its budget. Some states have set aside a portion of their budgets specifically for end-use efficiency. This set-aside comes from within the cap (in contrast to being an additional offset) and it may be rewarded for energy efficiency measures similar to those authorized through an offset mechanism. Energy efficiency measures awarded allowances from a set-aside would have to comply with requirements of the cap-and-trade program such as verification and quantification of energy savings.

The third approach is called an "offset" mechanism. An offset is a reduction in pollution from an activity at a source not already regulated by the cap-and-trade program. For example, in a cap-and-trade program that regulates greenhouse gases from electric generating units, an offset may be created through efficiency measures that reduce on-site fuel use in a building. If an efficiency

[3] Inclusion in a cap-and-trade program for a given pollutant does not preclude emission limits from some other program for the same pollutant such as a permit that includes minimum performance standards.
[4] An output-based approach can be used in the context of permitting and other approaches to air regulation as well as a cap-and-trade allocation. For additional detail on opportunities and experience with output-based approaches see EPA (2004b).

measure meets the requirements of the cap-and-trade program, such as verification and quantification of energy savings, the project may be awarded an offset allowance. The offset is a new allowance that is generated in addition to those already allowed as part of the cap. Offsets are then sold to polluters in the regulated sector and can be used for compliance.

Below we list specific opportunities for end-use efficiency to play a role in air regulation compliance (either directly or by reducing associated costs as a complementary strategy) and discuss experience with auctions, offsets, and "set-asides" in the Title IV Acid Rain Program, NO_x SIP Call, RGGI, and Cross-State Air Pollution Rule (CSAPR) cap-and-trade programs.

Title IV Acid Rain Program

The EPA's Title IV Acid Rain Program included a "Conservation and Renewable Energy Reserve" (CRER) of 300,000 allowances that were set aside for utilities that implemented efficiency or renewable energy measures (42 U.S.C. 7651C[5]). A list of qualifying demand-side efficiency measures implemented in the residence or facility of a utility customer was provided (see 40 CFR Part 73, Subpart F, Appendix A(1)); however, measures not included in the list could qualify if they were cost-effective demand-side measures (not an educational program) consistent with an applicable least-cost plan or least-cost planning process that increased the efficiency of the customer's use of electricity. Electric generators could earn one allowance for every 500 MWh of energy savings.

EPA reported that it has issued about 49,000 allowances from the reserve, just 16 percent (EPA 2012b).[6] Approximately 250,000 allowances from this reserve went unused. Experts have speculated as to the reasons for the limited success of the CRER. The requirements for applying for, qualifying for, and verifying CRER allowances were a barrier while the market price of allowances was much lower than forecast (York 2003). In addition, limits were placed on the utilities that were allowed to request CRER allowances and the price of allowances on the market was lower than expected. As a result of these factors, facilities may have found it simpler (and cheaper) to purchase emissions allowances, rather than to demonstrate that they were eligible for CRER allowances. The CRER is discussed in greater detail in a previous ACEEE publication (York 2003).

NO_x SIP CALL

The NO_x SIP Call established a multi-state cap-and-trade program to reduce emissions of nitrogen oxides from large fossil fuel-fired boilers, combustion turbines, and combined cycle systems that sell electricity (NO_x SIP Call Model Rule, 1998). The EPA issued a model rule that functioned as a set of guidelines for states that put the rule into law. The EPA's guidance on the NO_x SIP Call Model Rule outlined a set-aside mechanism for states to award allowances for emissions reductions achieved through end-use efficiency measures (EPA 2004a). The EPA recommended a list of technologies that could potentially qualify for set-aside allowances, although it was up to each state to make the final determination of the actions that qualified (EPA 1999b). Eligible technologies fell into three groups: (1) lighting, HVAC, and refrigeration, (2) motors, and (3) other technologies. The EPA guidance recommended that efficiency projects should receive set-aside allowances for at least three years and that verification of energy savings from projects should occur annually. The guidance allowed states to choose their own measurement and verification approach and listed the U.S. Department of Energy's International Performance Measurement and Verification Protocol (IPMVP) as an available tool (DOE 2002). The guidance recommended awarding set-aside allowances for efficiency to actors outside of the regulated sector, providing an opportunity for the sponsors of end-use energy efficiency projects to earn a return on their investments.

[5] 42 U.S.C. § 7651c: US Code—Section 7651C: Phase I Sulfur Dioxide Requirements. http://codes.lp.findlaw.com/uscode/42/85/IV-A/7651c
[6] The total CRER allowances issued was 48,868. Of that total, 37,816 were for "Energy Conservation."

Several states created “set-aside” pools of 1-5 percent of the allowances in their budgets that were earmarked for efficiency (and renewables). Table 1 lists states with these set-asides.

Table 1. State Energy Efficiency NO_x SIP Call Set-Asides for Energy Efficiency and Renewable Energy

States	Percentage of Total NO_x Budget	Set-Aside Pool (Tons of Allowances Available)	Allowances Requested
Indiana	2%	1,115	NA
Maryland	3%	436	NA
Massachusetts	5%	643	Oversubscribed due to energy efficiency applications made on behalf of hundreds of small projects
New Jersey	5%	410	Nearly fully subscribed as of 2006
New York	3%	1,241	None as of 2006 due to delays in finalizing program guidance
Ohio	1%	454	76 allowances requested in 2006 (first year)

Sources: EPA 2005, 2006

States had limited success with this approach. In some states the transaction costs and administrative burdens were barriers. For example, in New York and Maryland, administrative requirements for applying were not initially agreed upon or made clear to potential applicants. In Massachusetts the entire set-aside pool was used, primarily because a state agency acted on behalf of ratepayers and submitted claims for ratepayer-funded energy efficiency programs in aggregate.

Regional Greenhouse Gas Initiative (RGGI)

RGGI is a cap-and-trade program to reduce greenhouse gas emissions. RGGI is not a federal regulation, but is included in our discussion because it is a multi-state cap-and-trade program that includes an opportunity for energy efficiency to support compliance and relies on an allowance allocation approach that directs significant funding to energy efficiency programs. Ten Northeastern and Mid-Atlantic states voluntarily committed to participating in the program by adopting the RGGI Model Rule (RGGI 2005, 2006, 2007).

The RGGI Model Rule includes detailed guidance on how end-use energy efficiency projects in buildings could be used to earn offsets. The guidance includes a range of activities including physical changes to facility equipment, modifications to a building, revisions to operating and maintenance procedures, software changes, and new means of training or managing users of the building or operations and maintenance staff. Offsets can be awarded for up to 10 years at a time. Emission reductions must be “real, additional, verifiable, enforceable, and permanent within the framework of a standards based approach” (RGGI 2008). There are also detailed reporting requirements that must accompany the submission of an application for offsets. In addition to the detailed application requirements, a project sponsor must obtain certification from an independent third-party verifier that emissions reductions occurred.

In a market-based cap-and-trade scenario, the question of whether an emissions reduction project goes forward often hinges on whether allowances can be purchased for less than the costs of the project on a per-unit reduction basis (i.e., if a project costs $20 per ton reduced to implement but allowances can be purchased for $15 per ton, then it makes more sense to purchase allowances). The costs of generating the allowances through an efficiency measure often include upfront project costs, and the cost of an independent third-party verifier, as well as risks that the offset stream won’t be approved by the regulator or that some unforeseen event will reduce the project benefits (e.g., a piece of equipment stops working, an efficient building burns down).

To date no offset projects of any kind have been registered on the RGGI CO_2 Allowance Tracking System (RGGI 2011b). The cost of purchasing RGGI allowances on the market has remained low and seems to be considerably less than the cost to generate an efficiency offset, due at least in part to the expense of the third-party evaluation, measurement and verification (EM&V) requirements as well as the risk that once a project is financed and completed the offsets would not be granted. If allowance prices are low, these costs and risks make funding an offset project unattractive.

