ENERGY EFFICIENCY AND EMISSIONS TRADING: EXPERIENCE FROM THE CLEAN AIR ACT AMENDMENTS OF 1990 FOR USING ENERGY EFFICIENCY TO MEET AIR POLLUTION REGULATIONS

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ABSTRACT

The Clean Air Act Amendments of 1990 (CAAA) created a national "cap and trade" system as a means to reduce emissions of sulfur dioxide (SO_2) nationwide via a flexible, market system. Based on the relative success of this system, there are numerous national proposals to establish similar types of emissions trading systems for other air pollutants, which may include nitrogen oxides (NOx), mercury, and carbon dioxide (CO_2), depending on the specific proposal. Such *multi-pollutant* proposals are said to offer numerous advantages over more traditional "command-and-control" approaches, including lower compliance costs, greater flexibility, and greater stimulus for technological innovation. Energy efficiency can reduce energy use, which can thereby yield lower emissions. CAAA included provisions to award emissions control credits for qualified energy efficiency measures. This report examines the experience with CAAA and energy efficiency in order to develop recommendations for including energy efficiency as a compliance option within multi-pollutant proposals being considered by Congress and the Administration.

INTRODUCTION

Objective of this Report

The relationship between energy efficiency and emissions reduction is very strong. Reducing energy use through efficiency improvements clearly results in reducing airborne emissions—assuming some type of fossil fuel combustion for electricity generation is correspondingly reduced. This is the dominant case for the United States as a whole and for most individual states. Wisconsin and New York, in fact, have established public benefits energy programs with clear environmental objectives tied to their energy efficiency programs.

The Clean Air Act Amendments of 1990 was the first example of a federal environmental policy that gave specific pollution control credit to energy efficiency improvements. The lessons learned from this experience are critical to understand as we stand on the brink of creating new emissions trading systems for additional pollutants. The objective of this report is to examine the experience with energy efficiency and CAAA in order to understand how well this system worked and how we might incorporate similar systems of credits for energy efficiency in new market-based systems created through federal legislation. Providing pollution control credits for energy efficiency investments would provide an additional incentive for making such improvements. It also would better align such market incentives with the kinds of actions that can be taken to reduce pollution—a merging of energy and environmental policy. Just as economists argue that "polluters should pay," it also goes that "those who reduce pollution should benefit."

What Is Emissions Trading?

Beginning with the Clean Air Act of 1970, the federal government has sought to improve air quality by reducing air pollution through a variety of regulatory approaches The Clean Air Act of 1970 took a relatively rigid "command-and-control" approach to meeting air quality objectives. Factories, utility power plants, and other sources of air pollution had no flexibility in meeting various emissions requirements. Generally, all sources of the same type of plant had to meet the same pollution control standards, regardless of costs and other factors. Each source of pollution within a given type and class of plant was treated the same; the source had to meet established regulations or face fines or other penalties.[1]

There is no doubt that the Clean Air Act of 1970 and subsequent amendments through the 1970s were very successful in improving air quality across the United States. Despite this relative success in meeting its objectives, a criticism of the policy was its relative high costs of compliance and the rigidity of the "command-and-control" approach, particularly in regard to electric utility emissions control. Critics argued that a more flexible, "market-based" system could be used to yield the same results in terms of overall emissions reductions at a fraction of the cost. While the Clean Air Act of 1970 and subsequent amendments were

[1] Pollution standards typically vary by plant type (electric generation and non-electric stationary sources) and fuel type (coal, fuel oil, natural gas, etc.). Standards also typically vary by the class of plant (e.g., the type of technology employed, such as combustion turbines, steam boilers, or diesel engines).

successful in many respects, the lack of total achievement and the need for further improvements in meeting acid rain, ozone, and particulates objectives mandate further action today.

Under a market-based system, polluters may use "tradable permits" to meet pollution requirements. Physical reductions of pollution are still required on some aggregate basis, such as within a company or geographic region. The tradable permits allow greater flexibility for affected sources to meet reduction requirements.

One of the first such systems of "emission trading" began with the trading of emission-reduction credits for new source permitting. For example, a company might reduce emissions at an existing plant sufficiently to earn emission-reduction credits it would apply to meet emission requirements for operation of a new plant. In this way, the reductions at the existing plant would offset the requirements for allowable emissions at the new plant.

Another market-based system developed more recently is a "cap and trade" system, whereby a total cap on the amount of allowable air emissions is established by the environmental regulator. This sets a system-wide limit on emissions. The tradable permits are then allocated to designated sources of pollution based on some type of criteria established by the environmental regulator. The total number of tradable permits issued is equal to the emissions cap. Sources of pollution must possess sufficient permits for their emissions. Affected sources are free to buy and sell the permits in order to meet their needs. This allows them to find the most economical way to comply with emission requirements. One company might be able to "over-comply" so that it is able to sell extra emissions permits that it doesn't need. Other companies might face high costs of pollution control and therefore choose to buy such permits available from the market to meet their emissions requirements.

Title IV of the Clean Air Act Amendments of 1990 established one of the first national systems for a cap-and-trade system for meeting sulfur dioxide emissions targets in the electric power sector as a means to reduce acid rain in the United States. In this report, we examine the experience with the system created by Title IV of CAAA in order help assess the wisdom of various proposals being considered by the U.S. Congress in 2003 for expanding cap-and-trade regulation. The purpose of this report is to examine in particular the experience with provisions that allow energy efficiency services to participate in the emission trading provisions of the CAAA of 1990—not the entirety of these amendments.

