DISCUSSION PAPER

February 2012 ■ RFF DP 12-05

Tradable Standards for Clean Air Act Carbon Policy

Dallas Burtraw, Arthur G. Fraas, and Nathan Richardson

1616 P St. NW
Washington, DC 20036
202-328-5000 www.rff.org

RESOURCES FOR THE FUTURE

Tradable Standards for Clean Air Act Carbon Policy

Dallas Burtraw, Art Fraas, and Nathan Richardson

Abstract

EPA is in the process of regulating U.S. greenhouse gas (GHG) emissions using its powers under the Clean Air Act. The likely next phase of this regulatory program is performance standards under Section 111 of the act for coal plants and petroleum refineries, which the agency has committed to finalize by the end of 2012. Section 111 appears to allow use of flexible, market-based regulatory tools. In this paper, we discuss one such tool, tradable standards. Tradable standards appear to be a legally and politically viable choice for the agency, and evidence suggests they are substantially more cost-effective than traditional performance standards. The paper discusses implementation issues with tradable standards, including categorization, banking, and phased implementation, as well as broader issues with the Section 111 rulemaking process as it relates to state-level GHG regulatory efforts.

Key Words: averaging, flexibility, regulatory design, market-based regulation

JEL Classification Numbers: Q54, Q58

Contents

Tradable Standards for Clean Air Act Carbon Policy

Dallas Burtraw, Art Fraas, and Nathan Richardson*

1. Introduction

For the near and foreseeable future, climate policy in the United States is in the hands of the Environmental Protection Agency (EPA) and the states. EPA has committed to issuing what will be the first nationwide regulations on greenhouse gas (GHG) emissions from existing sources, initially applying to the largest categories of emitters: fossil-fuel steam power plants and oil refineries. The relevant part of the Clean Air Act (CAA), Section 111, provides the agency with the necessary authority, carves out a specific planning and implementation function for the states, and allows significant flexibility. Not only is this the first instance of GHG regulation of existing stationary sources, but key parts of Section 111 have been rarely used and potentially support a variety of options for the design of the regulation. The agency therefore has the opportunity (and the burden) of making a series of important choices about the nature of its program for regulation of GHGs at these sources.

The most fundamental of these choices is the regulatory approach the agency will use. Section 111 requires the use of "performance standards." Traditionally, this has meant one-size-fits-all standards for each sector or "source category" being regulated. But the statute does not require such rigid standards, at least with respect to regulation of existing sources, and the agency has argued that it may implement market-based emissions control programs under the section—a reading with which most legal analysts appear to agree (Wannier et al. 2011). (EPA made similar arguments in 2008 and 2005; see EPA 2008a at 44490, 2005).

One such market-based approach is cap-and-trade, which has been used under several previous CAA programs and was considered by Congress in 2009 for greenhouse gases. However, in the context of recent legislative efforts to address GHG emissions, the cap-and-trade approach has come to be seen by parts of the polity as "growth-limiting." But even if EPA eschews cap and trade, it need not forgo flexible, market-based tools entirely and resort to

* Burtraw, Darius Gaskins Senior Fellow, RFF, burtraw@rff.org; Fraas, Visiting Scholar, RFF, fraas@rff.org; and Richardson, Resident Scholar, RFF, richardson@rff.org. This research has benefited from comments from participants at the RFF's *Clean Air Act Greenhouse Gas Workshop* July 18, 2011 and *First Wednesday Seminar* December 7, 2011.

traditional inflexible standards. We describe an approach that can incorporate trading and most of its associated efficiency benefits while avoiding some, and perhaps all, of the political and practical drawbacks of cap-and-trade.

This alternative approach is a *tradable standard*. Put most simply, under a tradable standard the agency sets a performance standard, but allows emitters to trade so that it is achieved on a sector-wide, rather than individual, basis. Tradable standards are almost certainly legal, are both administratively and politically viable, and are relatively cost-effective—certainly more so than traditional standards, and perhaps approaching or exceeding the cost-effectiveness of cap-and trade depending on how either were to take shape. Also, tradable standards are not new, having been used by EPA in limited fashion as early as the 1980s, most prominently to implement the phaseout of lead in gasoline (Nichols 1997; Newell and Rogers 2003). But they are not a widely used or widely understood policy option. The primary aims of this paper are to explain this policy tool in theory and to describe the decisions EPA would have to make to put this tool into practice for GHG regulation.

The agency faces at least two other key decisions in implementing carbon regulations for existing sources. One is that EPA must decide how much to leave to the states. The agency could design a complete program for states to implement—a model rule—or it could leave basic program design to the states. Either way, states will play an important role. But a model rule would provide a path of least resistance for cash-strapped states and would likely be widely adopted. Since we envision a tradable standard as an interstate scheme, the implications of this delegation decision are relevant, and we discuss them in some detail in Section 5.

Finally, and perhaps most obviously, the agency will have to decide how stringent its Section 111 carbon regulations should be. We do not directly address that issue here except to highlight that stringency is related to flexibility since Section 111 requires the consideration of cost. By lowering cost, flexibility would afford and enable greater emissions reduction than would a traditional (inflexible) standard.