In spite of the lack of activity surrounding RGGI offsets for energy efficiency, proceeds from the auction of allowances have created substantial investments in efficiency measures. As previously mentioned, $952 million in proceeds have been generated for states since 2008. A recent analysis found that efficiency measures funded by RGGI proceeds will save customers in RGGI states nearly $1.1 billion on electricity bills and an additional $174 million on natural gas and heating oil bills over the next decade (Hibbard et al. 2011).

Cross-State Air Pollution Rule (CSAPR)

In July, 2011, the EPA finalized the Cross-State Air Pollution Rule (CSAPR), a cap-and-trade program for NO_x and SO_2 affecting 27 states. States have great flexibility if, and in how, they adjust the allocation of their state allowance budgets, such as establishing an allowance set-aside for energy efficiency and allocating allowances on an output basis. Many states are now in the process of developing their own rules, which could include efficiency using the opportunities discussed previously (output-base allocation, set-asides, and offsets). Days before implementation, a court order stayed the rule subject to review (USCA 2011). There are significant opportunities for states to incorporate energy efficiency into their CSAPR rules; however, timing for implementation of the final rule and the extent to which efficiency will be incorporated by individual states remains uncertain.

Permitting of Stationary Sources

The Clean Air Act requires permits for a number of polluting sources. These permits can set an emissions rate, or place a limit on the total emissions allowed, from the regulated pollution source and demand a range of different actions from the source such as installation of a pollution control technology, implementation of certain operating procedures, and modifications to the regulated source. Three permit approaches where energy efficiency can be used are discussed below.

Best Available Control Technology (BACT)

Under the Clean Air Act, certain polluting sources must obtain permits to construct and operate. The emissions limitations contained in these permits will vary based on a variety of factors such as geography (i.e., whether the area where the sources are located is meeting federal ambient air quality standards for the regulated pollutant), the type of facility (i.e., whether the source is an electric generating unit or an industrial boiler), and the potential emissions of the unit. In many cases the permit will require that the source applies the Best Available Control Technology (BACT), which is a case-by-case review of the best performing available control technologies. Since pollution control technology is constantly evolving, making the technology or activity that qualifies as “best available” under BACT a moving target. While the EPA issues guidance on how BACT should be determined, the final decision is generally made by the state or locality where the emitting source is located. The EPA recommends that states and localities use its “top-down” process for determining BACT, which involves five steps:

STEP 1 - Identify all available control technologies

STEP 2 - Eliminate technically infeasible options

STEP 3 - Rank remaining options by emissions control effectiveness

STEP 4 - Evaluate economic, energy, and environmental impacts

STEP 5 - Select best option as BACT for the source

BACT has traditionally been applied to air pollutants such as, nitrogen oxides (NO_x), sulfur dioxide (SO_2), volatile organic compounds (VOCs), and particulate matter, among others. The option that qualifies as BACT can be a technology, techniques, materials, fuels, operating practices, or a combination thereof. According to the EPA, using energy efficiency to comply with BACT is an approach that has long been available for common air pollutants; however, a greater emphasis has recently been placed on energy efficiency as the BACT for greenhouse gas emissions (EPA 2011d). A series of regulatory actions stemming from a 2007 U.S. Supreme Court ruling has obliged the EPA to begin incorporating greenhouse gas emissions into stationary source air regulations. Beginning on January 2, 2011, permits for certain new and modified facilities need to include BACT provisions for greenhouse gases (EPA 2011d).

According to the EPA, two categories of energy efficiency options should be considered in Step 1 of the BACT analyses (identifying potential control technologies): (1) for new and modified sources, options that maximize the efficiency of the individual emissions unit (e.g., a more efficient boiler or a combined cycle combustion turbine); and (2) for new sources that create energy for use on-site, options for improving the utilization of that energy including technologies, processes, and operations (EPA 2011d).

The EPA suggests that the analysis in Step 4 (evaluation of the economic, energy, and environmental impacts of the control option) can include impacts outside the geographical boundaries of the facility. This approach makes efficiency an even more attractive option because the multiple air pollution benefits from the reduction of power plant emissions can be considered. For instance, if energy use at the permitted facility declines, energy demand from the power plant will likewise decline. Permitting authorities are also encouraged to consider how available strategies for reducing greenhouse gas emissions from a stationary source may impact secondary greenhouse gas emissions from off-site locations. The Step 4 analysis includes both direct and indirect considerations of the emission control technology or strategy (EPA 2011d). The EPA has provided a series of white papers that covers specific sectors and lists technologies and process changes the agency believes are available for each emission unit or process within a plant (http://www.epa.gov/nsr/ghgpermitting.html). Strikingly, most of these white papers focus on efficiency as BACT.

The EPA has been forthright in stating that energy efficiency will be central to BACT compliance for greenhouse gas emissions. In a recent press release the agency said, "In most cases, [the BACT determination] process will show that the most cost effective way for industry to reduce [greenhouse gas] emissions will be through energy efficiency." (EPA 2010b). A review of EPA's supporting documentation confirms this. For example, the EPA has issued a white paper discussing options for industrial boilers to comply with BACT that includes approximately a dozen methods for improving efficiency (EPA 2010a). Aside from fuel switching, the only other method of compliance discussed is carbon capture and sequestration, which is listed as a pilot or demonstration project.

The EPA also encourages permitting authorities to consider establishing an output-based BACT emissions limit or a combination of output- and input-based limits. Output-based limits would base emissions limitations on the amount of energy or product the facility produces, as opposed to the amount of fuel used in a facility. Thus, by applying an output-based limit, the more a facility produces, the higher its emissions would be, effectively rewarding more efficient facilities that can produce more with less. This is in contrast to input-based emissions limits, which authorize emissions based on the amount of fuel consumed by the facility regardless of how productively that fuel is used.

The EPA's regulation of greenhouse gases and its new BACT Guidance represent a great opportunity for energy efficiency to be used to comply with air regulations. However, the newness of this opportunity means that experience is limited. For instance, in February, 2010 the nation's first PSD permit to include greenhouse gases in a BACT analysis was issued to a 600 MW natural gas-fired combined cycle project outside of Hayward California (California Energy Commission 2011; Roselius 2010). The permit places limits on greenhouse gas emissions from the facility's two gas turbines and heat recovery steam generators (i.e., combined-cycle), its fire pump diesel engine, and its five circuit breakers. In addition, the heat rate of the power plant is not allowed to exceed 7,730 Btu per kilowatt-hour (BAAQMD 2010). The five-step BACT approach was used in making this determination. The technologies identified as potential control technologies were thermal efficiency and carbon capture and storage (CCS). The CCS option was eliminated in Step 2 (elimination of technically infeasible options) as CCS was considered not commercially available, and no appropriate storage option was demonstrated. This left thermal efficiency as the only option to achieve GHG reductions. While this permit was the first of its kind, it is representative of a conclusion that is likely to be reached in the application of BACT to other facilities; efficiency is a best available control technology for limiting greenhouse gas emissions.

Boiler Maximum Achievable Control Technology (MACT)

EPA has promulgated national emission standards for hazardous air pollutants, including mercury, from industrial, commercial, and institutional boilers. These standards require application of technology that represents the Maximum Achievable Control Technology (MACT). The Clean Air Act directs that a MACT emission limitation for a new source is at least as stringent as "the emission control which is achieved in practice by the best controlled similar source" (EPA 2010d). For existing sources MACT is defined as the average performance of the top 12% of existing units (EPA 2000).