The emissions trading system established under Title IV has been successful in meeting its emission reduction targets. The U.S. Environmental Protection Agency (EPA 2002) reports that acid rain program sources reduced their combined SO_2 emissions in 2001 by 39% from 1980 levels—33% from 1990 levels. During Phase I of this program (1995–1999), there was 100% compliance by sources meeting their emissions reductions, and overall emissions from affected units actually were actually *22% below* the required levels—or 7.3 million tons of extra emissions reductions (EPA 2001; Environmental Defense 2000). All these achievements have been at much lower costs than predicted at the onset of the program (Burtraw 1998; Burtraw and Palmer 2003; Swift 2001). While controversial when first

proposed, there now is widespread praise from all sides as to the effectiveness and success of the SO_2 cap-and-trade system established by CAAA.

Relevance Today: *Clear Skies* and other *Multi-Pollutant* Trading System Proposals

The success of the CAAA of 1990 has led to proposals to use a similar market-based approach to meet *multi-pollutant* objectives. Rather than a system for a single pollutant of concern—such as SO_2—such *multi-pollutant* proposals would create multiple trading systems for three or four separate pollutants emitted by electric power generators. The proposals also would establish a lower national cap for SO_2 and create new national emission caps for NOx, and possibly mercury and CO_2. The argument is that even greater compliance cost savings can be achieved by applying emission trading to additional power plant air pollutants. Such a multi-pollutant system would have other advantages as well, such as the greater ease of administration and compliance for environmental regulators and affected pollution sources. A multi-pollutant system would also allow affected sources to plan better for plant renovations over the long term by knowing the full array of regulations they face.

The Bush Administration has introduced such a multi-pollutant trading system, called the *Clear Skies Act.* This proposal would amend the Clean Air Act to tighten the emission cap applicable to sulfur dioxide, and establish new emission cap and trade systems for NOx and mercury emissions from electric generating facilities, including industrial cogeneration facilities.[2] Clear Skies would not include any provisions to regulate CO_2, a major contributor to global climate change. The proposal would create many common program elements for the trading systems for three pollutants (SO_2, NOx, and mercury), including common definitions, allowance system procedures, monitoring, permitting and compliance requirements, penalties for non-compliance, opt-ins, and auction systems. All of these would be modeled after the existing Acid Rain Program, with allowances allocated to electric-generating facilities. While there would be common elements for many aspects of the cap-and-trade systems to be established for each of these three pollutants, there also are significant differences among them specific to each regulated pollutant. For the details of Clear Skies, see EPA (2003b).

The Bush Administration first announced the Clear Skies Act on February 14, 2002. Clear Skies legislation was first introduced in both Houses of Congress in July 2002. The program was reintroduced in the U.S. House of Representatives (HR 999) and the U.S. Senate (S. 485) as the Clear Skies Act of 2003 on February 27, 2003.

Another proposal was introduced by Senators Jeffords and Lieberman in the 107th Congress (S. 556), and they introduced another version of this proposal in the 108th Congress (S. 366). While the Jeffords-Lieberman Bill also would introduce multi-pollutant trading, this bill is significantly different from Clear Skies. The Jeffords-Lieberman Bill would strengthen the SO_2 cap and introduce a cap-and-trade system for NOx, but also would add CO_2 as a regulated pollutant. Mercury would be regulated, but would not be included in an emissions trading system. Instead of allocating allowances to pollution sources—as in Clear Skies—the Jeffords-Lieberman Bill would allocate the majority of allowances for SO_2, NOx, and CO_2 to

[2] While it has been proposed to include industrial cogeneration, there also is discussion regarding exempting them from mandatory participation and allowing them to opt-in voluntarily.

residential customers.[3] These allowances would go to trustees appointed by the Administrator, who would be charged to obtain fair market value for them by means of periodic auctions. Affected power plants would have to purchase allowances via these auctions. The proceeds from the auctions, in turn, would go to residential consumers through credits on their electricity bills. The rationale for allocating allowances to households is that the atmosphere is a public good that does not belong to any company or group of companies. Environmentalists support this bill because it is more aggressive in its emission reduction targets and timetables than Clear Skies, and includes CO_2, while Clear Skies does not.

A third proposal—one that is viewed as somewhat as a compromise between Clear Skies and the Jeffords-Lieberman Bill—is one introduced in the 108th session by Senator Tom Carper of Delaware and co-sponsored by Senators Lincoln Chafee of Rhode Island and Judd Gregg of New Hampshire (Carper 2003; Kelly 2003). Like the Jeffords-Lieberman Bill, the Carper-Chafee-Gregg Bill (S. 843) is a four-pollutant bill that includes CO_2. But Carper-Chafee differs from Jeffords-Lieberman in its emission reduction targets and timetable, taking a generally more moderate stance between the Administration's Clear Skies and Jeffords-Lieberman.

With these proposals and others that are emerging, the stage is clearly set for likely passage of some kind of multi-pollutant regulation that takes a market-based approach to meet its emissions-reduction targets.