2. EPA, Carbon, and the Clean Air Act

The CAA has only recently emerged as a tool for regulating greenhouse gases. The Supreme Court's 2007 *Massachusetts v. EPA* ruling (549 U.S. 497 at 528–529, 2007) clarified that the existing CAA gives the agency the authority to regulate GHG emissions. Since 2009, EPA has made a formal science-based "endangerment finding" for GHGs and used its CAA authority to begin regulation of carbon emissions from a variety of sources. These regulations include fleet standards for new road vehicles and preconstruction permits for new and modified stationary sources (primarily power plants and industrial facilities).

In late 2010, the agency committed to carbon regulations for the operation of both new and existing emitters in the sectors with the largest emissions: fossil-fuel steam power generation (mostly coal) and petroleum refining. These regulations are required under the terms of a pair of settlement agreements between EPA and states and environmental groups that had sued the agency seeking GHG performance standards.[1] The standards, under Section 111 of the act, will be the first national carbon regulations for existing emitters. Under the agreement, the agency was to propose the standards in 2011 (though this has been repeatedly delayed) and finalize them by the end of 2012.[2]

2.1 Section 111 Performance Standards: New and Existing Sources

When EPA does issue the promised standards, the process will unfold as follows. Under Section 111 of the act, EPA is charged with setting "performance standards" that will apply to new sources in defined "source categories" (see CAA § 111(b)). Sources cannot be operated unless they meet these standards (CAA § 111(e)). The agency currently has such new source performance standards (NSPS) for a wide variety of sources, covering a wide variety of pollutants (though not GHGs).

But Section 111 also provides for the regulation of *existing* sources via performance standards (CAA § 111(d)). Only specific pollutants can be subject to such existing source performance standards (ESPS): that is, those not regulated under other parts of the statute, such as programs for "criteria" or hazardous pollutants. In the past, almost no pollutants have fallen into this category, so the agency has issued only a few ESPS. But GHGs at existing sources are not regulated elsewhere under the act, and are therefore subject to ESPS.

ESPS, unlike NSPS, require states to play a major regulatory role. Under ESPS, states propose the standards, EPA decides whether to approve them, and states implement them. The

---

[1] See Settlement Agreement (boilers), *State of New York, et al. v. EPA*, No. 06-1332, D.C. Cir. (2007), www.epa.gov/airquality/pdfs/boilerghgsettlement.pdf; and Settlement Agreement (refineries), *State of New York, et al. v. EPA*, No. 06-1332, D.C. Cir. (2007), www.epa.gov/airquality/pdfs/refineryghgsettlement.pdf.

[2] As of early 2012, proposals have yet to be released, but EPA remains bound to issue them under the agreements. Failure to complete the rulemakings would result in the states and environmental groups reopening their litigation to force the agency to issue the standards.

statute explicitly analogizes the process to the State Implementation Plan (SIP) process for regulating conventional "criteria" pollutants such as nitrogen oxides and particulates under a different part of the CAA (CAA § 111(d)). The only substantive requirement Section 111 imposes on the states is that they must regulate using performance standards, as defined in the statute.

The statute appears to give states the initiative in the ESPS process, but since EPA must ultimately approve or disapprove state plans, under the agency's interpretation it must first issue guidelines to the states (see EPA 2011, 2). How detailed these guidelines will be is an important decision for the agency. They could come in almost any form, from a methodology for the states to apply in their planning process, to a simple emissions rate performance target, to a fully specified model rule for a trading program. Analogous examples of each approach can be found in the development of various SIPs for regulating conventional pollutants.

2.2 Performance Standards and Flexibility

Performance standards have traditionally meant a uniform source-category-wide standard, based on a technological assessment, which must be met by each source subject to the standard.[3] But both EPA and independent legal analysts have argued that the act does not require such a rigid approach for existing sources.

The statute defines performance standards as regulations that reflect the "best system of emission reduction" taking cost into consideration (CAA § 111(a)). EPA and legal analysts argue that this allows the use of market-based, flexible compliance mechanisms, since the agency could identify such tools as the "best system."[4]

In principle, Section 111 appears to be sufficiently flexible for EPA to implement a cap-and-trade system. Indeed, EPA attempted to do this in 2005 for mercury emissions from coal plants (see EPA 2005, 28606), though that rule was rejected by courts for unrelated reasons. Nevertheless, cap-and-trade is politically controversial, and opponents of environmental

---

[3] As traditionally understood, a "performance standard" sets a concrete regulatory goal, but need not be achieved by use of any particular technology or measure. Nonetheless, it is generally set at a rate of emissions that reflects the performance of a preferred control technology identified by EPA. Hence, the traditional standard is viewed as inflexible because technology options are in reality often limited, and because there is traditionally no ability to trade among facilities.

[4] While this interpretation has not been tested in court and is not universally accepted, it appears to be the prevailing view. See Wannier et al. 2011, 4–5; Richardson 2011, 10–17.

regulation would undoubtedly criticize an EPA decision to implement a policy recently rejected by Congress. At least one high-ranking EPA official has explicitly promised that the agency will not consider cap-and-trade (see Nelson 2011). Therefore, whatever the advantages of cap-and-trade as a policy tool may be, we do not consider it here.