In March of 2011 the EPA published the final Industrial Boiler MACT. The EPA's final rule includes two primary opportunities for energy efficiency as an air compliance mechanism. The Boiler MACT requires energy assessments to identify all "cost effective" energy conservation measures for all major sources. While an audit is required, implementation of the recommendations identified in the audit is not required.

The Boiler MACT also includes output-based standards as an alternative compliance mechanism, which defines pollution limits per unit of useful electric, steam, heat or unit of manufactured product output, (as an alternative to input-based standards which only look at the amount of fuel consumed by the boiler) and provides for a reasonable method for recognizing the multiple outputs of CHP systems. In addition to allowing for the use of alternative output-based standards, the rule also recognizes onsite efficiency improvements by the inclusion of "efficiency credits" to account for improvements in the efficiency of energy use at the facility. These credits are included in the calculation emissions rate of an individual boiler and, therefore, directly support compliance with the rule.

The EPA finalized this rule in March 2011 and issued a reconsidered proposal for the rule that is scheduled to be finalized in April of 2012. The initial compliance date is March 2014 so there is no recent experience available (EPA 2011a).

Utility Mercury and Air Toxics Standards (MATS)

The Maximum Achievable Control Technology (MACT) rule for regulating mercury from power plants was finalized in December 2011 (the Utility MACT rule was incorporated in the Utility Mercury and Air Toxics Standards, or MATS) (EPA 2011c). For existing sources MACT is defined as the average performance of the top 12% of existing units (EPA 2000).[7] For new sources, the standard is based on the level of emissions control currently achieved by the best-controlled similar source (EPA 2010d). Like the Boiler MACT rule above, MATS provides an alternative compliance standard that is output-

[7] If there are fewer than 30 existing sources, then the standard is the average emissions limitation achieved by the best-performing 5 sources in the category.

based and, therefore, recognizes the benefits of greater efficiency in electricity generation and provides for a reasonable method for recognizing the multiple outputs of CHP systems.

Utility New Source Performance Standards for Greenhouse Gases

In December 2010, the EPA agreed to a settlement requiring it to propose new source performance standards for greenhouse gas emissions from power plants and petroleum refineries. The settlement obligated the Agency to propose GHG new source performance standards (NSPS) for power plants and finalize them by May 26, 2012 (EPA 2010e). The rules will apply to new and modified facilities. A "standard of performance" is defined as:

"A standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any non-air-quality health and environmental impact and energy requirements) the EPA Administrator determines has been adequately demonstrated" (42 USC 7411).

The EPA's proposed NSPS rule has been delayed and is expected to be released in early 2012. At this point it is uncertain what the proposal will look like, but based on EPA's suggestions for meeting BACT for greenhouse gases, the rule may conclude that generation efficiency and fuel-switching are viable options. In addition, it is possible that end-use energy efficiency would also count towards meeting of the standards.

Utility New Source Performance Standards for PM, SO_2 and NO_x

In 2011 the EPA proposed output-based standards for new electric generating units (EPA 2011a). According to the EPA:

"By relating emission limitations to the productive output of the process, output-based emission standards encourage energy efficiency because any increase in overall energy efficiency results in a lower emissions rate. Output-based standards provide owners/operators of regulated sources with an additional compliance option (i.e., increased efficiency in producing useful output) that can result in both reduced compliance costs and lower emissions)".

The EPA requested comments on whether it is appropriate to recognize the environmental benefit of electricity generated by combined heat and power (CHP) units by accounting for the benefit of on-site generation, which avoids losses from the transmission and distribution of the electricity. The EPA explained, "Actual line losses vary from location to location, but if we adopt this provision in the final rule, we are considering a benefit of 5 percent avoided transmission and distribution losses when determining the electric output for CHP units" (EPA 2011b).

These proposed standards were finalized in December 2011.

State Implementation Plans (SIP) for National Ambient Air Quality Standards (NAAQS)[8]

The federal Clean Air Act Extension of 1970 requires the EPA to set National Ambient Air Quality Standards (NAAQS) for air pollutants that are harmful to public health and the environment. States show how they will attain the NAAQS through the submission of State Implementation Plans (SIPs). A SIP is a set of documents that results from a detailed, multi-year process that involves complex modeling and comprehensive planning by state air regulators. States must submit a suite of

[8] The following discussion focuses on states and localities that must submit SIPs to show attainment or maintenance of NAAQS. It should also be noted that energy efficiency can be used as a mechanism to proactively reduce emissions and avoid nonattainment designations.

regulations, programs, policies, measures, and technical documentation—the SIP package—that will demonstrate attainment of the NAAQS. The anticipated emission reductions from this package are input into a model that forecasts whether the state will attain and, if achieved, maintain the NAAQS EPA sets. For EPA to approve a SIP, it must show that a state will attain the NAAQS by its required attainment date (generally five years, with a greater range of dates for ozone SIPs).

There are two primary opportunities in this process for states to incorporate emissions reductions from energy efficiency. The first opportunity for energy efficiency is in the SIP modeling of the emissions "baseline". The baseline describes a current set of conditions that occur in the absence of additional emissions reductions contained in the SIP package. A state may include pollution reductions from efficiency measures as an impact on the future baseline emissions used in its SIP modeling. While this opportunity has been available for over 7 years, we are not aware of any state that has successfully used it (EPA 2011e).

In addition to baseline modeling, energy efficiency can be a useful compliance tool in the SIP process as part of the state's emission reduction package. As mentioned above, a state's SIP submission must lay out a plan describing the measures and programs it will use to reduce its emissions to meet NAAQS. SIPs often include a number of different programs and measures where each achieves some of the emissions reductions the state must demonstrate. Energy savings from efficiency measures can be included in this part of the SIP package.

In February 2012 the EPA will release a "Roadmap" for incorporating energy efficiency policies and programs into SIPs. The draft version of this Roadmap outlines 3 pathways in which states can take advantage of energy efficiency as part of the SIP compliance package:

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

In order for a state to take credit for emissions reductions from efficiency measures the emissions reductions must be quantifiable, surplus, enforceable, and permanent. Each requirement is discussed briefly below.

Surplus

If the measures to reduce utility emissions are already being used by the air emissions source to meet SIP regulatory requirements, then they are not surplus because the emissions reductions are already included in the state's SIP baseline. As a result, those reductions cannot be counted again to meet SIP requirements (EPA 2004a). It is worth noting, however, that a mandatory energy efficiency program may still be "surplus" if the air quality benefits from the policy aren't already included in the state's SIP. For example, many states have energy efficiency resource standards (EERS) in place and do not take credit for the air quality benefits of the EERS programs. The EPA has clarified that savings from these programs can be counted in state SIPs (EPA 2011e).

Enforceable

When the EPA approves a SIP control strategy it becomes federally enforceable. When that occurs EPA has authority to ensure the SIP is implemented (EPA 2011e). Most end-use efficiency programs will not be directly enforceable against a source. EPA has clarified that efficiency measures will only meet this standard if they are enforceable against another party responsible for the energy efficiency (EPA 2004a). For example, under an energy efficiency resource standard (EERS), a state could require certain entities to achieve some total energy savings through energy efficiency measures. If the state relies upon such requirements within the SIP, then the EERS energy savings measures could be enforceable against the entities required to achieve the energy savings, even if those entities are not responsible for the operation of the electricity generating units at which the emission reductions are expected to occur.

The EPA has explained that measures are enforceable against another party when the activity is independently verifiable, violations of standards by liable parties can be identified, and there is an ability to achieve corrective actions or apply penalties. Finally, the measure must establish a clear legal obligation for the source and allow compliance to be verified (EPA 1999a).