Other market-based systems to address environmental improvements through emission reductions have been created or are being initiated. Some states have implemented emission trading systems to address NOx reductions as part of their "state implementation plans" or "SIPs." For example, Congress created the Northeast Ozone Transport Region to address regional problems with non-attainment of ambient air quality standards for ozone NOx are a primary precursor to ground-level ozone, so these emissions are a primary target for reduction in these states. In 1994, these Northeast states established a memorandum of understanding (MOU) with EPA to promulgate regulations to reduce NOx emissions during the summer, which is when ozone problems typically occur (Wooley and Morss 2000). To provide affected pollution sources greater flexibility in meeting these reductions, this MOU created a region-wide NOx allowance trading system.

There also are voluntary emission credit trading programs developing for greenhouse gas emissions. For example, in January 2003 a group of 14 industries, utilities, and a municipal government joined to form the *Chicago Climate Exchange,* the first U.S. voluntary pilot program for trading of greenhouse gas emissions. Participation in this exchange includes a voluntary commitment to reduce a company's greenhouse gas emissions. Emissions trading

[3] The proposal is to allocate allowances in the following initial shares (2008): residential consumers (households) 62%, energy efficiency and renewable energy 20%, existing generators 10%, and the remainder to address adversely affected economies and to encourage techniques for geological and biological carbon sequestration. These allocation shares would change over the duration of the program, with the allocation for residential households rising to 78% by 2018, while the allocation for energy efficiency and renewable energy would remain at 20%.

to purchase credits achieved by emissions offsets would be one means for meeting reduction targets (Energy Central 2003).

Clean Air Act Amendments of 1990

While the Clean Air Act amendments enacted in 1970 and 1977 greatly helped improve air quality in the United States, some of the Act's objectives had not yet been met by the late 1980s. The Clean Air Act set specific timeframes for meeting federal clean air goals, some of which had not yet been achieved in time. A growing body of scientific research also was pinpointing certain problems that were more regional than national in scope, and that were not being adequately addressed by existing clean air legislation. Key among these problems was "acid rain" or "acid deposition," an environmental problem linked to SO_2 and NOx emissions. Once in the atmosphere, these emissions are transformed into acid rain or dry deposition, which then can fall on the ground hundreds of miles from the point of origin of the emissions. Such deposits can damage lakes, forests, soils, and buildings and can lead to reduced visibility. In the United States, this problem was especially prevalent in the Northeast and Great Lakes regions; much of the source of the problem in these areas in turn was linked to power plant SO_2 emissions in the Midwest—states such as Ohio and others with large amounts of coal-based power production.

Congress recognized this problem and in 1990 enacted Title IV of the Clean Air Act to address this problem and reduce SO_2 emissions. Title IV established the first comprehensive national market-based system to reduce pollution—in this case, that of SO_2 emissions. Title IV created an overall emissions cap for allowable SO_2 emissions from coal-fired and oil-fired power plants that was far below emission levels existing at that time. The cap established was 8.95 million tons, to be reached in two phases. The goal was to reduce SO_2 emissions by 10 million tons below 1980 levels. The statute then allocated SO_2 emission "allowances"—permits to emit one ton of SO_2—to units regulated under the program. Such units had to have sufficient allowances to equal their SO_2 emissions in a given year. Operators of affected units could either reduce their emissions to match their allowance allocation or purchase additional allowances from the market to match their emission levels. SO_2 allowances can be transferred, traded, and banked. An allowance market was created to provide the means for such transactions to occur.

To reduce emissions, power plants had two principal options—switch fuels (such as to lower sulfur coal) or control emissions through pollution-control technologies such as "scrubbers" (flue gas desulfurization units). If an operator reduces emissions below its allowance allocation, it can sell its extra allowances in the market. It can also "bank" such extra allowances for its own use at a later date.

Title IV allocated allowances based on target SO_2 emission rates that in aggregate would achieve SO_2 emission-reduction targets. This was done in two phases; in Phase I (effective January 1, 1995), this rate was 2.5 pounds of SO_2/million British thermal units (Btu). This rate multiplied by the unit's average 1985–87 baseline heat input (energy fuel equivalent) yielded that unit's allowance allocation. Phase I affected 110 specific power plants, predominantly in the Midwest. In Phase II (effective January 1, 2000), virtually all coal- and

oil-fired power plants in the United States with a 25 megawatt (MW) or greater output were allocated allowances based on an emission rate of 1.2 lbs. SO_2/million Btu times their 1985–87 baseline heat input. There were some exceptions to this general requirement, and a pool of "bonus" allowances was created that EPA could allocate to certain categories of power plants to address certain equity and economic concerns, such as "high growth" areas and municipally owned power plants.

To help assure that sufficient numbers of allowances were available via the market, EPA also was tasked with conducting yearly auctions for a small fraction of the total allowances allocated each year. These allowances are made available by withholding 2.8% of the allocation from affected power plants and placing them in a "Special Allowance Reserve." The Chicago Board of Trade then conducts auctions for EPA for a certain number of allowances from this reserve.

There are numerous other details of the mechanics and provisions of Title IV that we will not cover in this report. It was a groundbreaking and complex piece of legislation in addressing pollution control at the federal level. For analyses of Title IV and other provisions of the CAAA of 1990, see Burtraw (1998); Burtraw and Palmer (2003); Environmental Defense (2000); EPA (2001, 2002); Swift (2001); and Wooley and Morss (2000).

For purposes of this report, the most critical provisions of Title IV are those that specifically address energy "conservation" (efficiency) and renewable energy. We examine these in the next section.