The policy tool we describe, tradable standards, has some similarities with cap-and-trade—most obviously, the ability to trade credits. But tradable standards differ from cap-and-trade in important ways that reduce their associated administrative complexity and political controversy. First, they have much more in common with traditional performance standards that EPA has frequently used in the past under Section 111, likely reducing legal risk and certainly making states and EPA more comfortable with administering the program. They also require no emissions cap, likely reducing political criticism. Finally, they do not require EPA to administer the complex and controversial process of allocating emissions allowances.[5]

3. Fundamentals of Tradable Standards

Tradable standards combine elements of traditional performance standards with markets. Just as under traditional regulation, tradable standards require the regulator to set a performance standard for sources in the sector being regulated. But instead of requiring each source to meet the standard independently, sources that do not meet the standard can purchase credits from those that outperform it, such that the standard is achieved on average across the regulated sector.

3.1 Tradable Standards for the Electricity Sector

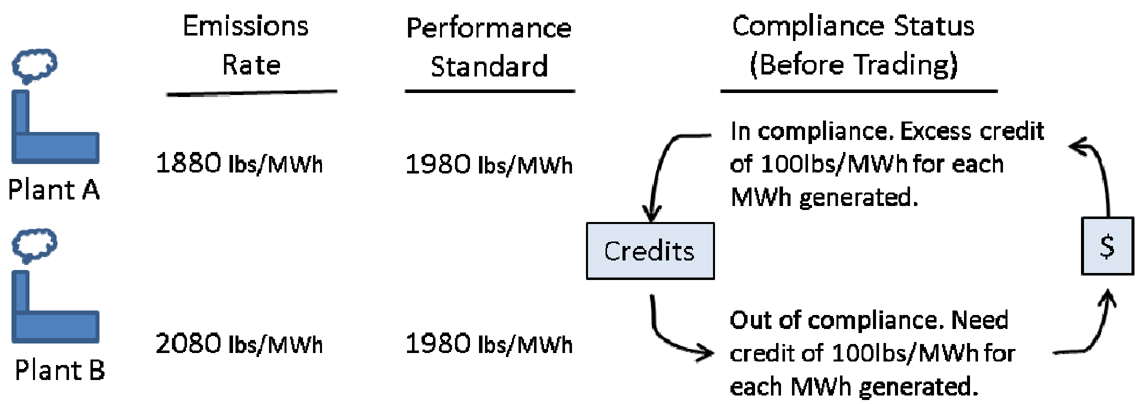
Fossil-fuel electricity generation is an especially important example because it has the largest emissions of any sector to be regulated by EPA. A tradable standard in the electricity sector would work as follows. First, the agency would set a standard limiting the average heat rate (energy input per unit of electricity output) or emissions rate (emissions per unit of electricity output) of regulated electricity generating units (EGUs) to a specified benchmark. EGUs that have a lower heat rate or lower emissions rate would earn credits that could be traded to other facilities, or potentially banked for later use. A unit that does not meet the performance

[5] Note that a tradable standard does not eliminate distributional issues entirely, because the regulated community may seek to secure advantage through subcategorization (which we discuss below), or by limiting or expanding the scope of trading.

standard could comply either through upgrades or through the purchase of credits from other regulated EGUs.

Figure 1 illustrates trading between two facilities to achieve compliance with an emissions rate standard set at 1,980 lbs/MWh, which would represent a reduction of about 5 percent from the average for coal steam boilers. Plant A, with an emissions rate of 1,880 would earn a credit of 100 lbs for every MWh it generates. It might sell the credit to Plant B, with an emissions rate of 2,080 lbs/MWh. Assuming the EGUs generate the same total kWh, this trade allows both to meet the standard. Plant B could also make upgrades to meet the standard rather than trading, and Plant A could make its own upgrades so as to have more credits to sell. What decision each plant makes depends on its upgrade costs and the market price of credits.

Figure 1. Credit Trading to Achieve Compliance with a Performance Standard



Formally, under a tradable standard, credits are earned for electricity production at the benchmark rate, and credits are surrendered at the facility's actual rate. The units on these credits are either Btu (in the case of a heat rate standard) or pounds of CO_2 (in the case of an emissions rate standard). Hence, one can envision a tradable standard as two instruments in one policy. In the first, it imposes an opportunity cost on a facility's heat rate or emissions rate, providing a continuous incentive for improvement. In the second, it provides an output subsidy equivalent to the value of credits earned at the benchmark performance standard for each unit of electricity generation.

