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Beyond Carbon Dioxide: Capturing Air Quality Benefits with State Section 111(d) Plans

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INTRODUCTION

In June 2014, the U.S. Environmental Protection Agency (EPA) is expected to proposed emissions guidelines under section 111(d) of the Clean Air Act for carbon dioxide (CO_2) emissions from existing power plants.[1] States will establish and implement CO_2 performance standards for existing generation in the context of a transitioning electricity sector driven by low natural gas prices, uncertain energy demand growth, increasingly cost-effective solar and wind generation that may disrupt traditional business models, and the potential retirement of nuclear plants.[2] At the same time, many power plant owners and state air regulators anticipate new or tighter air quality regulations for ozone, nitrogen oxides (NOx), sulfur dioxide (SO_2), and other pollutants. In light of these and other factors, state regulators will decide how to meet section 111(d) requirements in an environment of considerable market and regulatory uncertainty.

The Nicholas Institute for Environmental Policy Solutions recently published a broad analysis of opportunities for state energy and environmental regulators to pursue carbon reduction measures that respond to the array of challenges facing the power sector.[3] This paper builds on that multi-benefit framework in exploring the flexibility that section 111(d) gives states to establish and implement performance standards that generate benefits beyond reductions in CO_2 emissions. It identifies options for states to harness that flexibility to reduce carbon emissions while hedging risks and lowering compliance costs associated with anticipated air quality regulations for traditional pollutants. This analysis also identifies elements of state section 111(d) plans that may reduce criteria pollutant emissions.

Commenters and regulators have explored many different approaches to and benefits of multi-pollutant regulations in general.[4] Strategies range from enacting new legislation and statutory changes[5] to using regulatory discretion,[6] adjusting regulatory timelines,[7] and helping states evaluate emissions impacts.[8]

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[1] Clean Air Act, 42 U.S.C. § 7411(d) (2012) (authorizing the EPA to provide guidelines to states for the establishment of performance standards); Executive Office of the President, *The President's Climate Action Plan*, EXECUTIVE OFFICE OF THE PRESIDENT (June 2013), http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf (directing the EPA to regulate the emissions of carbon dioxide from new and existing power plants).

[2] JONAS MONAST & DAVID HOPPOCK, NICHOLAS INST. FOR ENVTL. POLICY SOLUTIONS, DUKE UNIV., DESIGNING CO2 PERFORMANCE STANDARDS FOR A TRANSITIONING ELECTRICITY SECTOR: A MULTI-BENEFITS FRAMEWORK (2014), http://nicholasinstitute.duke.edu/sites/default/files/publications/ni_r_14-04_final_0.pdf.

[3] *Id.*

[4] Sam Napolitano, et al. *A Multi-Pollutant Strategy: An Integrated Approach Could Prove More Effective for Controlling Emissions*, PUBLIC UTILITIES FORTNIGHTLY 34 (2009) (describing the EPA's history with multi-pollutant approaches); U.S. ENVTL. PROT. AGENCY CLEAN AIR ACT ADVISORY COMMITTEE WORK GROUP, MOVING TOWARDS MULTI-AIR POLLUTANT REDUCTION STRATEGIES IN MAJOR U.S. INDUSTRY SECTORS: A REPORT TO THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S CLEAN AIR ACT ADVISORY COMMITTEE (CAAAC) 5 (2011), http://www.epa.gov/air/caaac/pdfs/reduction_strategies.pdf (recognizing the potential for multi-pollutant regulatory approaches to achieve environmental and public health protection at a lower cost across pollutants); Alice Kaswan, *Environmental Justice and Domestic Climate Change Policy*, 38 ENVTL. L. REP. NEWS & ANALYSIS 10,287 (2008) (discussing the potential environmental justice benefits of co-pollutant reductions).

[5] *See e.g.*, Title IV of the Clean Air Act, 42 U.S.C § 7651 (2012) (regulating emissions of acidic compounds, specifically SO_2 and NO_x); Clear Skies Act of 2003, H.R. 999, 108th Cong. (1st Sess. 2003) (setting limitations on emissions of SO_2, NO_x, and mercury).

[6] CHARLES DRISCOLL ET AL., CO-BENEFITS OF CARBON STANDARDS (2014) (comparing estimated co-pollutant impacts of EPA 111(d) emission guidelines of various forms and stringency); Cross-State Air Pollution Rule, 76 Fed. Reg. 48,208 (Aug. 8, 2011); Clean Air Visibility Rule, 70 Fed. Reg. 39,104 (July 6, 2005); Clean Air Mercury Rule, 70 Fed. Reg. 28,606 (May 18, 2005); Clean Air Interstate Rule, 70 Fed. Reg. 25,162 (May 12, 2005).

[7] JODY FOSTER ET AL., NICHOLAS INST. FOR ENVTL. POLICY SOLUTIONS, DUKE UNIV., CLEAN AIR AND TECHNOLOGY INNOVATION WORKING CONCEPTS FOR PROMOTING CLEAN TECHNOLOGY INNOVATION UNDER THE CLEAN AIR ACT 8–9 (2013) (discussing the alignment of timelines for CAA and Non-CAA regulations).

[8] *See e.g.*, U.S. ENVTL. PROT. AGENCY, ROADMAP FOR INCORPORATING ENERGY EFFICIENCY/RENEWABLE ENERGY POLICIES AND PROGRAMS INTO STATE AND TRIBAL IMPLEMENTATION PLANS (2012), www.epa.gov/airquality/eere/pdfs/EEREmanual.pdf [Hereinafter "EE/RE ROADMAP"]; U.S. Envtl. Prot. Agency, Avoided Emission and geneRation Tool (AVERT), http://www.epa.gov/avert/ (describing AVERT as a tool to quantify the NO_x, SO_2, and CO_2 emissions benefits of energy efficiency and renewable energy policies and programs); STATE AND LOCAL CLIMATE AND ENERGY PROGRAM, U.S. ENVTL. PROT.

The flexibility afforded states in section 111(d) offers them an immediate opportunity to consider criteria pollutant impacts when choosing carbon reduction strategies. As a result, state environmental regulators will decide whether to comply with section 111(d) requirements by focusing exclusively on CO_2 emissions or by also considering the potential impacts of future air pollution regulations.

This paper discusses the importance and difficulty of planning in an environment of uncertainty as well as factors that may influence states' interest in looking beyond CO_2 emissions in section 111(d) planning. It summarizes potential air quality regulations that could affect the power sector and presents an overview of section 111(d), identifying the statutory origin of the flexibility it affords states. The paper discusses how states could use this flexibility to manage the regulatory risk of future air regulations, and it lists elements of state 111(d) plans that may lead to reductions in criteria pollutants.

