CONTROLLING POWER PLANTS: THE CO-POLLUTANT IMPLICATIONS OF EPA'S CLEAN AIR ACT § 111(D) OPTIONS FOR GREENHOUSE GASES

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In the enduring absence of federal climate legislation, the Clean Air Act ("CAA") stands as the central federal mechanism for directly controlling the greenhouse gas ("GHG") emissions that cause climate change. Controls on existing power plants, which generate thirty-two percent of the nation's GHG emissions,[1] are a critical component of

[1] U.S. ENVIRONMENTAL PROTECTION AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2012 ES-23 (2014).

CAA regulation. The Environmental Protection Agency ("EPA") is facing novel and challenging regulatory choices as it contemplates how to implement CAA § 111(d), the CAA provision applicable to existing power plants,[2] choices that are revealed and analyzed in EPA's proposed § 111(d) rule ("Proposed Clean Power Plan" or the "Plan"), released on June 2, 2014.[3]

Like most of the CAA's emission control provisions, § 111(d) appears to contemplate traditional source-specific controls, but advocates—the industry and administration—are suggesting numerous alternative regulatory approaches. One approach would continue to focus on source-specific controls but would also allow emissions averaging among electricity generating units ("EGUs"). Other approaches rely on system-wide opportunities to reduce power sector emissions, including "outside-the-fence" control options like end-use energy efficiency, renewable energy, or transmission improvements, implemented directly or through cap-and-trade programs. Advocates are promoting these options for a multiplicity of reasons: to lower costs, to achieve greater reductions, or to avoid conflicts between new federal requirements and existing state programs that are already addressing power plant GHG emissions.

As a legal matter, there is some debate about EPA's scope of authority under § 111(d)—about whether the statutory language limits EPA to "inside-the-fence" source-based controls or, instead, allows EPA to establish guidelines based upon system-wide emission reduction opportunities.[4] For purposes of this essay, I assume that EPA has the legal authority to base its guidelines on system-wide reductions.

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2 *See generally* Coral Davenport, *EPA Staff Struggling to Create Pollution Rule*, N.Y. TIMES, Feb. 5, 2014, at A12.

3 U.S. ENVIRONMENTAL PROTECTION AGENCY, CARBON POLLUTION EMISSION GUIDELINES FOR EXISTING STATIONARY SOURCES: ELECTRIC UTILITY GENERATING UNITS (2014) [hereinafter PROPOSED CLEAN POWER PLAN], *available at* http://www2.epa.gov/sites/production/files/2014-05/documents/20140602proposal-cleanpowerplan.pdf (last visited June 11, 2014) (pre-publication version).

4 *See* DANIEL A. LASHOF ET AL., NATURAL RESOURCES DEFENSE COUNCIL ("NRDC"), CLOSING THE POWER PLANT CARBON POLLUTION LOOPHOLE: SMART WAYS THE CLEAN AIR ACT CAN CLEAN UP AMERICA'S BIGGEST CLIMATE POLLUTERS (2012), *available at* http://www.nrdc.org/air/pollution-standards/files/pollution-standards-report.pdf; MEGAN CERONSKY & TOMÁS CARBONELL, SECTION 111(D) OF THE CLEAN AIR ACT: THE LEGAL FOUNDATION FOR STRONG, FLEXIBLE & COST-EFFECTIVE CARBON POLLUTION STANDARDS FOR EXISTING POWER PLANTS (2013), *available at* http://blogs.edf.org/climate411/files/2013/10/Section-111d-of-the-Clean-Air-Act-The-Legal-Foundation-for-Strong-Flexible-Cost-Effective-Carbon-Pollution-Standards-for-Existing-Power-Plants-O.pdf; M. Rhead Enion, *Using Section 111 of the Clean Air Act for Cap-and-Trade of*

Instead, this essay focuses on the policy debate. Key issues include the policy advantages and disadvantages to a source-based versus a systems-based approach, as well as the choice between direct regulatory measures and some form of market-based measures, including emissions averaging or cap and trade. Many critical variables are relevant to choosing among available regulatory options, including relative cost-effectiveness, administrative efficiency, enforceability, system reliability, stringency, and ancillary co-benefits.[5]

This essay does not attempt a full exploration of all of the relevant policy variables. Instead, it focuses on a distinct issue: the implications of these policy choices for co-pollutant emissions.[6] Measures to reduce GHGs, like shifting from coal to natural gas or reducing the use of fossil fuels, will simultaneously reduce co-pollutants, offering significant co-benefits.[7] As a practical matter, EPA regularly considers the ancillary