Alternatively the "enforceable" requirement can be overcome for up to 3% of a state's SIP emission reduction obligation by measures included in the EPA's Stationary Source Voluntary Measures Final Policy (EPA 2011e). These SIP measures are not required to meet the enforceability standard, but the state is responsible for assuring that the reductions credited in the SIP occur. In this case the state would need to make an enforceable SIP commitment to monitor, assess, and report on the emission reductions resulting from the voluntary measure and to remedy any shortfalls from forecasted emission reductions in a timely manner. An example of a voluntary SIP measures might be a program to encourage builders or homeowners to install energy-efficient windows.

Quantifiable

All emissions reductions that are generated under mandates to reduce pollution must be quantifiable. Emissions and emission reductions attributed to the measure are quantifiable if someone can reliably measure or determine their magnitude in a manner that can be replicated. The EPA recommends a four-step procedure for quantifying the amount of SIP credits generated by an energy efficiency control measure:

- STEP 1: Estimate the energy savings that an energy efficiency measure will produce. This is the difference between the baseline energy usage for the activity and the projected energy usage when the efficiency measure is fully implemented. Variables such as phase-in period of the equipment, change in hours of operation, and weather should be factored in.
- 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 purpose of step four is to determine the type of monitoring, record keeping, and reporting that is needed to evaluate whether the expected energy impacts, emission reductions and/or air quality improvements were achieved in practice. Communications with officials at state PUCs can reveal the frequency, rigor, and scope of the EM&V effort needed, as well as the timing for impacts reporting. These data can then be used by air officials to document and validate the effectiveness of the energy efficiency policy for SIP purposes. Public utility commissions can also point to any irregularities with the data, as well as any issues with reporting that may affect the policy validation process.

Permanent

The impacts of an energy efficiency policy or program need to continue through the future attainment year unless it is replaced by another control measure or the state demonstrates in a SIP revision that the emission reductions are no longer needed. In some cases, the quantity of emission reductions from an energy efficiency measure may change over time, but the reductions would still be "permanent". For example, as emissions controls are put on power plants, energy efficiency will displace fewer emissions than before. This does not mean the reductions are not permanent, but the amount of pollution reduced by the measure will decrease over time. Similarly, for some measures, the energy savings resulting from initial implementation may vary over time; however, they can be included in the SIP if certain factors likely to impact this variability are addressed (EPA 2004a).

As previously mentioned, EPA will release a "Roadmap" in early 2012 outlining options for incorporating energy efficiency policies and programs into SIPs (EPA 2011e). In addition to baseline modeling, the draft Roadmap outlines 3 paths in which states can take advantage of energy efficiency in the SIP process. While the traditional approaches of verifying emissions reductions used as part of a control strategy are going to remain in place (emissions reductions must be permanent, quantifiable, surplus, and enforceable), the Roadmap discusses areas of flexibility for states in the SIP process. The draft Roadmap outlines a "pathway" whereby emerging and voluntary measures can be included in the SIP process. A voluntary measure is a measure or strategy that is not enforceable against an individual emissions source or party administering the measure. An emerging measure is a measure or strategy that does not have the same high level of certainty as traditional measures for quantification purposes. These are generally locally-based initiatives that are designed to encourage or require citizens, businesses or local government to reduce emissions. This pathway is similar to the control strategy pathway in that an energy efficiency 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.

The Roadmap also provides a "weight-of-evidence" pathway, which allows certain states to take credit for efficiency policies and programs that will have an emissions impact on attainment even though air quality modeling may be inconclusive. Instead, a state can develop a basic description of policies and perform basic quantification of emissions impacts. The weight-of-evidence approach is a recommended option for energy efficiency policies and programs where a state or local agency wants to claim emissions benefits that will potentially affect air quality in the attainment year, but where modeling the impacts is either too resource intensive or not feasible.

State Experience with Energy Efficiency in SIPs

Several states have pursed inclusion of emissions reductions from energy efficiency in their SIPs. Some states established working groups to analyze the emissions benefits of efficiency and propose policy mechanisms involved in the approaches. Four states moved forward with these efforts between 2005 and 2007: Illinois, Texas, Louisiana, and New Jersey. Connecticut and the metropolitan Washington, D.C. region took steps independently to quantify their emissions reductions (EPA 2011e).

According to the EPA's draft Roadmap, state experience produced mixed results (EPA 2011e). The draft Roadmap concludes that:

"In all cases, states found that analyzing the effects of EE/RE [energy efficiency/renewable energy] 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" (EPA 2011e).

States must be able to quantify the emissions benefits of energy savings realized from efficiency policies and programs. There are multiple possible approaches to quantification for air benefits and these approaches vary in terms of the amount of time and resources they require. A state must balance limited resources against the risk that the EPA will reject its application and require a different approach. The EPA has provided guidance on what is appropriate; however, there appears to be a perception of continued uncertainty. The Connecticut experience below highlights an example of a state that adopted the "weight-of-evidence" approach to crediting energy efficiency measures, but the EPA proposed disapproval because the state didn't provide savings estimates that the EPA thought were warranted. The EPA responded by requiring that the state quantify the benefits of these measures, in spite of prior guidance that seemed to indicate otherwise. These same challenges exist with regard to SIP modeling.

Table 2. State Experience with Energy Efficiency in SIPs[1]

Connecticut[2]	Connecticut included efficiency measures in its proposed SIP using a weight-of-evidence approach.
Illinois	In early 2005 the state worked to develop preliminary estimates of the emissions impact of the state's Sustainable Energy Plan, with the intent of incorporating the reductions into the SIP.
Louisiana	The state's SIP proposal included performance contracting for 22 municipal buildings in Shreveport. The performance contract estimated savings of 9,121 MWh of electricity per year. This equated to NO_x emission reductions of 0.041 tons per ozone season-day. EPA Region 6 published approval of this SIP revision in August, 2005.
Maryland, Virginia, and Washington D.C	The Metropolitan Washington Council of Governments' regional air quality plan for 8-hour ozone standards was adopted by MD, VA, and DC. The plan included the installation of LED traffic lights and building energy efficiency programs as part of a voluntary control measure approach. The estimated daily savings generated for the two programs was over 40 million kWh. The 2009 estimated NOx emission reductions credits to the LED program was 0.02 tons per day.
Texas[3]	The TCEQ claimed credit for emissions reductions of 0.72 tons per day (tpd) of NO_x for energy-related measures in the 2005 Dallas-Fort Worth (DFW) five percent Increment of Progress (IOP) SIP revision.

Sources: DC: MWCOG 2007; LA: LA DEQ 2004; IL: DOE 2007
Notes: [1] Summarized from Appendix J of EPA Roadmap (EPA 2011e).
[2, 3] See more detailed summary in the next section.

The EPA's draft Roadmap also observes that states can only achieve their goals if many different parties, such as air regulators and public service commissions, are engaged over extended periods of time (EPA 2011e). Improved engagement and communication between state regulators, the EPA regions, utilities and stakeholders can reduce risks that state proposals will be disapproved and improve regulator certainty.

The barriers the EPA has identified can be mitigated by regulatory certainty from the EPA regions in the form of detailed guidance, increased communications between states and the EPA, and technical support to states for estimating the pollution impacts of efficiency measures and SIP modeling. These issues are discussed in further detail in the later sections of this report. The experiences in Connecticut and Texas are discussed in more detail below.

Connecticut

In its SIP proposal to demonstrate compliance with the 8-hour ozone standard, Connecticut relied upon the EPA's "weight-of-evidence" approach. The weight-of-evidence approach can be used to demonstrate that attainment is likely despite inconclusive modeling. Because the weight-of-evidence approach does not attribute specific quantities of emissions reductions to the efficiency measures included, Connecticut's DEP did not focus on quantification of emissions reductions. However, in response to a proposed disapproval of the state's SIP plan by EPA, state administrators provided conservative estimates of emissions savings of 1.5 tons of NO_x per day (Marrella 2009).[9] In order to estimate the emissions benefits of efficiency measures, the DEP worked with other states and a team of technical experts to analyze the mix of power plants used to meet peak demand and estimate the emissions impacts efficiency measures were having at peak times (EPA 2011e).