SECTION 111(D) PLANNING UNDER UNCERTAINTY

Section 111(d) of the Clean Air Act authorizes each state to establish and implement performance standards for CO_2 emissions from existing power plants.[6] State regulators, however, will make decisions about these standards in the face of uncertainty about future air quality requirements. To hedge any risk posed by these requirements and minimize long-term regulatory impacts, they may choose to look beyond carbon dioxide when evaluating the optimal methods for controlling power sector carbon emissions in their states.

Section 111(d) decisions by state regulators can have enduring consequences for the state, electric-generating unit (EGU) owners, and end-use customers for the lifetime of electric generating units. One reason is that emissions reduction measures at individual electric-generating units often require fundamental changes, such as retrofits to improve heat rate or efficiency, switches to lower-emitting fuel, and replacement by cleaner energy sources.[7] These measures require large capital investments and are, for practical purposes, irreversible. Once a coal-fired unit has been retrofitted to burn natural gas, for example, reversion to coal use is generally not cost-effective. Another reason that decisions about compliance with CO_2 performance standards are significant is that new and even modified electric-generating units can have a life expectancy spanning multiple decades. This long lifetime means that the units will need to comply not only with today's air regulations but also with new and updated regulations over the coming decades.

State regulators may therefore seek strategies that are robust across a range of future scenarios. Because the details and even the nature of relevant future environmental regulations are unknown and future compliance costs are no more certain, reliance on section 111(d) compliance choices that are low-cost in the short term may prove expensive over time. An electric-generating unit might invest in efficiency upgrades to reduce CO_2 emissions, only to find it is noncompliant with future air regulations. Investing in a second round of retrofits to comply with the new regulations could be more costly than if the unit had conducted all retrofits at one time. Further, the new standard might require the unit to retire, stranding the efficiency upgrade investment. In both situations, failure to consider the risk of future air regulations could mean ratepayers are asked to make section 111(d)-related investments that do not account for or hedge more stringent traditional pollutant standards. To avoid this situation, state regulators, when developing section 111(d) plans, may choose to consider not only the lowest-cost option for CO_2 reductions, but also the risk exposure presented by the uncertainty of future regulations.

AGENCY, ASSESSING THE MULTIPLE BENEFITS OF CLEAN ENERGY: A RESOURCE FOR STATES 94 (2001), http://www.epa.gov/statelocalclimate/documents/pdf/epa_assessing_benefits.pdf (describing how states can estimate the air and health benefits of clean energy).

[6] 42 U.S.C. § 7411(d)(1) (2012).

[7] *See* DAVID HASLER, SARGENT & LUNDY, COAL-FIRED POWER PLANT HEAT RATE REDUCTIONS, FINAL REPORT (2009), http://www.epa.gov/airmarkets/resource/docs/coalfired.pdf (identifying strategies and associated cost estimates for improving the heat rate of individual electric-generating units).

The risk presented by potential air regulation scenarios and states' use of section 111(d) to address criteria pollutants will depend on many variables.[9] First, states may be concerned with co-pollutant benefits only to the extent that they have or may develop nonattainment areas.[10] States that project an insignificant likelihood or consequence of nonattainment need not consider the co-pollutant benefits of actions that reduce CO_2 emissions. That said, even states with no nonattainment concerns might evaluate the potential economic advantages of developing an emissions margin for criteria pollutants below the level of National Ambient Air Quality Standards (NAAQS). By over-complying with these standards, states might develop and use an emissions growth margin to attract energy-intensive industries that bring jobs and revenue, but also emissions.

Second, in states with nonattainment concerns, power plant emissions may or may not affect nonattainment areas. Some nonattainment areas have no electric-generating units in or near them, and even if power plant emissions were relevant, transportation policy may be a more effective means of addressing nonattainment. States where power plant emissions have no substantial effect on nonattainment may be less interested in achieving co-pollutant reductions through section 111(d) planning.

Third, states will need to consider the magnitude of potential co-pollutant benefits. A state that has nonattainment concerns with power plant emissions of NO_x, for example, may find that some 111(d) compliance options will have greater impacts than others on these emissions in the state's particular areas of concern.

Fourth, states would need to evaluate their ability to provide reliable impact projections with an adequate level of granularity. A state may feel confident in its ability to predict the in-state impacts of a CO_2-reduction strategy but be less sure of its ability to predict emissions impacts at the county or nonattainment area level.

The degree to which states wish to consider the co-pollutant benefits of section 111(d) compliance options will depend on the factors mentioned above, and others.[11]

For state regulators concerned about future air rules, the next section describes some air quality regulations on the horizon. The subsequent discussion of section 111(d) includes examples of how state section 111(d) policy design choices can hedge against the risk presented by anticipated air quality regulations.

FORTHCOMING ENVIRONMENTAL REGULATIONS FOR POWER PLANTS

In the coming years, a range of air quality regulations may affect the power sector. Notably, NAAQS tend to become more stringent over time, and at least two anticipated air quality regulations may present regulatory risk for states.

Historical Tightening of Air Quality Standards

The Clean Air Act requires the EPA to set National Ambient Air Quality Standards for six common ("criteria") air pollutants, to review the standards every five years, and to revise them as appropriate to

[9] States that choose to consider the risk associated with future air regulations will need to decide the appropriate methods of risk analysis. Some states may choose to pursue a quantitative approach using dispatch and air quality models, while other states may pursue a qualitative approach that utilizes regulator expertise to game-out the consequences of various decisions under future regulatory scenarios.

[10] Nonattainment areas are areas within a jurisdiction's borders that are noncompliant with National Ambient Air Quality Standards.

[11] Other relevant factors may include the public health and welfare benefits of avoided emissions as well as the anticipated pace of technological innovations (e.g., battery storage and declining cost of renewables) and infrastructure development (e.g., pipelines for transporting natural gas and CO_2 for enhanced oil recovery).

protect public health and welfare.[12] Whether the EPA will revise a particular standard on a given review cycle is uncertain, but CAA standards tend to increase in stringency over time. If past trends are any indication, these standards will continue to become more stringent over the lifetime of new and modified generating units. Since 1997 the standard for 8-hour ozone has dropped from 80 ppb to 75 ppb.[13] For $PM_{2.5}$, the primary annual standard dropped from 15 µg/m3 in 1997 to 12 µg/m3 in 2012, and the 24-hour standard dropped from 65 µg/m3 in 1997 to 35 µg/m3 less than 10 years later.[14] Although some air quality standards have remained constant, and there may be a limit to how stringent they can get before running up against background levels, states face some degree of risk that the standards will become more stringent and lead to additional nonattainment areas. Even with fixed NAAQS levels, innovation in monitoring technology may increase nonattainment designations. An expanded monitoring network due to declining costs and increased accuracy of monitors may lead to the reclassification of areas currently designated in attainment. Further, the placement of monitors in previously unmonitored areas, such as near high-traffic roadways, could lead to a change in attainment status.[15] There are also indications that rising temperatures may hinder NAAQS compliance by, for example, exacerbating ozone formation.[16]