The simplest and probably most legally defensible program design begins with EPA's past practice of setting a performance standard based on a technology assessment. In the electricity sector, EPA would establish a performance standard on the basis of a technology assessment for each category (or subcategory) of electricity generation technology (e.g., coal-fired boiler, fluidized bed combustor, oil-fired boiler, etc.).[6]

3.2 Economic and Environmental Benefits of Tradable Standards

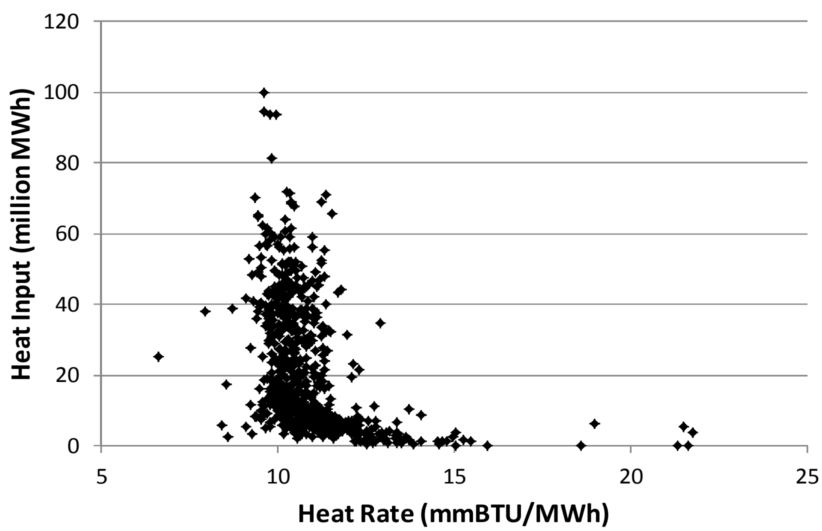
Once EPA has set the standard in this way, allowing trading only makes sense if it has identifiable benefits. There is evidence that incorporating flexibility into ESPS for coal-fired power plants could greatly increase the cost-effectiveness of regulation, and possibly the environmental benefits depending on how the cost savings are used.

The reason flexibility reduces cost is the underlying heterogeneity in the energy efficiency (heat rate) of the U.S. coal fleet. This is illustrated in Figure 2, which displays the heat rate of EGUs along the horizontal axis and the heat input at each unit on the vertical axis. More efficient units are toward the left, and more heavily utilized units are toward the top. Although many factors help explain the diversity in the operating efficiency of units, engineering case studies (Sargent & Lundy 2009; DiPietro and Krulla 2010; NETL 2010) and statistical analysis (Linn et al. 2011) suggest that opportunities for efficiency improvements are available.

There is substantial evidence that market-based approaches in general and tradable standards in particular can help identify the least-cost opportunities for efficiency improvements and thereby reduce the costs of GHG regulation. For example, Burtraw et al. (2011) find that a tradable standard for fossil EGUs would result in a 60 percent smaller increase in retail electricity prices and a two-thirds reduction in overall costs compared to a traditional (inflexible) performance standard.

[6] In the electricity sector, a similar approach was used under Title IV of the Clean Air Act, which allowed for an averaging of emissions rates for nitrogen oxides among commonly owned EGUs.

Figure 2. Distribution of Heat Rates across U.S. Coal Fleet in 2008



Tradable standards would also provide incentives for discovery of new improvements in energy efficiency and reductions in GHG emissions. In addition, the market associated with a tradable standard would yield important information on the costs and effectiveness of the program.[7]

Because cost is an explicit consideration in setting standards under Section 111, the cost savings from using tradable standards could lead to greater overall emissions reductions. EPA has reported that it would be reasonable to expect emissions reductions of 2 to 5 percent for individual plants (and up to 10 percent for a few plants) without major changes in plant utilization (EPA 2008b). If EPA follows precedent, it would base standards on an assessment of broad applicability and cost under its traditional standard-setting approach. In that case, a reasonable expectation for the average fleet-wide heat-rate reduction based on a plant-by-plant standard would be near the lower end of the range, at about 2 percent.

[7] It is important to note, however, that the price of a credit does not translate directly to a value for the cost per ton of GHG reduction that could be compared to the cost under other policies, such as an emissions tax for example, or to the social cost of carbon (Interagency Working Group on Social Cost of Carbon 2010). The credit price is influenced by the fact that credits are earned by generating electricity (at the benchmark performance standard), which constitutes an output subsidy that drives up the credit price.

But under a tradable standard approach, EPA could set a standard that reflects the heterogeneity and potential efficiency gains across the fleet of coal-fired power plants. Thus, EPA could adopt a standard based on an expected reduction in heat rate closer to 5 percent and justify it based on the opportunity and incentives of a trading program to make cost-effective improvements in the efficiency of coal-fired plants.

4. Design Choices for Tradable Standards

Although tradable standards are not fundamentally complex policies, EPA and/or the states nevertheless would face a series of important design considerations, just as with any regulatory policy.

4.1 Setting the Standard

As noted above, there are two basic approaches in the design of a performance standard, whether tradable or not, for GHG emissions from EGUs. An *energy-efficiency-based performance standard* would be set as heat input per unit of electricity generated, i.e. the heat rate (Btu per kWh). Alternatively, an *emissions rate performance standard* would be set as CO_2 emissions per unit of generation (pounds of CO_2 emissions per kWh).[8]

One distinction that favors a heat rate standard is that the identification of an efficiency target might appeal broadly in political terms even among those who are unconvinced of the threat of climate change. On the other hand, an emissions rate standard specifically identifies the focus of regulatory interest—emissions. In addition, it provides a slightly broader set of compliance opportunities because electricity generating units can achieve small reductions in emissions by changing the type of coal they use.