Provisions for Energy Efficiency and Renewable Energy

Congress included a provision in Title IV to allow energy conservation and renewable energy technologies to earn allowances from a special set of 300,000 bonus allowances that were set aside from the total emissions cap of 8.95 million. This reserve of allowances—called the Conservation and Renewable Energy Reserve or CRER—was created to allow qualifying utilities to earn these credits through energy efficiency measures and renewable energy development (EPA 2003a). The intent was to encourage investments in such technologies, which have clear environmental benefits in terms of reducing power plant emissions. CRER also was intended to provide utilities additional compliance options and give them greater control and flexibility in meeting the requirements of Title IV. Allowances gained from CRER could be used for current compliance, banked for future use, or sold.

Utilities affected by Title IV regulations are the only entities that are eligible to receive allowances from CRER. The applicants to the Reserve must sell electricity and have units affected under either Phase I or Phase II of Title IV. Non-utilities or other third parties that do not meet these eligibility criteria are not eligible to gain the allowances for renewable energy development or energy conservation measures.

There are additional eligibility requirements to earn allowances from CRER. The applicant must be subject to a "least cost" or other type of integrated planning that is approved or accepted by the applicant's rate-making body (typically a state public utility

commission). Further, investor-owned utilities applying to the reserve must be subject to a rate-making process that provides for "net income neutrality"—meaning that the rate-making authority adjusts utility rates for "lost sales" due to efficiency programs. Meeting this last requirement for net-income neutrality requires certification from the U.S. Department of Energy (DOE).

An additional purpose of CRER was to encourage utilities to achieve "early" reductions in emissions before Phase I became effective (January 1, 1995). Utilities could apply for Reserve allowances for energy efficiency measures and renewable energy generation brought into operation on or after January 1, 1992. Phase 1 affected utilities could earn Reserve allowances from this date through the start of Phase I—a 3-year period. Phase II affected utilities were eligible for energy efficiency or renewable energy generation measures for the period beginning January 1, 1992 through December 31, 1999. While no reserve allowances can be earned since the end of this period, utilities may apply until 2010 for reductions that occurred before that deadline. While technically still open, the eligibility ending date for program savings (12/31/99) means that for all practical purposes, CRER has expired. It is unlikely that utilities who have not already applied for CRER will now decide to apply for such allowances.

To receive allowances from CRER for energy efficiency measures, an applicant has to apply to EPA and verify the energy savings that were achieved. The applicant has to submit a "Conservation/Renewable Energy Reserve" form to EPA along with materials to verify the savings. There are two routes for this verification. If a utility is subject to regulation by a state public utility commission that uses a "performance-based rate adjustment," the utility submits verification to the state for approval. In other cases the utility must submit verification to EPA and is encouraged to follow "EPA's Conservation Verification Protocols (CVPs)," which provide forms and detailed instructions to complete the application for verification. According to EPA's Protocols, "The CVPs are designed to be rigorous without being burdensome on the utility or the regulator. The CVPs help to ensure the cost-effectiveness of utility conservation programs and SO_2 emission reduction measures, as well as the reliability of energy savings from those measures." (EPA 2003b).

The basic formula for awarding allowances from the Reserve is that one allowance is earned for every 500 megawatt-hours (MWh) of qualified efficiency savings or renewable energy generation. The 300,000 reserve allowances therefore meant that up to 150 billion kilowatt-hours (kWh) in energy either conserved through efficiency or generated from renewable sources would be eligible for gaining allowances.

The value of the allowance is its market value—a variable that played a key role in determining the relative attractiveness of using energy efficiency and renewable energy generation to earn allowances. In 1990, EPA estimate's for the market price of allowances was about $750 (Bohi and Burtraw 1997). As we discuss later, the actual market price has been much lower than this.

Energy efficiency measures could also benefit utilities through two other mechanisms in addition to the mechanism of being awarded allowances from CRER. These are "avoided emissions" and "reduced utilization."

"Avoided emissions" refer to emissions that do not occur as the result of a utility's investments in energy efficiency or renewable energy technologies. If a utility can reduce its demand through energy efficiency improvements, it does not need to generate as many kilowatt-hours, which can translate to reduced combustion of coal. Each ton of SO_2 avoided through the use of energy efficiency and renewable energy means one less allowance must be surrendered to comply with Title IV. According to EPA (1994), "The result is an allowance that can be used for current compliance, 'banked' for future use, or sold. The utility saves these allowances at the average emission rate of the utility's units affected by Title IV. For utilities currently emitting high rates of SO_2, avoided emissions can thus be particularly valuable." There is no application for avoided emissions, and there is no requirement for verification, since this mechanism is entirely internal within a utility.

The "reduced utilization" provision was designed to prevent load shifting away from Phase I affected units to unaffected SO_2-emitting facilities (in Phase II virtually all large SO_2-emitting facilities are affected, negating the need for this provision there). If utilities reduce utilization of Phase I units below their baselines, the provision requires the utilities either to specify the unit(s) that will provide the compensating generation or to surrender allowances below the baselines. However, utilities could follow one of three strategies to offset these shifts and avoid the loss of allowances, namely:

1. Shift to a sulfur-free generator,
2. Offset with demand-side efficiency measures, or
3. Offset with supply-side efficiency measures.