Ozone National Ambient Air Quality Standards

The current National Ambient Air Quality Standards for 8-hour ozone,[17] which was promulgated in 2008, is 75 parts per billion (ppb),[18] but recent events suggest the EPA may soon tighten this standard. In 2010 the EPA proposed a level within the range of 60 to 70 ppb.[19] President Obama subsequently asked the EPA to withdraw the proposed standard and to review the 2008 standard through the normal 5-year review process.[18] That process is currently under way. The EPA Office of Air Quality and Performance Standards recently released a policy assessment in which EPA staff preliminarily conclude that currently available information "call[s] into question the adequacy of the current primary standard" (75 ppm) and that the standard should be revised to a "level within the range of 70 ppb to 60 ppb," which "could provide an appropriate degree of public health protection and would result in important improvements in protecting the health of at-risk populations and life stages."[20] The Clean Air Scientific Advisory

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[12] 42 U.S.C. § 7409(d)(1) (2012). Section 7409 requires the Administrator to set standards in a manner that "accurately reflect[s] the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare . . . . "

[13] U.S. Envtl. Prot. Agency, *Ozone (O_3) Standards—Table of Historical Ozone NAAQS*, http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_history.html.

[14] U.S. Envtl. Prot. Agency, *Particulate Matter (PM) Standards—Table of Historical PM NAAQS*, http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_history.html.

[15] Jason Plautz, *New technologies let EPA 'collect a lot more data in a lot more places*,' GREENWIRE, http://www.eenews.net/greenwire/stories/1059997113/search?keyword=monitor+smog (Apr. 1, 2014). "In its 2010 revisions of the National Ambient Air Quality Standards for nitrogen dioxide, EPA required that more than 100 cities install monitors near roads to measure NO2, with monitoring for particulate matter and other criteria pollutants to follow. The monitors are phased in depending on city size through 2017. The goal is to track tailpipe pollution that isn't detected by stationary monitors that are usually placed far from major roads." *Id.*

[16] Scott Streater, *Ozone levels will rise dramatically as climate warms—study*, GREENWIRE (May 5, 2014), http://www.eenews.net/greenwire/2014/05/05/stories/1059999012.

[17] Ozone has been linked to several health problems, including asthma and other respiratory diseases, and has been found to be harmful to certain ecosystems. U.S. Envtl. Prot. Agency, *Health Effects* (Nov. 1, 2012), http://www.epa.gov/airquality/ozonepollution/health.html; U.S. Envtl. Prot. Agency, *Ecosystem Effects* (Nov. 1, 2012), http://www.epa.gov/airquality/ozonepollution/ecosystem.html.

[18] National Ambient Air Quality Standards for Ozone, 73 Fed. Reg. 16,436, 16,501 (Mar. 27, 2008) (to be codified at 40 C.F.R. pt. 50).

[19] National Ambient Air Quality Standards for Ozone, 75 Fed. Reg. 2938, 2992–93 (proposed Jan. 19, 2010) (to be codified at 40 C.F.R. pt. 50).

[18] Press Release, President Barack Obama, Statement by the President on the Ozone National Ambient Air Quality Standards (Sept. 2, 2011), http://www.whitehouse.gov/the-press-office/2011/09/02/statement-president-ozone-national-ambient-air-quality-standards.

[20] U.S. ENVTL. PROT. AGENCY, POLICY ASSESSMENT FOR THE REVIEW OF THE OZONE NATIONAL AMBIENT AIR QUALITY STANDARDS—SECOND EXTERNAL REVIEW DRAFT ES-1, 4-63 (2014), http://www.epa.gov/ttn/naaqs/standards/ozone/data/20140131pa.pdf. In a separate health and risk exposure assessment, agency staff concluded that a standard between 60 and 70 ppb would result in reduced child exposure, lower hospitalization rates, and

Committee will consider this assessment before making its recommendation to the EPA. The EPA is scheduled to finalize new 8-hour ozone standards in the fall of 2015.[21]

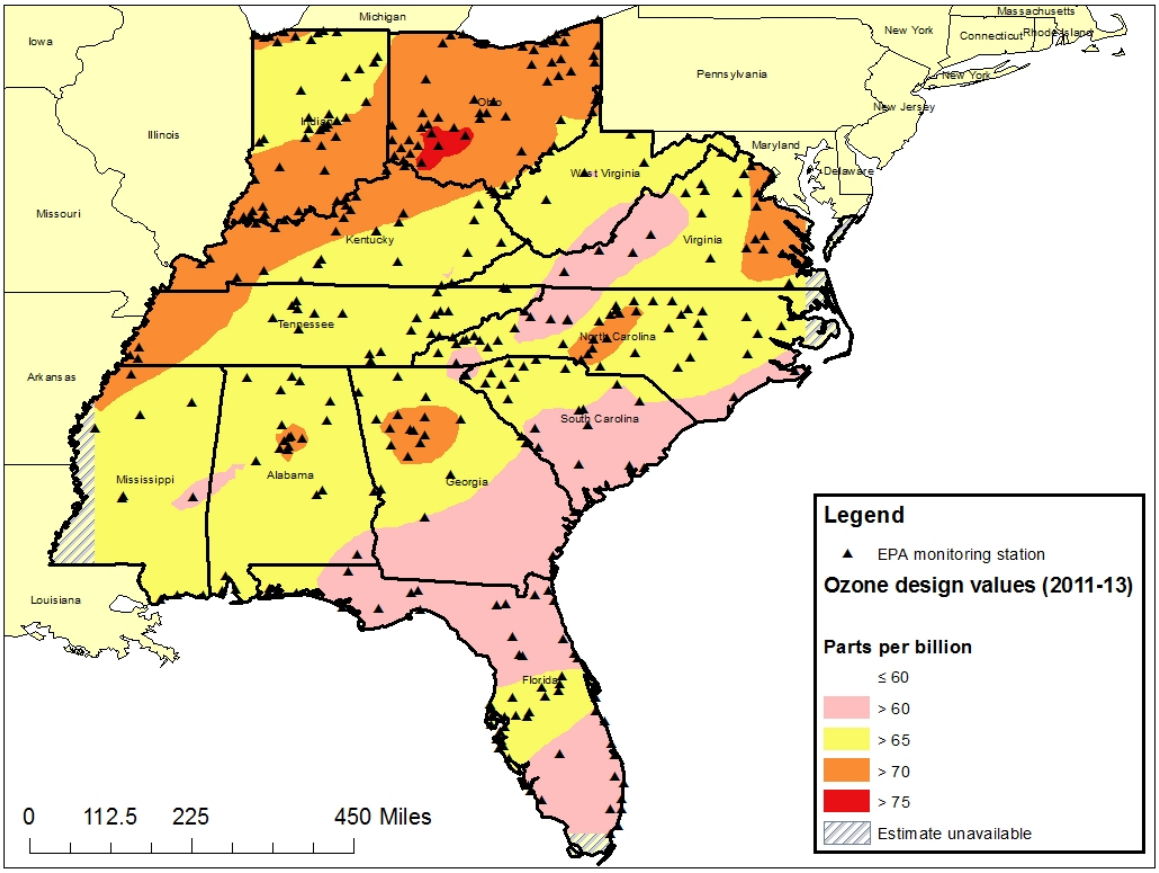
Figure 1 below suggests that lowering the 8-hour primary standard to between 60 and 70 ppb could put much of the Midwest and Southeast into nonattainment and that other parts of the country may experience similar effects. The figure uses design values based on 2011–2013 data from EPA monitoring stations to interpolate ozone concentrations throughout the region.[22] Although this map does not present modeling projections, it does suggest that tightening the ozone standards to a level between 60 and 70 ppb could affect the compliance status of many states, which may wish to conduct their own risk analysis for ozone nonattainment. If the standard were 65 ppb today, nearly all of Kentucky, Tennessee, West Virginia, Ohio, Indiana, Mississippi, Alabama, and North Carolina would be out of attainment. State design values may decline as electricity-generating units retrofit or retire to comply with Mercury and Air Toxics Standards, the Cross–State Air Pollution Rule, and other regulations. As a result, states may want to assess the risk presented by revised ozone standards in light of their current and anticipated fleet profile. A revised standard would require states to submit plans to the EPA for bringing new nonattainment areas into attainment. These plans could include emissions limits on vehicles, equipment, industrial facilities, and power plants that emit nitrogen oxides and volatile organic compounds, which contribute to ozone formation.