4.2 Geographic Scope

The cost advantage from compliance flexibility stems from the heterogeneity of regulated sources; savings accrue by enabling emissions reduction activities to occur where they are least expensive, avoiding changes that are more expensive. In any market-based emissions control program, trading across as broad a group of sources as possible is desirable because it would

[8] Efficiency (heat rate) is strongly correlated with GHG emissions—a reduction in heat rate translates to a corresponding reduction in CO_2 emissions. As a rule of thumb, a reduction of 10 million Btu roughly equals a 1-ton reduction in CO_2.

encompass more heterogeneity and provide more opportunities for emissions reductions and cost savings.

Perhaps the most obvious implication of this is that programs that cover a larger geographic area are expected to have a lower average cost per unit of emissions reduction and less price volatility than smaller programs. This means that an *interstate* tradable standard is preferable, and a nationwide standard is ideal from a cost-effectiveness perspective. To the extent that interstate coordination is easier if EPA provides more direction, the benefits of greater geographic scope point in favor of EPA taking a larger role.

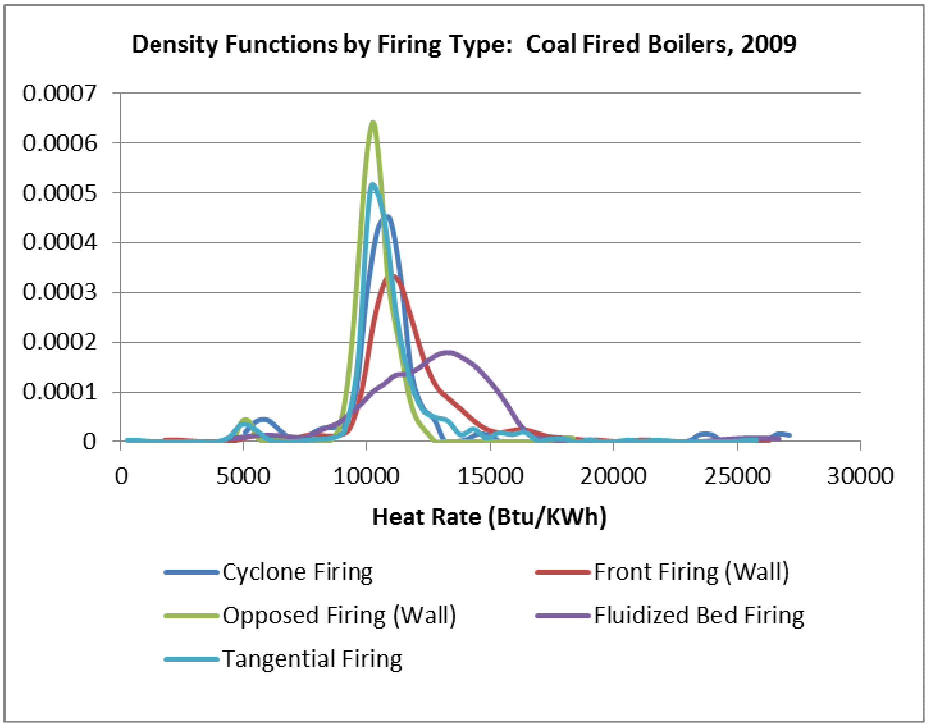
Uniform national regulations would also reduce transaction costs and uncertainty across an interstate trading program. Such consistency provides an accurate, certain, and consistent quantification of the performance of each source and assures the integrity of the credits traded in the market. Consistency across states also makes it easier for EPA to administer the program.

4.3 Identifying Source Categories/Subcategories

In prior implementation of regulations under Section 111, EPA has traditionally established categories and/or subcategories of emissions sources that are technologically similar with identifiable control technologies. Using this approach, EPA would establish performance standards for the identified categories or subcategories that are consistent with its judgment of the overall degree of emissions reduction that could be achieved by the source category—e.g., coal-fired boilers or fossil-fuel-fired electric generating units. As noted above, the statute requires EPA to use source categories as the basis for its Section 111 performance standards, but the agency retains discretion over whether and how to define the boundaries of these categories (CAA § 111(b); see also EPA 2011, 2–3).

The strongest case for creating different categories arises where there are significant differences in technology and performance. Figure 3 illustrates the distribution of heat rates at various facilities, sorted by boiler technology. Among coal technologies, fluidized bed combustors involve a different combustion technology and appear to be significantly different in terms of performance. Hence, EPA might reasonably create a category for fluidized bed combustors that is separate from other coal-fired EGU boilers.

Figure 3. Distribution of Heat Rates by Boiler Technology



There appears to be no statutory restriction prohibiting EPA from enabling a standard that bridges multiple source categories (see Richardson 2011, 17–18; Wannier et al. 2011, 6–7). Doing so would broaden the scope of the program just as interstate trading or banking would. The most cost-effective program design would allow trading across many source categories.