[9] As a point of comparison the Connecticut 8-Hour Ozone Attainment Demonstration projected a total of 72 tons per day of NO_x emissions from stationary sources in the entire state. See Appendix 4E: Emission Projection for 2008, 2009, & 2012 Including Calculation of Emission Reductions Resulting from Control Strategies available on page 36 here: http://www.ct.gov/dep/lib/dep/air/regulations/proposed_and_reports/app4e.pdf.

Table 3 reflects data provided by Connecticut's Energy Conservation Management Board summarizing energy efficiency projects implemented under the program since 2003. While the state did include these savings in its SIP, it did not include energy efficiency measures funded through revenues created by RGGI or projects funded by the American Recovery and Reinvestment Act.

Table 3. Energy Savings and NO_x Emissions Avoided/Reduced from Connecticut Energy Efficiency Fund Projects (2003-2008)

Year	NO_x Avoided or Reduced (Tons/Year)	Cumulative Lifetime NO_x Avoided or Reduced (Tons)	Annual Energy Saved (MWh)	Cumulative Energy Saved (MWh)
2003	73	1,151	131,000	131,000
2004	112	1,548	291,000	422,000
2005	123	1,702	318,000	740,000
2006	89	1,243	328,000	1,068,000
2007	104	1,258	355,000	1,423,000
2008	58	672	368,000	1,791,000
TOTALS	**559**	**7,574**	**1,791,000**	**1,791,000**

Source: Marrella 2009

Examples of the types of energy efficiency policies the state has implemented for crediting in its SIP include (CT DEP 2008):

- The mandatory periodic assessment and reporting of energy efficiency and other clean energy resources available to meet capacity requirements by Connecticut's two major load serving entities—United Illuminating and Connecticut Light and Power;
- A requirement that energy capacity needs must first be met through all available energy efficiency and demand-side resources that are cost effective, reliable and feasible;
- The mandatory assessment of how best to eliminate or stabilize growth in electric demand;
- The mandatory incorporation of the impact of current and projected environmental standards, including the ozone standard;
- All state building projects over $5 million must meet Leadership in Environmental Design Silver (LEEDS Silver) standards or better;
- The creation of a home heating oil conservation and efficiency program; and
- The adoption of appliance efficiency standards.

The Connecticut Department of Environmental Protection (DEP) submitted edits to their original attainment demonstration in February 2011. EPA has not yet taken final action on this submission.

Texas

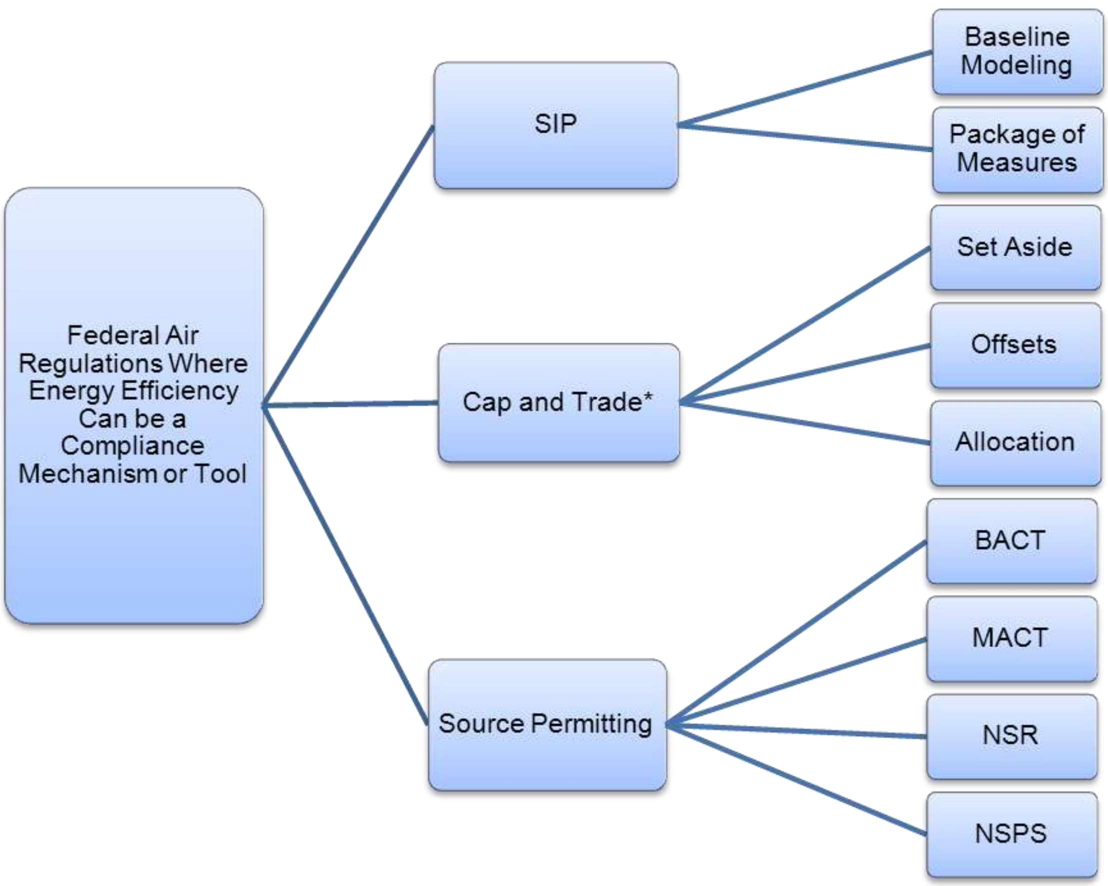
The Texas Commission on Environmental Quality (TCEQ) claimed credit for emissions reductions of 0.72 tons per day of NO_x for energy-related measures in the 2005 Dallas-Fort Worth (DFW) 5% Increment of Progress (IOP) SIP revision. It did so by citing Senate Bill (SB) 5 (77th Legislature) and SB 7 (76th Legislature) requirements. SB 5 and SB 7 directed municipalities in ozone nonattainment counties and in counties deemed near-nonattainment to reduce their electricity consumption by 5% per year. The energy efficiency reductions included in the DFW 5% IOP SIP were based on electricity and natural gas usage reductions resulting from construction following the implementation of revised building codes. The 0.72 tpd in NOx reductions assisted the area in achieving the 5% emissions reductions required.

It is noteworthy that, while there is excellent participation in these energy conservation measures and associated reporting, there is no state enforcement mechanism. Therefore, the use of any such NO_x

reductions in ozone SIP revisions in the state, for example, could not be ensured simply by citing SB 5, SB 12 or SB 898. Mindful of the inherent opportunities but cognizant that these reductions are not legally enforceable, the Texas Commission on Environmental Quality (TCEQ), as noted above, used energy efficiency in the weight-of-evidence in the DFW attainment demonstration for the 1997 8-hour ozone standard, and the attainment demonstration received conditional approval on January 14, 2009 (74 FR 1903).

This report has discussed a number of opportunities for using energy efficiency as a compliance mechanism or complementary tool to help states and emitting sources meet federal air quality requirements. Figure 4 summarizes the regulatory mechanisms with opportunities for energy efficiency that this paper focuses on. Note that each of these opportunities exists for more than one pollutant and many types of emitting sources. For example, cap-and-trade opportunities exist at the federal level for both NO_x and SO_2 and BACT permitting requirements apply to utilities, industrial facilities and other polluting sources.