lower mortality rates. *See* U.S. ENVTL. PROT. AGENCY, HEALTH RISK AND EXPOSURE ASSESSMENT FOR OZONE—SECOND EXTERNAL REVIEW 3-5 (2014), *available at* http://www.epa.gov/ttn/naaqs/standards/ozone/data/20140131healthrea.pdf.

[21] Jeremy P. Jacobs, *Judge signals she'll side with enviros on EPA ozone deadline*, GREENWIRE (Apr. 30, 2014), http://www.eenews.net/greenwire/2014/04/30/stories/1059998740 (reporting that environmentalists seek a court order requiring the EPA to finalize ozone NAAQS by October 1, 2015, whereas the EPA wants a deadline of November 15, 2015).

[22] U.S. Envtl. Prot. Agency, Design Values, http://www.epa.gov/airtrends/values.html (defining design value as "a statistic that describes the air quality status of a given location relative to the level of the National Ambient Air Quality Standards").

Figure 1. Ozone Design Values (2011–2013).



Source: U.S. Envtl. Prot. Agency, AirData Download Files—Annual Summary Data, http://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual (listing annual summary data from 1990 to 2014).
Note: Design values for each monitoring station were calculated by averaging the fourth-highest measured 8-hour values over the 2011–2013 period. These design values were interpolated using a standard ozone kriging method to estimate current ozone levels in areas without monitoring stations.

Cross–State Air Pollution Rule

In 2011 the EPA promulgated the Cross–State Air Pollution Rule (CSAPR) to limit the unlawful interstate transport of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) from upwind to downwind states. The Good Neighbor Provision of the Clean Air Act prohibits a state "from emitting any air pollutant in amounts which will . . . contribute significantly to nonattainment in, or interfere with maintenance by, any other State with respect to any such" primary or secondary National Ambient Air Quality Standard.[23] The Cross–State Air Pollution Rule requires 28 upwind states to control power plant emissions that cross state lines and contribute to ozone and fine particle pollution in downwind states.[24] The EPA provided each

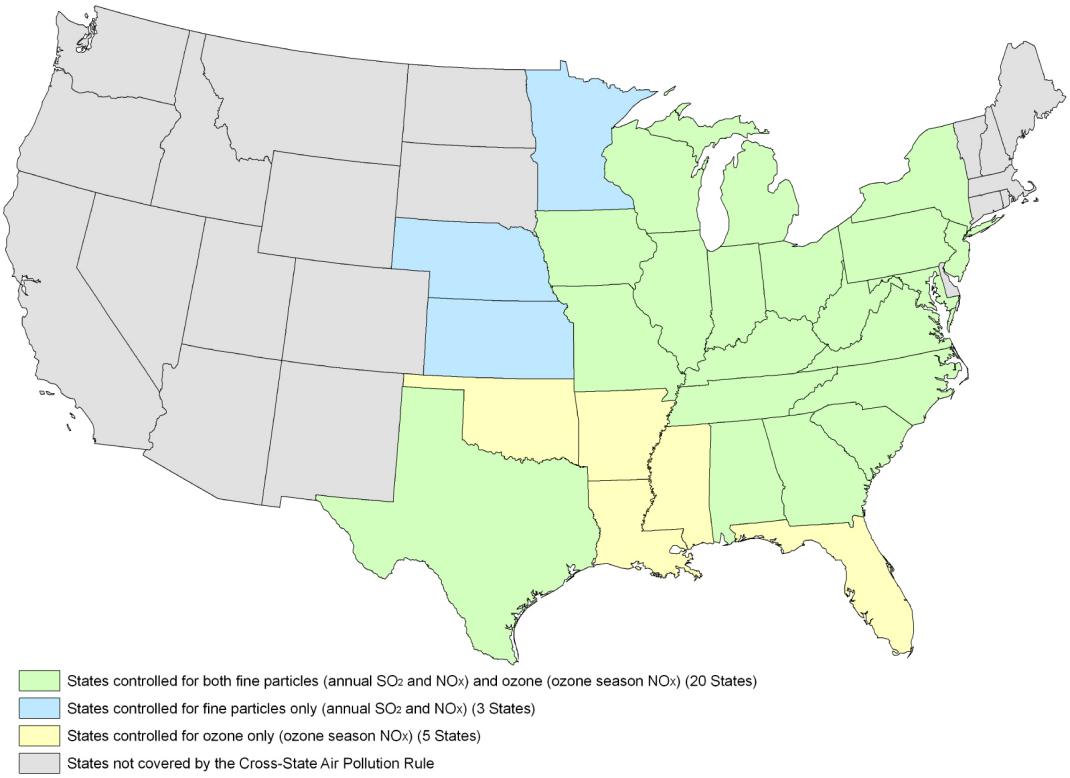
[23] 42 U.S.C. § 7410(a)(2)(D)(i)(I) (2012).
[24] Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208, 48,208 (Aug. 8, 2011) (codified at 40 C.F.R. pt. 51).

covered state with emission budgets for annual SO_2, annual NO_x, and ozone-season NO_x emissions.[25] States can comply with the rule by achieving state emission budgets through their preferred emission-reduction methods, including trading.[26]