Another important issue, from the perspective of achieving cost-effectiveness, is the definition of the benchmark that determines the rate at which credits are earned in each source category or subcategory. Units with heat rates or emissions rates below the benchmark will emerge as winners under the program relative to units with rates above the benchmark. Owners of units that have relatively higher rates will have an economic interest in creating multiple benchmarks that might be implemented as different subcategories or different benchmarks within a category.

In general, the greater the number of benchmarks, the closer each unit will be to its benchmark, which will limit the total magnitude of credit transfers among units. With a proliferation of benchmarks, EGUs earn credits at their idiosyncratic benchmark rate rather than the average rate for the source category. This has the effect of providing a smaller incentive to expand output at relatively efficient units because they earn credits at a lower rate than if there were a single benchmark. Conversely, less efficient units have a greater incentive to maintain output because they earn credits at a greater rate. This means that to achieve the same level of emissions reductions with a greater number of subcategories, a more stringent average standard would be required.

The overall result is that the proliferation of benchmarks is likely to raise program costs even as it reduces the financial transfers among units. Consequently, a tradable standard with the smallest possible number of benchmarks within the trading group is expected to be more cost-effective.

4.4 Biomass Co-firing

Biomass co-firing at conventional coal-fired boilers may provide further opportunities beyond efficiency improvements for emissions reductions.[9] The amount of biomass that can be co-fired varies with boiler type, but can be as much as 10 percent of the heat input at a plant. If one considers the combustion of waste biomass to be roughly CO_2 neutral, the substitution of biomass for coal will reduce GHG emissions for these plants. EPA has suggested that co-firing with biomass could replace 2 to 5 percent of current coal use (EPA 2008b).

However, because biomass availability and the boiler characteristics vary by region, EPA could not adopt a traditional Section 111 standard requiring co-firing of biomass at each facility, since many facilities would be unable to comply (or unable to comply at reasonable cost). With trading across the sector, a market-based program such as a tradable standard could consider the potential GHG emissions reductions from co-firing biomass.[10] Emitters with access to biomass fuels could use them, thereby overcomplying with the standard and generating credits that could be used elsewhere.

4.5 Banking and Bad Years

Allowing the banking of credits increases the efficiency of an emissions trading program by allowing sources to shift reductions to lower-cost time periods, smoothing price variations

[9] Depending, of course, on one's views about the life-cycle emissions of the biomass fuel being used. However, co-firing of biomass is likely to involve waste biomass almost exclusively, with little or no use of closed-loop dedicated biomass fuel supply, avoiding most of the issues associated with life-cycle biomass emissions.

[10] Richardson 2011, 31–34, suggests that treating emissions from biomass cofiring differently from coal emissions is probably, but not necessarily, legally compatible with CAA § 111.

among different vintages of credits and increasing the cost-effectiveness of the program. Banking also encourages early reductions in emissions.

Moreover, the utility sector could be vulnerable to a bad year created by a combination of events—a hot summer, a Katrina-like storm, the outage of a nuclear plant—that might require a greater utilization of the coal-fired capacity in the fleet than anticipated in EPA's development of the standard. Less efficient units are typically less utilized and may see a relatively greater increase in utilization in such a year, which would put strains on the GHG regulatory program and on the electric utility sector.[11] A banking program could address this potential problem by providing a "safety valve" to address such contingencies. Banking allows EGUs to set aside credits for use to address unusual or unanticipated situations such as extreme weather events or the loss of significant generation capacity due to the shutdown of other facilities.

4.6 Continuing Improvement

While a tradable standard provides EGUs with an incentive to adopt cost-effective measures to meet the standard, a set standard provides a weak incentive for ongoing improvements in industry-wide heat rate or reductions in emissions rate. The standard could be tightened in the future, but since it is unclear when or whether this will happen, it is a source of uncertainty.

An explicit commitment to specified, evolving future targets would mitigate these issues. To be sure, such a phased standard could be changed just as easily as a static one, but this is probably less likely. A phased program could start earlier in order to capture the low cost opportunities and as a way to provide rewards for early action. . In fact elsewhere under the Clean Air Act, EPA has interpreted phased implementation to allow voluntary early adoption of measures more stringent than currently required to qualify for delayed compliance with of subsequently required measures.[12] More directly, by coupling phased reduction targets for future years coupled with the opportunity for credit banking, EGUs would likely pursue a glide path of reductions that would improve the cost-effectiveness of the program.

---

[11] One observation about this scenario is that relatively higher heat rates or emissions rates are explained in part by lower utilization. Hence, other things being equal, the increased utilization of units will improve their operating performance. However, this is not likely to be sufficient to address the industry concern.

[12] These provisions were part of the implementation of the NO_x program under Title IV. See 40 C.F.R. § 76.8 (2012).