Figure 4. Opportunities where Efficiency Can Assist States and Emitting Sources in Meeting the Goals of Federal Air Regulations[10]



*The major upcoming cap-and-trade opportunity is CSAPR. There are also opportunities within existing programs such as RGGI and the Clean Air Interstate Rule (CAIR). As the U.S. considers how best to mitigate greenhouse gas emissions, a cap-and-trade mechanism is one option that could be considered.

[10] This graphic provides a simplified summary of federal opportunities. The interplay of EPA regulations is somewhat more complicated and interrelated. For example, permitting requirements and cap-and-trade programs can be, and often are, included in either baseline modeling or as part of the "package of measures" included in a state's SIP.

The following section discusses some of the challenges that have arisen for states and stakeholders attempting to take advantage of these opportunities.

Barriers to Using Energy Efficiency in the Context of Air Regulation

Earlier we discussed the historically differing goals of air quality regulators and public utility commissions. These differences, as well as existing market and regulatory barriers, have contributed to a number of general challenges that can inhibit the use of energy efficiency as a means of achieving air quality requirements. We list a number of these more general challenges below.

Lack of Communication between Regulatory Bodies

The differing histories and missions behind air quality regulation and demand side management have contributed to the evolution of dissimilar processes and vocabulary. For example, to an air regulator “verification” of an emissions reduction means one thing whereas “verification” means something different to staff of a public utility commission. Not only have these two disciplines developed their own professional fields and language, but in some cases public utility commissions and air quality professionals may be unaware of what each other are doing with regard to the same utilities. In a single state the air regulators and the utility PUC will likely have authority over the same power plants within the state’s geographic boundaries. Decisions of the air regulators may impact reliability and decisions about reliability can impact air pollution. In many jurisdictions, environmental agencies have not traditionally partnered with public utility commissions and state energy offices. This lack of coordination means states may miss out on the most cost-effective options for resource planning and place unnecessary regulatory burdens on the power sector.

Finally, the authors have observed, and believe it is worth noting, that there seems to be a fundamental disagreement about how the emission impacts of energy efficiency should be viewed. For example, air regulators may argue that in the context of a cap-and-trade program energy efficiency does not reduce emissions unless allowances awarded for those measures are retired (rather than sold to emitting sources). In contrast, energy efficiency advocates may observe that energy efficiency reduces demand for electricity and is likely to reduce the amount that electric generators operate. Energy efficiency also simultaneously reduces multiple pollutants. While both perspectives are correct to varying degrees, this divergence in perspectives can sometimes result in these two communities talking past each other when cooperative efforts and collaboration is what is needed. The authors suggest that this is largely a matter of perspective and vocabulary. Increased dialogue and collaboration between these two communities would likely help to resolve some of these differences and help these groups to work together towards the mutual goals of improving air quality, maintaining electric reliability, while finding the lowest-cost means to effectively do both.

Measurement

The Clean Air Act includes legal mandates that require the EPA to manage both ambient air quality and regulate emitting sources. The amount of pollution measured from emitting sources, and in the air, can be the determining factors for judging whether the EPA has successfully carried out its mandate. Naturally, many of the EPA’s regulations reflect this. For example, when the EPA sets standards for specific emitting sources, compliance can be gauged by measuring air emissions with equipment such as continuous emission monitoring systems (CEMS) or through measurements taken periodically at the smokestack of a power plant or boiler.

The impacts of end-use energy efficiency are not measureable in the same way. Emissions reductions from end-use efficiency are based on the energy saved by the project or efficiency program. For example, a program that saves energy by weatherizing residential properties has the potential to reduce emissions at the power plants that supply electricity to the properties, but the activity that generates savings occurs at the residential property while the source of the emissions is a power plant. It's not possible to trace electricity backwards through the electric grid to its exact source. Rather, electricity is generated from multiple sources simultaneously and distributed as needed throughout an entire network of consumers. This process makes it impossible to determine exactly which power plant has changed its operation at any given moment due to energy savings at a single residential property.

In addition, there is no standard approach for measuring energy savings. Several standard protocols have been issued, but no national standard has been established to measure energy savings for the purpose of compliance with federal air regulations. Rather, each state PSC develops mechanisms to measure energy savings, often with little or no input from state air regulators or the EPA. ACEEE has recently conducted a 50-state survey of approaches for EM&V of efficiency measures and will issue a final report in early 2012.

Quantification

Energy savings generated as a result of DSM programs are typically quantified in kilowatt-hours (kWh) or megawatt-hours (MWh). In contrast, air regulators are concerned with a measurable amount of pollution reduced, often quantified in tons of pounds per unit of heat input. Converting kWh or MWh to tons of pollutant can be challenging. Variables include:

- type of generation offset (peak versus baseload);
- fuel use of the offset generation (coal versus natural gas);
- timing of the offset (summer peaking versus lower demand periods);
- presence and operation of pollution controls; and
- age of the generating units offset (older, inefficient technologies versus newer power plants with emissions controls).

Shifts in any of these variables can significantly change the amount and type of emissions that are offset. Multiple methods for quantifying emissions reductions from energy savings are currently in use. A grid average approach uses the average emissions per MWh for the national grid, or a region, as a baseline to quantify emission reductions. Another approach is to quantify what emissions would have been emitted from the power source that comes on the grid last, often a peaking source, as this type of source is what would most likely be offset by a reduction in energy demand. This method requires more complex modeling to anticipate which plant will be the marginal unit at varying points in time. A third approach is to use emissions from planned generation plants to determine emission reductions (Dickerson et al. 2005).

The EPA has issued guidance stating that converting energy savings into NO_x emissions reductions can be done through either a single region-wide factor or multiple factors for sub-regions within each state (EPA 2004a). Using a single region-wide factor, a state could use the NO_x emissions limit of 0.15 lbs/mmBtu, which was used in the NO_x SIP Call. A single, region-wide rate can be simple to administer as it creates a uniform system for rewarding energy efficiency projects across the SIP Call region. However, it may be less accurate since it does not fully capture the variations in local NO_x emission rates.

The second option would be to establish emission rates for each regulated air pollutant for North American Electric Reliability Council (NERC) sub-regions. This approach is a more technically accurate measure and closely approximates state-by-state differences by more accurately capturing the generation mix, imports, and exports occurring across different NERC sub-regions.

Each of the above methods has its trade-offs. Complex models can be very expensive to implement and require large amounts of data and resources. The simpler approaches are by nature less robust and are viewed by some as less reliable. In some cases, uncertainty about which of these methods would be approved by air regulators has been an obstacle. States may be unwilling to risk the investment of the resources necessary to model energy savings if there is some risk that the approach would be rejected by the EPA.

Verifying Emissions Reductions

As previously discussed, the electric grid makes it impossible to tell where energy savings on the consumer side will “show up” among the various generation resources serving a given market. For some air regulators, the inability to pinpoint where emissions reductions occur is perceived as an inability to verify that emission reductions occurred.

In a state that imports electricity, the imports may be reduced, but the pollution generated within the geographical bounds of the state could remain the same. The EPA has issued guidance on how states can address these issues (EPA 2011e). EPA acknowledges that there can be uncertainty around where energy savings from efficiency will show up as reduced electrical generation and reduced power plant emissions though it does not view this uncertainty as insurmountable.

Timing is another aspect of verification that could be viewed as a barrier to crediting end-use energy efficiency for air pollution reductions. Generally, air regulators prefer that emissions reductions are verified ex post based on a measurement at a smoke stack, CEMS or concentrations in the ambient air. Alternatively, energy savings from efficiency are frequently based on ex ante calculations. For example, energy savings due to the replacement of a water heater with a more efficient unit will be calculated prior to the installation of the unit. In some cases “verification” of efficiency measures may be done by an independent third-party verifier that ensures the measure is appropriately installed and operational. Some programs verify savings using analysis of data on utility bills after the installation of a measure, though this approach is rarer.