On April 29, 2014, the Supreme Court of the United States reversed the D.C. Circuit's opinion that vacated the Cross–State Air Pollution Rule.[27] Although the Supreme Court's decision to reinstate the rule provides some clarity on the interstate transport issue, some uncertainty remains. Compliance timelines for the rule, passed in January 2012 and 2014, raise questions about when states must comply with their emissions budgets.[28] The EPA may update these budgets in the event that it tightens certain air quality standards, such as the standard for 8-hour ozone. The agency stated in the final Cross–State Air Pollution Rule that "[i]f more protective NAAQS are promulgated, in the case of pollutants for which interstate transport is important, additional emission reductions to address transported pollution may be required from the power sector, from other sectors, and from sources in additional states."[29] There is also some uncertainty about state positions relative to their CSAPR budgets in light of any NO_x and SO_2 benefits from plant retirements and retrofits to comply with the Mercury and Air Toxics Standards.[30] Figure 2 shows the jurisdictions subject to the Cross–State Air Pollution Rule.

[25] U.S. Envtl. Prot. Agency, Resources for Implementation of the Cross-State Air Pollution Rule (CSAPR), http://www.epa.gov/airtransport/CSAPR/stateinfo.html#states (listing each state's budget per pollutant).
[26] *See* Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208, 48,211 (Aug. 8, 2011) (explaining that CSAPR has four separate trading programs).
[27] EPA v. EME Homer City Generation, 134 S.Ct. 1584 (2014), *rev'g* EME Homer City Generation v. EPA, 696 F.3d 7, 11 (D.C. Cir. 2012).
[28] CSAPR Final Rule, 76 Fed. Reg. 48,208, 48,214 (Aug. 8, 2011) ("The first phase of Transport Rule compliance commences January 1, 2012, for SO_2 and annual NO_X reductions and May 1, 2012, for ozone-season NO_X reductions. The second phase of Transport Rule reductions, which commences January 1, 2014, increases the stringency of SO_2 reductions in a number of states . . . .").
[29] *Id.* at 48,210.
[30] Jeremy Jacobs & Daniel Lippman, *High court cross-state ruling leaves much unsettled for EPA*, GREENWIRE (May 2, 2014), http://www.eenews.net/greenwire/2014/05/02/stories/1059998916.

Figure 2. States Subject to the Cross-State Air Pollution Rule.



Source: U.S. Envtl. Protection Agency, Transport Rule States Map, http://www.epa.gov/airtransport/CSAPR/statesmap.html.

NAAQS Compliance Strategies for the Power Sector

Responsibility for achieving National Ambient Air Quality Standards does not fall exclusively on the shoulders of the power sector, but state plans to meet the standards often call for emissions reductions from power plants. Depending on the pollutant at issue, some power plants may install pollution control technologies that capture pollution before it is emitted into the atmosphere, and others may reduce emissions by limiting operations or retiring all together. State plans to attain air quality standards may also incorporate market-based programs, demand-side energy efficiency policies and programs, and increased generation of low- or zero-emitting resources.

INTEGRATING 111(D) COMPLIANCE WITH OTHER ENVIRONMENTAL REGULATIONS

CO_2 Performance Standards for Existing Power Plants

The EPA is in the process of fulfilling its Clean Air Act mandate under section 111(d) to develop a greenhouse gas regulatory program for power plants. In June 2013, President Obama gave the EPA a timeline for the development of section 111(d) regulations, directing the Agency to propose section 111(d) guidelines by June 1, 2014, finalize the guidelines within a year, and receive state section 111(d) plans by June 30, 2016.[31]

[31] Presidential Memorandum from President Obama on Power Sector Carbon Pollution Standards 1–2 (June 25, 2013), http://www.whitehouse.gov/the-press-office/2013/06/25/presidential-memorandum-power-sector-carbon-pollution-standards.

According to regulations and public comments by the EPA, section 111(d) regulation generally involves three steps. First, the EPA releases "guideline documents" that identify systems of emissions reduction and the "best system of emission reduction" (BSER) for the covered pollutant (e.g., CO_2).[32] The EPA's guideline documents also include an emissions guideline, which indicates the degree of emissions limitation achievable through application of the best system of emissions reduction and is a binding emissions target for states and covered sources.[33] Next, each state creates a plan that establishes standards of performance and provides for implementation and enforcement of the standards.[34] A performance standard must reflect the emissions guideline identified by the EPA.[35] Notably, states play a significant role under section 111(d). They, not the EPA, establish performance standards and determine how covered entities within their borders will meet those standards.[36] Finally, each state submits to the EPA a section 111(d) plan, which the Agency approves or denies on the basis of whether the plan satisfies the criteria outlined in EPA guideline documents. If a state fails to submit a plan or submits a plan that the EPA determines is unsatisfactory, the Agency may develop a plan for the state.[37]

Decision making under uncertainty is not new for air regulators, but the statutory text of section 111(d) provides states a notable degree of flexibility to develop and implement performance standards. Unlike other Clean Air Act provisions, section 111(d) expressly provides that states, not the EPA, create section 111(d) plans that "establish[] standards of performance" and "provide for the implementation and enforcement" of the standards.[38] But state authority is not necessarily unbounded, and stakeholders disagree over the role of the EPA and states when it comes to determining the stringency of performance standards.[39] Nevertheless, there is general agreement that states can implement performance standards by allowing electric-generating units to choose from a variety of flexible compliance options. Some units may take advantage of low-cost opportunities to reduce carbon emissions through onsite improvements to equipment and operations. Flexible compliance options would allow units to comply through offsite actions that result in emissions reductions among existing fossil fuel–fired units. Examples of such flexible strategies include zero-emitting generation, end-use energy efficiency, emissions averaging, market systems, transmission line efficiency gains, a carbon fee, and preferential dispatch of low-carbon generation.

Notably, many of these section 111(d) compliance options overlap with strategies that electric-generating units may employ anyway to address criteria pollutant emissions. As discussed above, these units may

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[32] Standards of Performance for New Stationary Sources, 40 C.F.R. § 60.22(b) (2014).