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Greenhouse Gas Emissions: Obstacles and Solutions, 30 UCLA J. ENVTL. L. & POL'Y 1 (2012); KATE KONSCHNIK & ARI PESKOE, HARVARD LAW SCH. ENVTL. LAW PROGRAM, EFFICIENCY RULES: THE CASE FOR END-USE EFFICIENCY PROGRAMS IN THE SECTION 111(D) RULE FOR EXISTING POWER PLANTS 3–4 (2014), *available at* http://blogs.law.harvard.edu/environmentallawprogram/files/2013/03/The-Role-of-Energy-Efficiency-in-the-111d-Rule.pdf; Timothy J. Mullins & M. Rhead Enion, *(If) Things Fall Apart: Searching for Optimal Regulatory Solutions to Combating Climate Change Under Title I of the Existing CAA if Congressional Action Fails*, 40 ENVTL. L. REP. 10864 (2010); Franz T. Litz et al., *What's Ahead for Power Plants and Industry? Using the Clean Air Act to Reduce Greenhouse Gas Emissions, Building on Existing Regional Programs* (World Res. Inst., Working Paper, 2011), *available at* http://www.wri.org/publication/what%E2%80%99s-ahead-power-plants-industry-using-clean-air-act-reduce-ghgs-building-regional; Robert M. Sussman, *Power Plant Regulation Under the Clean Air Act: A Breakthrough Moment for U.S. Climate Policy?*, VA. ENVTL. L.J. 98, 118–21 (2014); Gregory E. Wannier et al., *Prevailing Academic View on Compliance Flexibility Under Section 111 of the Clean Air Act* (Inst. for Policy Integrity, Working Paper No. RFF DP 11-29, 2011), *available at* http://policyintegrity.org/files/publications/Prevailing_Academic_View_on_Compliance_Flexibility_under_Section_111.pdf. EPA's Proposed Clean Power Plan defends the agency's legal authority to adopt a system-wide approach. PROPOSED CLEAN POWER PLAN, *supra* note 3, at 119–24 (Section IV(B), "Summary of Legal Basis").

5 *See generally* JONAS MONAST & DAVID HOPPOCK, NICHOLAS INST. FOR ENVTL. POLICY SOLUTIONS, DESIGNING CO_2 PERFORMANCE STANDARDS FOR A TRANSITIONING ELECTRICITY SECTOR: A MULTI-BENEFITS FRAMEWORK (2014) (advocating a holistic approach to setting § 111(d) standards to achieve multiple benefits, including increasing system reliability and improving public health).

6 This essay draws upon a longer article that addressed the role of co-pollutant benefits in climate policy: Alice Kaswan, *Climate Change, The Clean Air Act, and Industrial Pollution*, 30 U.C.L.A. J. ENVTL. L. & POL'Y 51 (2012).

7 *See* JAMES K. BOYCE & MANUEL PASTOR, COOLING THE PLANET, CLEARING THE AIR: CLIMATE POLICY, CARBON PRICING, AND CO-BENEFITS (2012), *available at* http://dornsife.usc.edu/assets/sites/242/docs/Cooling_the_Planet_Sept2012.pdf; LASHOF ET AL., *supra* note 4, at 30–32; Michelle L. Bell, *Ancillary Human Health Benefits of Improved Air Quality Resulting from Climate Change Mitigation*, 7 ENVT'L. HEALTH 41 (2008); Dallas Burtraw et al., *Ancillary Benefits of Reduced Air Pollution in the US from Moderate Greenhouse*

co-pollutant implications of its regulation of particular pollutants.[8] The co-pollutant implications of EPA's § 111(d) GHG regulations will be important because power plants are not only the largest stationary source of GHG emissions,[9] they are among the nation's largest sources of sulfur dioxide, nitrogen oxides, particulates, and hazardous air pollutants, like mercury.[10] These pollutants have significant public health and environmental consequences, and notwithstanding extensive federal and state efforts many areas fail to meet national air quality standards.[11] Even though EPA has recently adopted significant new pollution limits that will reduce conventional emissions from coal-fired power plants in coming years,[12] EPA's § 111(d) GHG rules will nonetheless offer additional co-pollutant benefits above and beyond the CAA's more direct co-pollutant reduction initiatives.[13] While not the only variable, co-pollutant consequences are a relevant factor in assessing the strengths and weaknesses of alternative climate policies and maximizing their overall benefits.[14]

Gas Mitigation Policies in the Electricity Sector, 45 J. ENVTL. ECON. & MGMT. 650 (2003); G.F. Nemet et al., *Implications of Incorporating Air-Quality Co-benefits into Climate Change Policymaking*, 5 ENVTL. RESEARCH LETTERS 1 (2010). Although efforts to reduce GHGs in the energy sector will reduce co-pollutants, particularly to the extent they shift reliance to less polluting sources, it should be noted that GHG reduction requirements imposed on natural gas facilities could lead to a slight increase in nitrogen oxide emissions. *See* Stephen P. Holland, *Spillovers from Climate Policy* 3 (Nat'l Bureau of Econ. Research, Working Paper No. 16158, 2010), *available at* http://www.nber.org/papers/w16158.