Misaligned Financial Motivations

Traditional utility ratemaking allows utilities to earn revenues based on the total volume of electricity sold to consumers. Utilities are also permitted to earn a fixed return on capital investments. In an effort to maximize revenues and earn profits for shareholders, a utility is likely to choose capital investments in new supply rather than investments in DSM programs. For the same reasons, a utility is also likely to avoid DSM programs that reduce the volume of electricity sold. In the traditional regulatory environment these are valid financial considerations that cause utilities to oppose DSM programs. For example, in the context of a market-based cap-and-trade mechanism for reducing pollution, the regulated entities should seek the lowest cost means of achieving emissions reductions. This would suggest that utilities regulated in a cap-and-trade program would implement all cost-effective energy efficiency rather than purchase allowances for each ton of pollutant emitted. However, the barriers to efficiency inherent in the traditional utility regulatory business model can cause utilities to oppose energy efficiency investments. Even when pollution controls are a more expensive means of reducing pollution than DSM programs, a utility that makes a capital investment in pollution control equipment will receive both reimbursements for those capital expenses as well as a guaranteed rate of return on the capital investment. Under the traditional regulatory model, an investment in DSM has the potential to reduce the utility’s revenues by reducing sales and does not offer a rate of return. This report does not attempt to measure the impacts of these financial regulatory barriers, but a previous ACEEE white paper discusses how these financial disincentives are significant obstacles to energy efficiency (York and Kushler 2011).

In addition to a misalignment of the financial motivations of utilities in the traditional utility business model, most states don’t allow for the appropriate valuation of the benefits that result from simultaneous reductions of multiple pollutants inherent in energy efficiency measures. When deciding if an energy efficiency measure should be implemented, most states employ a cost-benefit test that balances the costs of the program or measure against the benefits it will provide. However, most states do not include the multiple air quality benefits of energy efficiency in the benefits side of the calculation (Neme and Kushler 2010).

Double Counting or Additionality

"Additionality" is a criterion for assessing whether a project activity has resulted in emissions reductions beyond what would have occurred in its absence. This is important to air regulators so that they can avoid "double counting". In the SIP process a state that takes credit for 100 tons of emission reductions must also clarify what activities will cause that reduction. This helps ensure that those 100 tons of emissions reductions are being counted only once and that the appropriate emissions reductions are occurring in the context of multiple simultaneous activities. In its recent guidance the EPA provides specifics on existing state EERSs and how those policies should be credited in SIPs (EPA 2011e).

Cap-and-trade program administrators are concerned about additionality for slightly different reasons. If an "offset" is awarded for an efficiency measure, that offset can be used in lieu of an allowance to cover emissions of one ton of pollution, increasing the allowable emissions in the program (allowing the capped sources to emit the original cap plus one ton for each offset allowance). The purpose of the offset mechanism is to encourage activities that reduce pollution from the lowest cost sources. If the offset is awarded for reductions that are already required under law or were already happening, the cap is being inflated without any actual offsetting pollution reductions.

In energy efficiency "additionality" is traditionally addressed as part of the issue of "net" versus "gross" energy savings. The issues that tend to arise in efficiency programs include accounting for naturally occurring conservation that would have occurred in the absence of the program, and "free riders", program participants who would have implemented the program measure or practice in the absence of the program (Dickerson et al. 2005). Currently there is no uniform approach to address these issues however many states have deployed methods that are currently in use and efforts to standardize approaches have been initiated in the Northeast (see NEEP EM&V Forum at http://neep.org/emv-forum), Northwest (see Regional Technical Forum here http://www.nwcouncil.org/energy/rtf/subcommittees/deemed/Default.asp), Midwest (see MEEA activity here http://www.mwalliance.org/events/regional-emv-forum-annual-public-meeting) and at the U.S. Department of Energy (SEEAction 2011). A forthcoming report from ACEEE will outline state approaches to EM&V of energy savings.

EPA's Converging Power Sector Regulations

The EPA is proposing to update, or has updated, at least six regulations affecting coal-fired power plants with compliance deadlines over the next seven years (Elliott et al. 2011). The combination of these increasingly stringent regulations will impact investment decisions of utilities. Estimates forecast that utilities will be making investments in infrastructure between $70-180 billion (Celebi et al. 2010). While some are characterizing this suite of regulations a "train wreck" that will hinder the energy sector, it is in fact a great opportunity for utilities to leverage the multiple air benefits of energy efficiency.[11] Energy efficiency addresses all of these regulations to some degree and is often the lowest cost option for meeting requirements. For example, the EPA summarized a modeling analysis for an "Energy Efficiency" case as part of its Mercury and Air Toxics Standard. The analysis shows that actions to encourage energy efficiency significantly decrease demand and reliability concerns (EPA 2011a). The "Energy Efficiency" case also showed that if energy efficiency policies are implemented along with the MATS, electricity bills would fall because customers will be consuming less electricity (EPA 2011a).

The opportunities to use energy efficiency as a mechanism to comply with the suite of federal air regulations provides a chance for PUCs to safeguard system reliability and curb compliance costs. In addition, utilities that use energy efficiency as an air compliance mechanism can reduce the costs of compliance and mitigate their compliance risks.

[11] See Washington Post article here: http://www.washingtonpost.com/blogs/ezra-klein/post/getting-ready-for-a-wave-of-coal-plant-shutdowns/2011/08/19/gIQAzkZ0PJ_blog.html

RECOMMENDATIONS TO LEVERAGE ENERGY EFFICIENCY OPPORTUNITIES IN AIR REGULATIONS

The United States is in the process of implementing substantial improvements in air quality through federal regulations mandated under the Clean Air Act. Compliance with federal regulations will require significant investment in the energy sector (Celebi et al. 2010). The choices we make will impact the cost and quality of energy services and the environment for generations to come. Decision makers in the utility sector are weighing a variety of options to comply with environmental regulations and reliably meet energy demand. Energy efficiency is a relatively low cost energy resource that is generally less expensive than investments required to bring existing coal plants into compliance or to construct new generation capacity, and can be deployed much more quickly (Elliott et al. 2011). Energy efficiency is also recognized as a strategy for meeting capacity challenges as retirement of coal plants begin to increase.

The current utility regulatory structure is unnecessarily burdensome and does not guarantee that the best, lowest-cost options for compliance with regulatory requirements are the most attractive. Regulators should provide greater regulatory certainty so that long-term investments can be made and duplicated and so that unnecessary expenses can be avoided. Regulators should also make flexibility available so utilities can comply with regulations at the lowest cost to utility ratepayers. The following sections make a number of recommendations to help ensure that these goals are achieved.

PUCs and Air Regulators Should Talk

Collaboration can help all parties understand the details of relevant policies and how the emissions benefits of energy efficiency programs and policies can be used to achieve federal air quality requirements. For example, greater collaboration may help with the transfer the information that is needed for SIP documentation from energy agencies to air agencies. Furthermore, partnerships among state air and energy offices can facilitate successful monitoring of compliance with adopted energy efficiency policies and evaluation of their impacts, ensuring projected energy and emission benefits are achieved.

States should convene planning sessions that bring air regulators, utility DSM regulators, utilities, efficiency service providers, and other stakeholders to the same table to determine guidelines and processes to use energy efficiency as an air compliance mechanism. Efforts between state PUCs and air quality offices should be coordinated to develop mechanisms for harmonizing state activity with federal requirements.

EPA Should Provide Clear Guidance

The EPA has recently issued updated guidance in its draft, *Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State Implementation Plans/Tribal Implementation Plans,* that clarifies how states can obtain credit for efficiency measures in the SIP process (EPA 2011e). This is a great first step and the EPA regional offices should go further by working with states to clarify and streamline the process. In addition, the EPA should provide greater clarity on ways states can include energy efficiency in their CSAPR rules. The EPA should provide explicit direction and support for energy efficiency such as model language for CSAPR and future rulemakings.