[33] Standards of Performance for New Stationary Sources, 40 C.F.R. § 60.24 (2014) (mentioning several times that states are "required" to comply with various provisions of the emissions guidelines); Bipartisan Policy Center, *State, Regional and Company Approaches to Reduce Power Sector GHG Emissions—Keynote Remarks*, YOUTUBE 25:10 (Apr. 10, 2014), https://www.youtube.com/watch?v=GDz8xxzrnSY (statement by EPA Administrator Gina McCarthy that "this carbon pollution standard is going to be federally enforceable; it is going to be a requirement"); U.S. Envtl. Prot. Agency, *Clean Air Act and Upcoming Carbon Pollution Guidelines for Existing Power Plants*, YOUTUBE 20:00 (Aug. 27, 2013), https://www.youtube.com/watch?v=4k-cNN8J6wY (stating that "while called 'guidelines,' [the emissions guidelines] go through notice and comment and are binding on states"). Some stakeholders argue that the EPA has limited section 111(d) authority. *See e.g.,* N.C. DEPT. OF ENVT. AND NAT. RES., NORTH CAROLINA § 111(D) PRINCIPLES 10–11 (2014) (arguing that the EPA can identify what control technologies are "adequately demonstrated" within the fence line of EGUs but cannot set substantive standards); JON BRUNING, ATTORNEY GENERAL, NEBRASKA, ET AL., 111(D) WHITEPAPER 6–8 (2013) (asserting on behalf of 18 state attorneys general that the EPA can only set procedural processes for the submission of state 111(d) plans and cannot impose substantive limits on state performance standards) [on file with author].

[34] 42 U.S.C. § 7411(d)(1) (2012).

[35] 42 U.S.C. § 7411(a)(1) (2012).

[36] § 7411(d)(1).

[37] § 7411(d)(2).

[38] § 7411(d)(1). By comparison, the EPA establishes performance standards for new sources, which states implement and enforce. 42 U.S.C. § 7411(b) (2012). Similarly, the NAAQS program is designed so that states implement plans to achieve air quality standards set by the EPA. 42 U.S.C. §§ 7408, 7409 (2012) (requiring the EPA to identify harmful air pollutants and then establish air quality standards that protect the public health and welfare); 42 U.S.C. § 7410 (2012) (providing for state implementation plans that achieve NAAQS).

[39] *See supra* note 33.

meet NAAQS requirements through unit-level efficiency, market-based programs, retirements, energy efficiency, fuel-switching, and other strategies—all likely section 111(d) compliance options. This overlap between section 111(d) and NAAQS compliance strategies allows states to use section 111(d) as an opportunity to take actions that sow benefits across Clean Air Act programs.

Risk and Cost Management through State Section 111(d) Planning

The Clean Air Act allows those states interested in looking beyond CO_2 emissions the flexibility to structure section 111(d) plans so as to manage their vulnerability to anticipated air pollution standards and to promote low-cost regulatory compliance over the life of power plants.

First, state carbon policies can respond to regulatory risk by reducing the state's overall vulnerability to future air quality standards. Although degree of vulnerability to future regulations and appropriate risk abatement strategies will vary across the nation, a state's 111(d) choices have the potential to improve the position of that state under future regulations by reducing overall emissions. For example, a state concerned with the possibility that large areas become designated nonattainment areas under a new ozone standard might allow zero-emitting generation or demand-side energy efficiency as section 111(d) compliance options. Increases in these energy resources that displace or replace fossil generation could contribute to an overall limitation on or reduction in NO_x emissions statewide and move the state as a whole toward achievement of future National Ambient Air Quality Standards.

Second, state 111(d) policies can promote decisions that reduce EGU compliance costs with air regulations over the covered units' life. In some cases, the same measure can simultaneously reduce emissions of multiple air pollutants. Fuel-switching from coal to natural gas, for instance, could help a unit reduce CO_2, NO_x, and SO_2 emissions. There also may be efficiencies in complying with multiple regulations through one round of retrofits, rather than one round to meet CO_2 requirements and another to achieve revised CSAPR or ozone requirements. To this end, reducing load through end-use energy efficiency may allow units to meet section 111(d) requirements in the short term and delay decision making about unit-level retrofits until compliance obligations for other pollutants are known. Depending on individual circumstances, investments in demand-side energy efficiency also can help plants manage load growth rates to avoid the addition of new units and accompanying emissions. There also maybe financial benefits to incrementally reducing emissions through a beyond-carbon approach to section 111(d). In this sense, shaving off emissions of traditional pollutants through carbon-reduction measures may reduce overall compliance costs compared with delaying measures until future air regulations are final and incurring total compliance costs at once.

Third, state 111(d) plans can benefit consumers financially by minimizing long-term capital investment in power plants vulnerable to future environmental regulations. Under an inflexible carbon policy that requires noncompliant units to either retire or retrofit, a fossil fuel–fired unit may find it cost-effective to achieve section 111(d) requirements through capital-intensive retrofits but be forced to retire just years later by its compliance costs for meeting tighter NAAQS requirements for NO_x, 8-hour ozone, or fine particulate matter. Such a scenario would leave the unit and consumers with a stranded investment in heat rate upgrades. By allowing units to trade allowances or average emissions under section 111(d), stranded investments can be minimized. An EGU owner, for example, could purchase allowances to comply with section 111(d) until ozone standards are released, at which point the owner would have greater certainty about the requirements and compliance costs for both CO_2 and ozone.

Section 111(d) Compliance Options with Potential Co-pollutant Benefits

This section identifies elements of state 111(d) plans that can result in criteria pollutant emission reductions.

Limiting Fossil Emissions through Increased Dispatch of Low- and Non-emitting Generation

Limiting increases in generation from existing fossil plants by increasing the dispatch of low- and non-emitting generation limit criteria pollutant emissions. The U.S. Energy Information Agency forecasts an increase in coal emissions through 2029 as existing coal units augment generation to meet demand.[40] Retiring fossil units can significantly reduce criteria pollutant emissions, though many states are unlikely to incentivize this measure as a 111(d) compliance strategy. Some states may, however, favor limiting increases in fossil emissions that would result from running existing fossil units at a higher capacity factor. States that meet demand growth with increased dispatch of low- or zero-emitting energy resources (e.g., natural gas, energy efficiency, renewables, and nuclear power) can avoid such increases in CO_2, NO_x, SO_2, and other pollutant emissions, while keeping relatively efficient coal plants online.

State 111(d) plans can encourage the use of non-emitting generation from wind, solar, and nuclear in several ways. First, it can allow that use as a compliance option, rather than requiring that compliance occur exclusively through measures taken inside the fence line of individual units. Second, states can provide guidance and streamlined administrative requirements for any monitoring, reporting, or emissions tracking required by the state plan. Dispatch preferences for low-carbon generation could further lead to increased use of relatively low-emitting generation. Also worth noting, non-111(d) state policies that favor renewables (e.g., renewable portfolio standards and tax benefits) can provide compounding incentives for non-emitting energy when layered with state 111(d) carbon reduction requirements.

Encouraging Energy Savings Measures

Efficiency and load management practices—such as end-use energy efficiency, other forms of demand-side management, and transmission line efficiency—can simultaneously yield reductions in CO_2 and criteria pollutant emissions. The impact of these measures, however, must be carefully evaluated. Load-shifting strategies, for example, have the potential to reduce or increase total emissions depending on the marginal units displaced and the fuel source used to meet the shifted load during off-peak times. The following elements of a state section 111(d) plan may encourage energy efficiency programs.