Efficiency and renewable energy resources thus allowed utilities to reduce usage of Phase 1 plants without the requirement to designate a compensating unit or to give up additional allowances (EPA 1994). To receive credit for one of the above off-setting strategies required a "Reduced-Utilization Plan" to be filed with and approved by EPA. Unlike CRER, this program was not subject to least-cost planning or net income neutrality requirements.

RESULTS: LESSONS LEARNED FOR EFFICIENCY AND RENEWABLE ENERGY

Title IV and the Allowance Market: How Well Have They Worked?

Title IV has been very successful in meeting its objective—reducing SO_2 emissions to prescribed caps (and even lower) through a flexible system that has allowed affected sources to make the necessary reductions in the most cost-effective solution for their circumstances. There were 2,792 units used to generate electricity that were subject to the SO_2 provisions of Title IV in 2001. The Acid Rain Program established by Title IV has resulted in a reduction in SO_2 emissions of 39% from 1980 to 2001—33% from 1990 levels (EPA 2002). During Phase I (1995–1999), affected units reduced allowable SO_2 emissions to 22% below the

levels required compared to their base allowance allocations, which means that utilities achieved 7.3 million tons of extra emissions reductions (Environmental Defense 2000).

It is expected—and early experience in Phase II confirms this—that the allowances "banked" during Phase I from reducing emissions below levels required by the allowance allocations will be drawn down during Phase II ("withdrawn from the bank") to help meet requirements. These extra reductions represent a concrete economic asset expressly due to the banking and trading provisions of the program. As Bohi and Burtraw (1997) note, "The bank represents a 'win-win' outcome for the environment and for industry. The early reductions provide an opportunity for environmental recovery and improved public health at an earlier point in time than would occur otherwise, while the bank provides an opportunity for industry to lower its overall costs of compliance and the ability to ease into the more stringent Phase II."

The primary compliance strategy by sources affected under Title IV during Phase I has been fuel-switching to low-sulfur coal. Fuel switching has generally proven to be the least-costly option for meeting emission requirements. EIA (1997) reported that in 1995 (the first year of Phase 1), fuel switching was used by 59% of the affected units to meet SO_2 reductions and fuel gas desulfurization (*scrubbers*) were used by 28% of affected units.

The allowance market itself has developed slowly, as might be expected for development of any new commodity market exchange—and maybe particularly for such a novel commodity as SO_2 allowances. Bohi and Burtaw (1997) observed that indeed the initial allowance market was not very active or large. Utilities seemed to be banking any allowances in excess of their compliance requirements.

More recently the allowance market has showed signs of more rapid development. The number of allowance transfers increased greatly from the program's inception—from only 613 allowance transfers in 1995 to 1,584 in 1998 to 2,832 in 1999. More of these transfers also are becoming "inter-utility" transfers—i.e., between two companies with no financial or organizational ties. In earlier years, the majority of transfers were "internal" to utilities (Environmental Defense 2000). In 2001, the number of allowance transfers had increased to 4,900—affecting over 22 million allowances. Of these allowances transferred in 2001, 55% were transferred between economically unrelated parties (EPA 2002).

The market price for allowances has defied many dire predictions and remained well below levels expected by most analysts. As late as 1989, EPA was predicting that the marginal costs of SO_2 control would be $1,500/ton, which would correlate directly to the market price for SO_2 allowances. A year later, after passage of CAAA, EPA had adjusted its estimates by half—down to $750. Still, most projections of the market price for allowances were in the range of about $300–500 (Burtraw 1998). Actual market prices for allowances have generally fallen within the range of $100–200, and have never exceeded $250 for the duration of the program (EPA 2002).

Efficiency and Renewable Energy: How Well Used As Compliance Options?

Despite the great promise and intent of Title IV to encourage investments in energy efficiency and renewables as a means to meet emission requirements and yield allowances to the entities making such investments, the actual results from CRER are poor. According to Walke (2003), EPA reports that only 47,493 allowances—approximately 16% of the total reserve of 300,000—have been awarded (through April 2003). This number is unlikely to increase as the period of eligibility for measures to be installed ended December 31, 1999. Utilities that have not already applied for CRER allowances are unlikely now to apply for them. This means that about 252,500 allowances have been left in the reserve—unused in the allowance market. The value of these allowances—assuming a market price of $150/allowance—is approximately $37.9 million. The fact that such an apparently large asset was left "unclaimed" gives a strong message itself that this provision of Title IV was not very successful. Of the total CRER allowances that have been awarded, 36,360 have been for conservation measures and 11,133 have been for renewable energy generation.

Vine (2003) and Wooley and Morss (2000) cited principal reasons for the poor participation in CRER for energy efficiency and renewable energy investments. These reasons include:

- The actual market price of SO_2 allowances has been much lower than expected. Utilities needing additional allowances than their allocation under Title IV generally found it cheaper and easier to purchase SO_2 allowances in the market than to pursue allowance allocation under CRER. Many utilities simply met their allowance requirements by fuel-switching or other pollution control strategies internal to their operation and did not participate in the allowance market.
- The conversion factor for determining the number of allowances to be awarded based on either conserved energy or energy generated by renewables was low (one allowance per 500 MWh) and thereby discouraged participation. For a market price of $150/allowance, this yields a value per saved kilowatt-hour of only $0.0003. This low value is hardly sufficient to drive new investment in energy efficiency over that driven by more specific project economics. Another way to look at this value is that to generate 500 MWh with a coal-fired power plant meeting the Phase II emission rate (1.2 lbs. SO_2/million Btu), the operator would need 2.7 allowances (assuming a heat rate of 9,000 Btu/kWh). This suggests that the playing field is not level when it comes to energy efficiency and renewables and that these options are undervalued for their emissions-reduction potential. However, even if the value of allowances was tripled to "level the playing field," CRER allowances would still be worth less than one mill (tenth of a cent) per kilowatt-hour—hardly an enticing value.
- The transaction costs of applying for the allowances and meeting all the requirements for qualified energy efficiency improvements—especially verification costs—were relatively high given the low value of the earned allowances. In short, most utilities did not find it worth their time and effort to apply for allowances from CRER for their energy efficiency and renewable energy investments.
- The CRER provisions were created to fit a regulated utility industry. As deregulation and restructuring initiatives gained rapid momentum in the 1990s, utilities lost much of their

motivation and interest for pursuing energy efficiency. This, in turn, created much less incentive to participate in CRER. These broader issues also occupied much more of senior management time and concern than participating in CRER, which at best yielded marginal returns.

- Only utilities could gain allowances from the set-aside reserve. Other parties that provide energy efficiency services were not eligible to participate in CRER.

The shortcomings of CRER under Title IV provide clear lessons for creation of new emission-trading schemes under new legislative proposals for either single or multi-pollutant systems. In the next section, we make recommendations based on these lessons.

Another opportunity for using energy efficiency to help comply with Title IV provisions mentioned earlier—"reduced utilization"—has gone untapped. According to Morgan (2003), EPA did not receive any applications for reduced utilization. He speculated hat the hurdles for documentation compared to the relative low value of allowances did not make it worthwhile for utilities to seek this option.

It is not possible to assess the impact of "avoided emissions" due to energy efficiency programs. As noted earlier, this is an internal mechanism within a company. No application to the environmental administrator (EPA) or documentation is required. There are no studies or estimates available of this possible impact. However, Morgan (2003) suggested that this mechanism may have been the most beneficial to utilities under Title IV. The value to any given company would be different. It would be a function of the specific generation sources within a company's portfolio of resources offset by conservation. To estimate the amount and type of generation that was "backed down" due to energy savings from conservation programs would require individual company assessments. In turn, the amount of emissions not generated would translate to allowances that could be used by companies to meet present or future requirements.

RECOMMENDATIONS FOR MULTI-POLLUTANT EMISSIONS TRADING PROPOSALS TODAY

While utilities generally have not actively pursued energy efficiency as part of their pollution control strategies, energy efficiency programs continue to be offered by utilities and other organizations to capture more direct economic and resource benefits, as well as for more general environmental improvement. Recent research by ACEEE (York and Kushler 2002) tracked and analyzed trends in utility and non-utility energy efficiency programs. In 2000, total spending on energy efficiency programs was about $1.1 billion—clearly illustrating the importance placed on these programs by utilities, regulators, policy makers and consumers (see text in box for more information and a summary of these trends).

Granting emission credits for energy efficiency is a desirable alignment of energy and environmental policy, especially considering the amount of funding directed towards each objective. Granting such credits for energy efficiency improvements provides the right market signals to reward those who invest in energy efficiency as technology that has clear environmental benefits. Including provisions to reward such investments within a broader

emission trading system gives additional flexibility and an expanded menu of options to those entities affected by emission regulations. Experience from over two decades of energy efficiency programs clearly shows that the energy efficiency savings achieved through such programs can be documented and verified, which is central to granting such savings environmental credits.

Trends in Utility and Public Benefits Energy Efficiency Programs

Energy utilities and other organizations have offered programs to promote greater levels of energy efficiency in homes, businesses, institutions, and industries for over 20 years. While the structure, funding, and approaches of such programs may have evolved over the years, the overarching rationale for such programs generally has been that such programs provide economic and *environmental* benefits greater than their costs. Most of these programs have resulted from legislation and/or regulation at the individual state levels. In the 1980s and into much of the 1990s, such programs generally fell under the umbrella of utility *demand-side management.* In the 1990s and into the 2000s, *market transformation* emerged as a program model and objective for affecting permanent changes in markets for energy-efficient products and services. *Resource acquisition* emerged in tandem with market transformation to denote programs that sought to achieve very direct and quantifiable energy (kilowatt-hour) and demand (kilowatt) savings. Since the late 1990s, p*ublic benefits* programs have been created by several states that have restructured or are restructuring their energy market. In many cases, such public benefits programs that address energy efficiency are carried out by non-utility organizations. However, as York and Kushler (2002) noted, utilities still accounted for the largest share of efficiency programs in 2000, whether *public benefits* or *demand-side management* programs.

Research by ACEEE over the years has documented energy efficiency program activity at the state level and for the United States as a whole. Most recently, York and Kushler (2002), in their research on state and national trends, found:

- Total spending on utility and public benefits energy efficiency programs declined from about $1.8 billion in 1993 to just over $900 million in 1998 and then rose to about $1.1 billion in 2000.
- Public benefits spending is expected to continue to increase as indicated by the total amount of funding authorized by states enacting such programs.
- The states most actively providing publicly supported energy efficiency programs have been and continue to be in the Northeast (New England and the Mid-Atlantic region), the Pacific Northwest, and the Midwest, along with Florida and California.
- Total energy efficiency program savings in 2000 were about 57 TWh—or enough in one year to have earned 114,000 SO_2 allowances at the rate established by Title IV to award 1 allowance for 500 MWh of energy conserved through qualifying energy efficiency programs.