States Should Adopt Streamlined Processes for Crediting Efficiency in Air Regulations

State air regulators should streamline the process for verifying certain preapproved efficiency measures and adopt simple and clear preapproved EM&V methods for crediting emissions reductions from energy efficiency. In addition, state PUCs should adopt methods approved by air regulators for

EM&V of energy savings. Utilities that verify energy savings for PUCs should not be penalized by air regulators that require them to demonstrate the same activity using different methods. In many cases efficiency improvements will involve simple equipment replacement. Regulatory certainty and clarity will avoid expensive and unnecessarily bureaucratic process to verify that equipment has been replaced.

State PUCs are typically responsible for establishing EM&V requirements for the efficiency programs under their jurisdiction. The approach used in states varies and the definition and measurement of a megawatt-hour saved can vary from state to state. Several organizations are currently working to increase the consistency of EM&V across the industry through regional or national protocols and several such protocols already exist. A forthcoming ACEEE report will provide further analysis of the EM&V protocols in all 50 states.

States Should Include Efficiency in their CSAPR Rules

If states opt to distribute allowances under CSAPR, they have several options. If states allocate allowances (rather than auction them), they should allocate on an output basis and include end-use efficiency programs. If output-based methodology is used, then a standard "negawatt" calculation could be made (York and Kushler 2011). In an output-based allocation scheme, all megawatts are treated equally, regardless of the amount or type of fuel used to generate that energy; delving into the generation resource mix behind a megawatt or negawatt is unnecessary. Similarly, the generation of a negawatt (representing an improvement in efficiency that reduces the demand of 1 MW) should receive equal treatment.

States should also consider an auction approach, which can also generate significant revenues for states. As previously mentioned, the RGGI auctions have generated $952 million in revenues for participating states. The CSAPR rule limits both NO_x and SO_2. While the price of these allowances remains to be seen, a back-of-envelope calculation of potential revenues from these programs shows that at $488 for an annual NO_x allowance representing one ton (average annual price for 2011 vintage in 2009, see Evolution Markets 2009) and a 2012 cap of 1,245,869 tons (EPA 2012a) means that states could generate revenues of roughly $600 million **annually** from just the annual NO_x portion of the CSAPR rule. At a time when many states are facing budget shortages, these revenues can be immensely beneficial. If states do choose to auction allowances, they should maximize the impact of these funds by investing a large share of the revenues to fund energy efficiency measures that will reduce the cost of complying with EPA regulations for NO_x, SO_2, greenhouse gases, particulates, and mercury.

States should also include set-aside pools of allowances earmarked for efficiency programs. The process for earning set-asides should be streamlined to reduce cost and should be made very clear to eliminate uncertainty and regulatory risk to project developers.

Evaluate Efficiency Programs, Not Projects

Aggregating measures by DSM program will address many of the barriers that are currently inhibiting end-use efficiency as an air compliance tool. A residential home energy retrofit will reduce emissions, but not enough to generate reductions equal to an entire ton of pollution annually (depending on the pollutant). However, many homes aggregated across a utility DSM program will generate a large total reduction in emissions. Combining the impacts of all projects in a program helps overcome the expense involved in modeling program effects in the SIP process. Further, aggregating projects can reduce the risk that a project will not meet measurement and verification standards. A random sampling across programs can be used to verify results. The California Climate Action Registry withholds a portion of their offset allowances as an insurance mechanism. Under its Forest Project Protocol there is a provision for ensuring permanence (CAR 2009). Project developers are responsible for compensating for any reversals in stored carbon. To assist project developers, forest projects are “insured” through a buffer pool where each forest project is required to set aside a certain amount of Climate Reserve Tonnes (CRTs).[12] This pool can be tapped into if a project has a reversal in stored carbon. The amount of CRTs set aside depends on the risk of reversal for the given project.

Similarly, multiple end-use efficiency programs could be bundled to form a "virtual" power plant (James and Schultz 2011). This "virtual" power plant strategy has been called an Efficiency Power Plant (EPP) and it is a carefully selected bundle of DSM and energy efficiency programs designed to distribute a specified volume of capacity and energy savings over a specific time period. EPPs allow energy efficiency to be integrated into power sector planning and financing as supply-side resources.

Technical Assistances for States

Technical assistance should be provided to states to maximize their limited resources and avoid duplicate efforts across states. Below are examples of tools that would be particularly effective:

- Models, or other technical assistance, that helps states to incorporate the effects of efficiency programs in their SIPs.
- Efforts that help to aggregate the impacts of efficiency improvements.
- Assistance that helps states to easily convert the energy savings from end-use efficiency programs into credible emission reductions.
- Standard contract documentation that ensures that third-party energy efficiency programs meet standards for air regulation.

Tools for Quantifying Energy Savings in the Buildings Sector

Software that simulates energy use and savings in new buildings and industrial facilities is currently used as the basis for determining federal tax credits. This same software could be used by states for purposes of quantifying energy savings in the buildings sector. Two paths exist to qualify a home to earn ENERGY STAR status: 1) Prescriptive Path is a predefined package of improvements; and 2) Performance Path is a customized package of upgrades. These paths both offer opportunities to improve energy efficiency in buildings (IPMVP 2002). This approach can be used to verify savings at individual facilities and can be useful for large utility customers. For smaller customers, a combination of deemed savings metrics and billing analysis to verify and refine the deemed savings could be used. In residential buildings, credit for emission reductions could be awarded relative to the 2000 International Energy Conservation Code (IECC).

Accounting for Multiple Benefits

States should adopt energy efficiency cost benefit tests that take into account the multiple benefits of energy efficiency, including the simultaneous reduction of NO_x, SO_2, particulate matter, mercury, and greenhouse gases. The Total Resource Cost Test (TRC) is the primary test used by PUCs to assess the cost-effectiveness of energy efficiency programs. Air quality benefits are rarely incorporated into the cost-effectiveness screening under the TRC (Neme and Kushler 2010). States should change to a different cost test that explicitly includes the air benefits of energy efficiency. Alternatively, they should consider improving on the methodology and assumptions underlying their use of the TRC.

Conclusions

The U.S. is poised to make a major transition from dirty, outdated, and wasteful energy resources to a cleaner, more efficient energy system. While energy efficiency has been a significant energy resource

[12] One Climate Reserve Tonne (CRT) is equal to one metric ton (tonne) of carbon dioxide equivalent (CO2e) emissions reductions.

for decades, the convergence of new air regulations, a recovering economy, and an aging network of outdated power plants makes energy efficiency an increasingly attractive option. Recognizing this, the EPA has crafted rules that allow for energy efficiency to be used for compliance or as a complementary compliance tool. EPA has provided guidance for how energy efficiency can be used in the context of air regulations, but past efforts to incorporate energy efficiency as part of an air quality compliance strategy have had limited success. In order to take advantage of this opportunity, stakeholders and policymakers will need to proactively and strategically address some long-standing barriers to using energy efficiency as a tool to comply with air regulations.

Communication between air regulators and others in the energy sector, particularly public service commissions, must be improved. Dialogue and a common vocabulary will help to ensure that mutually beneficial opportunities are not missed. These efforts can be combined with the development of standardized approaches for evaluating, measuring, and verifying energy savings and quantifying the emissions reductions attributable to those energy savings. This standardization will, in turn, provide certainty that the savings from these projects will be recognized by both public utility commissions and air regulators and allow for aggregation of savings from smaller projects.

These efforts will help ensure that our goals for cleaner air are met at the lowest possible cost and that the U.S. transitions to a clean, reliable, and affordable energy system.

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