- **Types of efficiency programs**—States can provide guidance about the types of energy efficiency programs that can count toward compliance, whether they be efficient lighting programs, weatherization projects in residential or commercial buildings, performance contracting, information-based programs, utility rebate programs, or other measures.
- **Achievable evaluation, measurement, and verification (EM&V) protocols**—EM&V protocols must be rigorous enough to meet EPA requirements and demonstrate real emissions reductions without being so burdensome that they discourage utilization of energy efficiency. Harmonizing EM&V protocols for section 111(d) and other state requirements (e.g., utility commission requirements) can also encourage energy efficiency.
- **Energy efficiency set-asides**—States that use mass-based market systems may consider whether creating energy efficiency set-asides to award the achievement of emissions reductions through end-use efficiency measures will better encourage energy efficiency programs than the incentives provided by the limit on total emissions.
- **Investing auction revenue**—Rather than placing revenue from carbon allowance auctions into a state's general operating fund, states may be able to amplify the emissions impacts of their carbon reduction strategies by channeling that revenue to a fund that supports energy efficiency programs. The Regional Greenhouse Gas Initiative has used this model successfully.[41]

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[40] U.S. Energy Info. Agency, Annual Energy Outlook 2014—AEO Table Browser**,** http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014&subject=4-AEO2014&table=17-AEO2014&region=1-0&cases=ref2014-d102413a (scroll down to view table row for "Electric Power 6/Coal").

[41] REG'L GREENHOUSE GAS INITIATIVE, REPORT ON EMISSION REDUCTION EFFORTS OF THE STATES PARTICIPATING IN THE REG'L GREENHOUSE GAS INITIATIVE AND RECOMMENDATIONS FOR GUIDELINES UNDER SECTION 111(D) OF THE CLEAN AIR ACT 6 (2013),

Comparing Consequences of Different Forms of the Performance Standard

By empowering states to establish and implement performance standards, section 111(d) allows them to choose the optimal method for reducing their carbon emissions. Stakeholders have expressed different preferred compliance approaches, including unit-level efficiency retrofits, rate-based market programs, mass-based market programs, a portfolio approach, and a carbon fee. These approaches will have different consequences not only for 111(d) compliance costs but also for criteria pollutant emissions. As a result, states interested in co-pollutant benefits might compare the relative impacts of each approach.

Crediting State Criteria Pollutant Reductions

Regardless of whether they craft section 111(d) plans with the intent of reducing criteria pollutant emissions, states will probably induce collateral co-pollutant benefits through their section 111(d) carbon reduction policies. This likelihood raises questions not just about how to achieve multi-pollutant impacts through section 111(d) strategies, but also about how to receive credit for those reductions under the NAAQS program. This issue has received minimal attention in section 111(d) discussions and white papers, and little is known about the EPA's plans for recognizing co-pollutant benefits from 111(d) plans.

To initiate conversation and to solicit comment, this section discusses, in broad strokes, two potential frameworks for crediting reductions in criteria pollutant emissions spurred by state section 111(d) plans. Under the first framework, a state quantifies the benefits of its section 111(d) plan as a whole and uses them to decrease its baseline emissions forecast for criteria pollutants. Under the second approach, a state calculates the energy or emissions impacts of discrete elements of its 111(d) plan—such as energy efficiency and renewable energy policies and programs—and incorporates their criteria pollutant impacts under the NAAQS program.

Crediting Impacts from a State 111(d) Plan as a Whole

One potential strategy for recognizing the co-pollutant benefits of a section 111(d) plan is to incorporate into the NAAQS baseline forecast for criteria pollutants the energy and emissions impacts of a state section 111(d) program as a whole. States with air pollution levels that exceed EPA standards must develop state implementation plans (SIPs) to remediate air quality.[42] States generally begin by developing baseline forecasts for emissions of the pollutants at issue in order to compare projected air quality levels with EPA standards. Emissions forecasts for the power sector are grounded in forecasts for energy demand and generation, which states can acquire from a range of sources. In the event that a source forecast does not include state and local policies that affect emissions, the state can incorporate incremental measures into the baseline forecast.[43]

If a baseline forecast does not include a state's 111(d) plan, the state might adjust that forecast to reflect expected 111(d)-plan impacts on demand, electricity generation, and dispatch, which may lead to reductions in criteria pollutant emissions. This approach may offer states some advantages compared with incorporating discrete carbon-reduction measures (such as energy efficiency (EE) and renewable energy (RE) programs) into state plans for attaining NAAQS. The EPA has not weighed in on this approach in the context of section 111(d), but it did provide welcome guidance for states on including EE/RE programs in their implementation plans when it released its Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans (EE/RE Roadmap).[44] The EE/RE Roadmap does limit how states can use EE/RE programs for air quality compliance. For example, it allows states to adjust their emissions baseline only with EE/RE programs

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http://www.rggi.org/docs/RGGI_States_111d_Letter_Comments.pdf (discussing how the reinvestment of auction proceeds has contributed to reductions in CO_2 emissions and decreased compliance costs).

[42] 42 U.S.C. § 7410 (2012).

[43] *See* JOHN SHENOT, REGULATORY ASSISTANCE PROJECT, QUANTIFYING THE AIR QUALITY IMPACTS OF ENERGY EFFICIENCY POLICIES AND PROGRAMS 12–16 (explaining the emissions baselining process for SIPs and identifying as data sources the EIA's Annual Energy Outlook and forecasts by independent system operators and electric utilities).

[44] EE/RE ROADMAP, *supra* note 8. *See infra* page 14–15 for an explanation of the EE/RE Roadmap's pathways.

that are mandated by state law,[45] and it limits credit for projected emissions impacts by voluntary measures.[46]

As a result of these parameters, some states may want to eschew the EE/RE Roadmap for a strategy that permits the adjustment of NAAQS emissions baselines using the projected emissions impacts of a state 111(d) plan that includes incentives—but not requirements—for particular emissions reduction measures, such as EE and RE measures. For example, section 111(d) plans that use a carbon fee, mass-based market program, or rate-based trading program can lead to increases in demand-side energy efficiency and renewable generation without expressly requiring those measures with the force of law. A carbon fee would encourage dispatch of renewable energy by increasing the wholesale market price of fossil-fuel generation but would not mandate renewable energy generation. Similarly, the tonnage limit in a mass-based trading program may encourage the deployment of demand-side energy efficiency and renewable generation without requiring those electricity resources by law. The EE/RE Roadmap does not permit states to modify baseline forecasts on the basis of such voluntary EE/RE measures. If allowed to project criteria pollutant impacts of its section 111(d) plan as a whole and adjust its NAAQS baseline accordingly, a state might take credit for real criteria pollutant benefits without making otherwise voluntary measures legally enforceable.[47]

Crediting Impacts of Particular 111(d) Measures

Under a second potential framework, states incorporate certain elements of their section 111(d) plan into their NAAQS SIPs. The EPA published the EE/RE Roadmap in 2012 to guide states in including EE/RE programs in air quality SIPs.[48] The EE/RE Roadmap specifies four pathways, each with its own parameters, for incorporating EE and RE programs into state implementation plans: Baseline Emissions Projection Pathway, Control Strategy Pathway, Emerging/Voluntary Measures Pathway, and Weight of Evidence Pathway. How particular EE and RE policies fit into a state implementation plan will depend on pathway requirements and on the way energy efficiency and renewable energy are built into the state 111(d) plan.