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There is great variability in funding levels for energy efficiency programs. About one-third of the states (16) account for 86% of total U.S. spending on energy efficiency programs. One-half of the states (25) account for essentially all (95%) of total spending on energy efficiency programs. This means that one-half of the states have virtually no publicly supported energy efficiency programs.

While the broad concept of using energy efficiency to earn tradable emission permits to meet environmental emission-reduction targets is attractive and meshes well with market-based approaches to pollution control, the experience with CRER from Title IV shows that such a system needs to be carefully structured to be successful. We offer the following two

major recommendations for the design of multi-pollutant emission trading systems that include energy efficiency as a direct option for earning allowances. These two recommendations should serve as guiding principles for creating any such system.

1. Efficiency improvements would be granted allowances based on the amount of "equivalent" generation avoided (at generation level). For example, a 10 MWh savings at the customer level would generate allowances at least equal to the equivalent generation that it offsets (i.e., 10 MWh plus some factor for transmission and distribution losses). Determining what generation is "offset" in this manner is a potentially difficult issue, as this is a function of the type of generation affected by the conservation savings. The market will determine the value of allowances, and in turn, the explicit environmental value of energy efficiency investments. In most cases, this value alone is unlikely to be a deciding factor for energy efficiency investments, but its marginal value might well help tip the scales in favor of many types of projects whose benefits versus costs are otherwise about even. The objective should be to create a "level-playing" field with respect to supply-side and demand-side options to reduce emissions.
2. The eligibility to receive allowances for qualified energy efficiency measures should be open to a variety of stakeholders, including utilities, customers, and third parties, such as energy service companies or manufacturers. The trading system administrator—the EPA—would need to work out systems to accommodate these different market participants and ensure that there is no double-counting of qualified measures. EPA might assign initial ownership of energy efficiency allowances to customers who purchase or make qualified energy efficiency improvements. Customers, in turn, could transfer ownership to appropriate parties—such as manufacturers, energy service companies, or utilities—who might have provided financial incentives for their improvements or otherwise were involved in making the improvements. Alternatively, EPA might directly reward allowances to utilities or energy service companies (third parties) for achieving energy efficiency gains from working with customers. A variety of approaches are possible. EPA would need to work out a "hierarchy" of ownership for energy efficiency measures, perhaps based on the party making the investment or facilitating the improvement.

Beyond these two over-arching principles, we provide the following additional recommendations for options to consider for some of the implementation details necessary to create a workable, equitable system to reward qualified energy efficiency measures with allowances:

- Multi-pollutant emissions trading systems must allow projects to be aggregated into a relatively large minimum size, which is necessary for an entity to participate effectively and economically in the multi-pollutant allowance market. Energy efficiency almost always comes in small increments relative to fossil-fuel generation units. Any trading system that includes energy efficiency must provide a way for aggregation of individual efficiency improvements, such as by entire programs or portfolios of programs. The transaction costs of aggregation and participation in the multi-pollutant allowance trading markets generally would be too big a barrier for small businesses and other small organizations to overcome to participate in this market.

- Making non-utility and other parties who are not directly subject to emission control requirements eligible to participate in the allowance market would provide one avenue to address the aggregation problem. For example, energy service companies or manufacturers of energy-efficient products might benefit from earning allowances (either awarded to them from the Administrator directly or transferred from customers themselves) and selling them in these markets. Making non-utility parties eligible to participate in allowance markets may be a key to success for driving energy efficiency as a means to gain allowances. Companies that provide energy-efficient products and services would gain additional incentives directly related to their core business of delivering energy savings.
- Another strategy to overcome the problem of aggregation would be to encourage integrated utilities, generation companies, or distribution companies to serve this aggregation function. There are several advantages to having these types of companies play this role.
  - Integrated utilities and generation companies by default will be in the allowance trading market since they will be required to have allowances sufficient for their electricity generation. Participation costs would therefore be reduced for them to aggregate and trade energy efficiency-based allowances.
  - Many integrated utilities and distribution companies have experience with energy efficiency program structures, implementation, measurement, and verification.
  - The allowances earned through aggregation of energy efficiency projects have real value to the aggregator, which provides a motivation for success in this area.
  - The integrated utility or distribution company could expense additional transaction costs as allowable operating costs. This would vary state by state, but the enabling federal legislation could contain language that encourages states to allow cost recovery of transaction costs in aggregating energy efficiency projects to qualify for allowances by regulated utilities and distribution companies.
  - While different types of companies may have different motivations, the program administrator should be able to develop incentives that attract and engage a variety of different types of companies in aggregating energy efficiency-based allowances and participating in multi-pollutant allowances markets.
- Awarding allowance credits for purchase of selected new, energy-efficient products by residential and commercial customers is a promising mechanism to increase sales of efficient goods and services and help achieve environmental objectives. Customers who purchase eligible energy-efficient products could receive the allowance credits. The customers could then transfer the credits to a third party, such as manufacturers, utilities, or energy service companies. For example, the third party would purchase the allowance credit from the customer through some transaction, such as a rebate.