Moreover, a phased program could drive further improvements in the energy efficiency of EGUs. EPA has interpreted Section 111 as allowing phased standards. In setting standards, EPA may "look toward what may fairly be projected for the regulated future, rather than the state-of-the-art present" (EPA 2005, 28620).[13]

5. Interaction with the States

Whatever policy tool EPA chooses for its GHG performance standards, it will not be working on a blank slate. Many states have existing or planned GHG regulatory programs, and California and the northeastern states in the Regional Greenhouse Gas Initiative have cap-and-trade programs in place. Moreover, as noted above, states will play an important role in implementing and perhaps designing ESPS regulations, whether they have their own existing programs or not. For these reasons, EPA decisions about states' role in the regulatory program will be critical.

5.1 Top-Down or Bottom-Up?

EPA's typical practice in setting up a trading program has been to issue a detailed model rule for adoption in State Implementation Plans (SIPs) (see EPA 2011, 2). In addition, EPA has provided the resources to administer the market for those states adopting the model rule. This approach reduces the burden on the states in developing a plan and obtaining EPA approval, and providing the resources necessary to administer a trading market.[14] The adoption of a model rule further assures state-by-state consistency in trading requirements, reducing transaction costs and uncertainty across an interstate trading program and providing a consistent quantification of the

[13] In its Clean Air Mercury Rule, for example, EPA adopted emissions caps in 2010 based on specified technologies, and a significantly more stringent emissions cap in 2018 based on other control technologies that were adequately demonstrated, but were not considered to be available for commercial application by the earlier 2010 date. In legal terms, the agency interpreted the "best system of emission reduction" to mean not only a trading system, but one with increased stringency over time, based on technology and costs. EPA's position has support in the relevant case law. See *Portland Cement v. Ruckelshaus*, 486 F.2d 375, 391 (DC Circuit 1973) (holding that "Section 111 looks toward what may fairly be projected for the regulated future, rather than the state of the art at present"; though note that this holding is in reference only to the new source provisions of Section 111). See also *Lignite Energy Council v. EPA*, 198 F.3d 930, 932 (DC Circuit 1999) (holding that "EPA's choice[s under Section 111] will be sustained unless the environmental or economic costs of using the technology are exorbitant").

[14] States may adopt the model rule—a fully approvable control strategy satisfying all the requirements of the Section 111 SIP process—either by incorporating the model rule by reference or directly codifying the provisions of the model rule in its SIP.

performance of each source. This consistency assures the integrity of the allowances traded in the market and makes it easier for EPA to administer the program.

In past model rules involving cap-and-trade, EPA has provided states with the flexibility to adopt their own approaches to the allocation of allowances, a process that we have noted would not be required under a tradable standard. However, the assignment of economic value associated with all sorts of environmental permitting has traditionally been state prerogative, and it might be left up to states to determine benchmarks for subcategories within their state to address specific distributional issues or other goals. If states are allowed to adopt their own benchmarks, EPA might be justified in requiring those states to demonstrate that equivalent or greater emissions reductions would be achieved relative to the model rule benchmarks (ignoring interstate trading).

As we also have noted, adding subcategories and corresponding benchmarks could reduce aggregate cost-effectiveness. Requiring a demonstration of equivalency would help remedy the concern that one state could take an action that imposed greater emissions reductions and raised costs for another state. It would raise costs overall, but the additional costs would largely be imposed within the state choosing to deviate from EPA's benchmarks.[15]

5.2 States with Their Own GHG Programs

States with existing GHG regulatory programs will undoubtedly seek to establish "equivalency" with whatever form of Section 111 performance standards EPA issues, so that the measures that in-state sources take to comply with the state programs also count toward federal compliance. EPA must decide, based on the statute, what equivalency means.

One option is to require the state to show that within its program the sources covered by EPA's standard will achieve equal or greater performance.[16] Where state programs include a variety of different sources, or allow interstate trading, it may be difficult to make this showing.

---

[15] In addition, of course, states may adopt their own program outside of EPA's model rule. However, states choosing to do so must develop a SIP and obtain EPA approval of the SIP by demonstrating that it is equivalent in achieving the environmental goals of the EPA model program. Under current EPA regulations, states are required to include emissions standards in their plans—that is, standards based on an allowance system that caps emissions or that prescribes allowable rates of emissions (see 40 C.F.R. 60.24).

[16] Interpreted as increase in efficiency (if EPA establishes a heat-rate standard) or reduction in the rate of GHG emissions (if EPA's program is denominated in GHG emissions per kWh).

EPA would have to interpret the program in terms of emissions reductions rather than a more narrow emissions rate average for this to be viable.

Another way for EPA to accommodate a variety of state-level programs would be to allow the conversion of a rate-based (efficiency) standard to a mass-based (emissions) measure, and to provide guidance for how that conversion should be conducted. As noted above, this approach could enable states to claim credit for emissions reductions from a variety of alternative programs including efficiency programs or regional cap-and-trade.

If a nationwide EPA trading program were superimposed on existing state regulations that are more stringent than EPA's national program, this could pose a problem for the state program. In this case, emitters that comply with the state program will overcomply with the national program. If these emitters then use their overcompliance to generate credits to be traded into the national program, the net result of the state program will simply be to export its emissions, leaving national emissions unaffected, and likely impose upon itself higher local costs (see Goulder and Stavins 2011).