The Baseline Emissions Projection Pathway is attractive because it allows a state to build EE/RE emissions impacts into its NAAQS baseline emissions scenario without making the EE/RE measures federally enforceable. To qualify for this pathway, EE/RE programs must be "on the books," meaning that they must be incorporated into law or a regulatory regime prior to development of NAAQS baseline projections.[49] EE/RE programs are on the books when they are "existing federal, state, tribal and local regulations and programs that will come into effect by the future attainment year."[50] Examples of on-the-books carbon emissions reduction strategies may include existing renewable portfolio standards, EE policies or programs, and building codes. But some 111(d) energy efficiency measures may not be considered on the books. A rate-based trading program, for example, might encourage EE/RE measures and allow an electric-generating unit to adjust its emissions rate by acquiring EE credits, but it would not set enforceable, on-the-books EE requirements. As a result, projected EE impacts could not be used to adjust the state's emissions baseline under the NAAQS program.

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[45] *See infra* note 50 and accompanying text (explaining that the Baseline Emissions Projection Pathway is only an option for EE/RE policies that are "on the books").
[46] *See infra* notes 56 and accompanying text.
[47] If a state's baseline projections end up underestimating emissions reduction and state air quality fails national standards, the state would be responsible for remedying the situation. 42 U.S.C. § 7410(c)(1) (2012).
[48] EE/RE ROADMAP, *supra* note 8, at 9 (2012). The EE/RE Roadmap permits energy efficiency programs to be credited toward several types of section 110 SIP requirements: attainment demonstration SIPs for nonattainment areas; reasonable further progress (RFP) plans; contingency measures for attainment plans; SIP measure substitution; and maintenance plans. *See* U.S. ENVTL. PROT. AGENCY, ROADMAP FOR INCORPORATING EE/RE POLICIES AND PROGRAMS INTO SIPS/TIPS—FREQUENTLY ASKED QUESTIONS 1 (2013), http://epa.gov/airquality/eere/pdfs/eerefaqAug2013.pdf.
[49] EE/RE ROADMAP, Appendix E, *supra* note 8, at E-5 to E-6, http://epa.gov/airquality/eere/pdfs/appendixE.pdf.
[50] *Id.* at E-5.

The Control Strategy Pathway in the EE/RE Roadmap allows full incorporation of projected emissions reductions from mandatory state EE/RE programs and renders these programs federally enforceable.[51] Unlike the Baseline Emissions Projection Pathway, which allows incorporation of mandatory policies or programs in the emissions baseline, the Control Strategy Pathway allows states to show projected emissions levels that include emissions impacts of programs not reflected in the baseline forecast. This pathway could house a new (or tightened) EE resource standard, for example, to help show that a nonattainment area will come into compliance. The Control Strategy Pathway's parameters may limit its attractiveness for section 111(d) EE/RE programs. Any 111(d) EE/RE programs that are voluntary or likely to occur, but are not mandated, do not qualify for the Control Strategy Pathway. If EE/RE measures are already enforceable and on the books before baseline forecasting, a state may prefer to incorporate them into its implementation plan using the Baseline Emissions Projection Pathway to avoid federal enforceability.

The Emerging/Voluntary Measures Pathway (E&V Pathway) allows a state to take credit for EE measures that are "not enforceable against an individual emissions source or party administering the measure" (voluntary)[52] or that "do[] not have the same high level of certainty as traditional measures for quantification purposes" (emerging).[53] Voluntary EE/RE measures incentivized by a section 111(d) market program or carbon fee[54] may fit under the E/V Pathway. A state wishing to build these voluntary measures into its implementation plan would need to estimate the energy savings but could only apply those savings to a maximum of "6 percent of the reductions needed for reasonable further progress (RFP), attainment, or maintenance of a NAAQS."[55] If the state wanted full credit for projected energy savings beyond this 6 percent limit, it could create mandatory programs and incorporate them into the Baseline Emissions Projection Pathway or Control Strategy Pathway.

The Weight of Evidence (WOE) Pathway allows states whose implementation plan shows them just shy of achieving NAAQS to include projected EE/RE program impacts to get the state the rest of the way. The detail required for a WOE determination depends on the rigor of the primary analysis for attainment, but the pathway accommodates emissions reduction measures without making them federally enforceable.[56] Emissions impacts from voluntary EE/RE programs or financial incentives that stimulate EE/RE programs may be available for use under this pathway.

CONCLUSION

With finalization of the EPA's section 111(d) guidelines, states will make significant choices about how to reduce CO_2 emissions. These decisions could fundamentally affect the U.S. power sector, but state regulators will develop their section 111(d) plans in an environment of uncertainty about the timing, stringency, and compliance costs of future air quality regulations. In light of this uncertainty, states may wish to look beyond carbon dioxide when developing section 111(d) plans. The Clean Air Act allows them the flexibility to reduce carbon emissions in a way that hedges the risk of anticipated air regulations and that potentially lowers long-term compliance costs.

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[51] EE/RE ROADMAP, Appendix F, *supra* note 8, at F-8. http://epa.gov/airquality/eere/pdfs/appendixF.pdf.
[52] EE/RE ROADMAP, APPENDIX G, *supra* note 8, at G-4, http://epa.gov/airquality/eere/pdfs/appendixG.pdf.
[53] *Id*.
[54] Judy Chang et al., The Brattle Group, A Market-based Regional Approach to Valuing and Reducing GHG Emissions from Power Sector: An ISO-administered carbon price as a compliance option for EPA's Existing Source Rule (2014) (discussion paper prepared for Great River Energy), http://www.brattle.com/news-and-knowledge/news/616 (follow link to paper at bottom of page).
[55] EE/RE Roadmap, Appendix G, *supra* note 8, at G-5, http://epa.gov/airquality/eere/pdfs/appendixG.pdf. "The actual amount of credit to be awarded and the rationale for approving voluntary/emerging measures will be established through notice and comment rulemaking during the SIP/TIP approval process." *Id.*
[56] EE/RE ROADMAP, Appendix H, *supra* note 8, at H-4 to H-5, http://epa.gov/airquality/eere/pdfs/appendixH.pdf.