  This approach has several benefits. It first establishes a clear mechanism for aggregating numerous small purchases necessary to achieve the threshold for participating effectively and economically in the allowance trading market. Also, a rebate and associated records also help the savings look more “legitimate” to the customer, thus increasing likelihood of buying high efficiency. It also educates customers about the energy–environment link and sends the right market signal to the consumer regarding the energy and environmental benefits of more efficient products.

- If allowances are granted to customers for energy efficiency, industrial customers who make energy efficiency improvements will require a different approach for gaining allowances. Unlike residential and many commercial markets, industrial improvements typically involve customized "system optimization," which addresses "right sizing" of equipment and responsive control strategies. Consequently, industrial markets will require a more customized approach for demonstrating and documenting efficiency improvements that will qualify for allowances. While more complex, the payoff is that most industrial improvements can yield much higher levels of energy savings per project compared to household purchases or commercial building improvements.
- Non-utility generation is a rapidly growing segment of the generation market and any emissions trading system must include provisions for these producers, who might serve an aggregation function for energy efficiency-based allowances in order to secure allowances necessary for their generation.
- Transaction costs of applying for and being awarded allowances must be reasonably low, even for the larger entities that would participate in this market activity. If the administrative burden of applying to the environmental regulator to receive emission allowances is too high, companies simply won't avail themselves of this opportunity. Any systems created should avoid some of the regulatory requirements associated with earning allowances from CRER—such as "net income neutrality."
- Consideration should be given to creation of a *set-aside* program to assure a certain minimum number of available allowances, similar to what was done for the SO_2 trading system. A set-aside pool of allowances would *not* be necessary if efficiency improvements are granted allowances based on the amount of "equivalent" generation avoided (the first recommendation in this section). However, if this type of direct equivalency is not established, a set-aside for energy efficiency improvements may be warranted. The set-aside would create an initial pool of allowances that could only be awarded to qualified energy efficiency projects. This would both provide a "jump start" to this aspect of the market and help reduce risk and uncertainty associated with obtaining energy efficiency-based allowances in the market because there would be a known quantity of such allowances available at the initiation of the program. This set-aside would be designed to start the market, not sustain it. Therefore, after an initial start-up period, this set-aside could be phased out if no longer needed.
- Verification protocols must be applied to provide reasonable levels of assurance that energy efficiency savings actually are achieved, but also are not too burdensome or costly. The program rules for applying for and receiving energy efficiency-based allowances should not impose undue costs on entities seeking this option. The program rules must strike an effective balance between the need for accurate accounting of emission reductions and the need for user-friendly, streamlined administrative processes required of participating entities. We suggest relying on such protocols already established and in use for residential and commercial markets, such as DOE's International Performance Measurement and Verification Protocols. As noted above, industrial customers who make energy efficiency improvements may require development of similar verification protocols.
- The administrative rules for such systems must be designed with the intent of encouraging and rewarding new investments in energy efficiency above that which is "naturally occurring" within the market or required by codes and standards. The

protocols to be established would need to address the issue of identifying net efficiency impacts of energy efficiency improvements that qualify to receive allowances. Net efficiency impact in this context (also sometimes referred to as *additionality*) is the difference between the energy use of a more energy-efficient technology and a reference level of energy efficiency for the technology. The program administrator will have to establish clearly defined reference levels and/or protocols for all eligible energy efficiency improvements. This will need to be done in a manner that is reasonably simple for participants and practical for the administrator.

- Equity concerns would dictate that existing programs should get the same credits as new programs. This also would help prevent "gaming" of programs in order to qualify. Ongoing programs should get credit for savings beyond what would happen in a no-program base case, on a going-forward basis (i.e., for all new installations resulting from the program—not for savings from measures installed in years prior to the policy enactment).

CONCLUSION

National legislation addressing air pollution is likely to be passed and signed into law sometime in 2003 or 2004. The leading proposals all call for some type of trading systems for selected pollutants. The Bush Administration's proposal calls for three air pollutants to be targeted— SO_2, NOx, and mercury. Other proposals would include CO_2 in addition to these three pollutants. The trading systems to be created would be based on Title IV of the Clean Air Amendments of 1990, which created the first national level emission trading system. In this case, the pollutant addressed was SO_2 as a means to reduce acid rain in the United States.

While Title IV has been successful in meeting SO_2 emission reductions through a pioneering national "cap-and-trade" system, it has not been very successful in encouraging energy efficiency and conservation as a means to earn allowances. This lack of success means lost opportunities for encouraging greater levels of energy efficiency within the economy to achieve both economic and environmental benefits.

Energy efficiency clearly can reduce airborne emissions from power plants since saved energy translates to reduced energy demand, and in turn, reduced electricity generation and associated emissions from fuel combustion. As lawmakers consider creating and revising cap-and-trade systems for meeting air pollution objectives, it is important to include provisions in any such laws that will create opportunities for energy efficiency to play a role in meeting such objectives. Reducing emissions through saving energy should have equal standing to reducing emissions through various supply-side options, such as fuel-switching or flue-gas pollution controls.

Over two decades worth of experience with energy efficiency programs has clearly demonstrated that such programs can achieve significant amounts of energy savings. However, the very direct linkage to environmental improvement from such savings has not generally been made. Creating an effective role for energy efficiency to play within federal clean air legislation would make this direct linkage—a linkage that would align both environmental and energy policy objectives.

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