However, states could probably avoid this problem relatively easily. Most obviously, a state with its own trading system could opt out of the national trading market. This would likely raise costs for other states by denying them credits from the proactive state, assuming that state is also a potential provider of low-cost allowances.[17]

6. Conclusion

EPA faces a series of choices as it decides on its approach for regulating stationary-source GHG emissions. It must decide whether to incorporate flexibility, what role to leave to states, and how stringently to regulate—in addition to myriad technical and procedural issues.

Adopting a tradable standard, in a phased fashion and through a model rule, could balance competing interests and create a comprehensive, cost-effective regulatory program (given that the agency has eschewed cap-and-trade). Tradable standards are fundamentally flexible, and evidence suggests that they would lead to very large cost savings over inflexible, traditional standards. Politically, tradable standards cannot be characterized as a cap-and-trade

[17] We note that it is common practice of states to provide incentives (and disincentives) through taxes and tax relief, training programs, etc. to attract or discourage economic activity within their states (Shobe and Burtraw 2012).

approach because they do not establish a cap. The important role for states may also shield EPA from some political criticism.

Tradable standards do come with some risks. Litigation over any approach is assured, and there is some possibility a court would reject tradable standards as incompatible with the CAA, though this appears unlikely. Tradable standards are fundamentally transparent and simple. However, adaptations to address environmental or distributional objectives run the risk of introducing complexity into the program design that could erode some of the virtues of a market-based approach. Balancing these considerations will be an important element of EPA's decisions.

Other EPA decisions on related issues also will be important, but good options are available. A phased approach reduces uncertainty for industry while enshrining improved environmental performance in the program from the start. Allowing banking of credits mitigates problems arising from unforeseen events. And a model rule reduces the burden on state regulators, making an interstate trading program more viable, while leaving states the freedom to take a different course if needed.

In sum, tradable standards have been successful in the past, are broadly consistent with both the statute and agency practices, and appear to be much more cost-effective than traditional performance standards. These advantages make them a compelling option for the agency.

References

Burtraw, D., A. Paul, and M. Woerman, 2011, Retail Electricity Price Savings from Compliance Flexibility in GHG Standards for Stationary Sources. Discussion Paper 11-30. Washington, DC: Resources for the Future.

DiPietro, P. and K. Krulla, 2010. Improving the Efficiency of Coal-Fired Power Plants for Near Term Greenhouse Gas Emissions Reductions. DOE/NETL-2010/1411, National Energy Technology Laboratory.

EPA, 2005. Clean Air Mercury Rule (CAMR). 70 Federal Register 28606.

———, 2008a. Advance Notice of Proposed Rulemaking: Regulating Greenhouse Gas Emissions under the Clean Air Act (ANPRM). 73 Federal Register 44354.

———, 2008b. Technical Support Document for the Advance Notice of Proposed Rulemaking for Greenhouse Gases: Stationary Sources. Washington, DC: U.S. Environmental Protection Agency.

———, 2011. Background on Establishing New Source Performance Standards (NSPS) under the Clean Air Act. www.epa.gov/airquality/pdfs/111background.pdf.

Goulder, L. H. and R. N. Stavins, 2011. Challenges from State-Federal Interactions in US Climate Change Policy. American Economic Review 101: 253–257.

Interagency Working Group on Social Cost of Carbon, 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866. Washington, DC: U.S. Government.

Linn, J., E. Mastrangelo, and D. Burtraw, 2011. Regulating Greenhouse Gases from Coal Power Plants under the Clean Air Act. Discussion Paper 11-43. Washington, DC: Resources for the Future.

Nelson, G., 2011. EPA Promises to Avoid Cap, but Some Utilities Want Trade. E&E Publishing. www.eenews.net/public/eenewspm/2011/02/04/2.

NETL (National Energy Technology Laboratory), 2010. Improving the Thermal Efficiency of Coal-Fired Power Plants in the United States. National Energy Technology Laboratory.

Newell, R. G., and K. Rogers, 2003. The Market-Based Lead Phasedown. Discussion Paper 03-37. Washington, DC: Resources for the Future.

Nichols, A. L., 1997. Lead in Gasoline. In Economic Analyses at EPA: Assessing Regulatory Impact, edited by R. D. Morgenstern. Washington, DC: Resources for the Future, 49–86.

Richardson, N., 2011. Playing without Aces: Offsets and the Limits of Flexibility under Clean Air Act Climate Policy. Discussion Paper 11-49. Washington, DC: Resources for the Future.

Sargent & Lundy, 2009. Coal-Fired Power Plant Heat Rate Reductions. 12301-001, Chicago.

Shobe, W. M., and D. Burtraw, 2012. Rethinking Environmental Federalism in a Warming World. Discussion Paper 12-04. Washington, DC: Resources for the Future.

Wannier, G., J. A. Schwartz, N. Richardson, M. A. Livermore, M. B. Gerrard, and D. Burtraw, 2011. Prevailing Academic View on Compliance Flexibility under § 111 of the Clean Air Act. Discussion Paper 11-29. Washington, DC: Resources for the Future.