8 As discussed further below, EPA must consider cost, feasibility, energy, and environmental factors in setting its existing source standards. *See infra* note 23 and accompanying text.

9 *See Sources of Greenhouse Gas Emissions*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/ghgemissions/sources.html (last visited May 18, 2014) (noting that thirty-two percent of 2012 GHG emissions stemmed from electricity generation, in comparison with twenty percent from the manufacturing industry).

10 Kaswan, *supra* note 6, at 63 (describing power plants' contribution to air pollution); CLEAN AIR TASK FORCE, POWER SWITCH: AN EFFECTIVE, AFFORDABLE APPROACH TO REDUCING CARBON POLLUTION FROM EXISTING FOSSIL-FUELED POWER PLANTS 24 (2014), *available at* http://www.catf.us/resources/publications/files/Power_Switch.pdf (describing coal-fired power plants' co-pollutant harms).

11 In 2012, 142 million people lived in areas that failed to attain one or more of the nation's air quality standards for criteria pollutants. *See Air Quality Trends*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/airtrends/aqtrends.html#comparison (last visited Feb. 14, 2014).

12 *See infra* note 76 and accompanying text (discussing recently promulgated coal-fired power plant controls).

13 *See infra* note 78 and accompanying text (discussing projected co-pollutant benefits of carbon controls on existing power plants notwithstanding recent direct co-pollutant requirements).

14 *See* BOYCE & PASTOR, *supra* note 7; Kaswan, *supra* note 6, at 55–78 (discussing role of co-pollutant benefits in climate policy); Nemet, *supra* note 7. As policy experts from the Environmental Defense Fund have stated, robust standards would "allow[] states and companies to make sensible investments in multi-pollutant emission reductions and clean, safe, and reliable electricity infrastructure." CERONSKY & CARBONELL, *supra* note 4, at 12.

Part I of this essay describes § 111(d) and EPA's implementation steps to date. It then provides an overview of the ways in which energy sector emissions can be reduced and the regulatory options EPA could use (or allow states to use) to spur those reductions. The essay focuses on four options: (1) traditional technology-based standards, (2) emissions-rate averaging among fossil-fuel plants, and two system-wide approaches—(3) cap and trade and (4) direct system-wide requirements.

Part II identifies key parameters for evaluating co-pollutant implications, including (1) distributional outcomes, (2) the magnitude of absolute emission reductions, (3) transformative incentives, (4) real versus paper emission reductions, and (5) reductions in the regulated sectors. Part II first provides a conceptual analysis of each regulatory option pursuant to these parameters and then synthesizes the potential co-pollutant implications of each regulatory option. It should be noted that this essay provides a conceptual framework for analysis and identifies general trends; it does not quantify co-pollutant outcomes. Actual outcomes will depend upon specific implementation details.

Part III draws several lessons from the analysis. The co-pollutant implications of GHG reduction policies have been a lightning rod for controversy in environmental justice circles, marked by concern that market-based mechanisms like cap and trade could have adverse co-pollutant consequences relative to other regulatory options.[15] This essay reveals that conclusions about co-pollutant effects from different forms of GHG controls in the energy sector defy easy generalizations and will depend upon specific implementation details and parameters. Ultimately, the most important factor for achieving both GHG and co-pollutant reductions will be the stringency of EPA's § 111(d) standards, and, as elaborated below, that stringency can be achieved only by relying upon a system-wide approach to determining achievable emissions reductions. Thus, the ability to take a system-wide approach that prompts a range of reductions will be more significant than the abstract choice between direct regulation and market-based approaches. Another lesson from the analysis is that maximizing both GHG and co-pollutant reductions will inevitably implicate the future of coal-fired power, given its disproportionately high GHG and co-pollutant emissions.[16]

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15 *See infra* note 70 and accompanying text.

16 *Cf.* RICHARDSON ET AL., GREENHOUSE GAS REGULATION UNDER THE CLEAN AIR ACT: STRUCTURE, EFFECTS, AND IMPLICATIONS OF A KNOWABLE PATHWAY 39 (2010) (stating, in relation to GHG reductions, that "[t]he primary way that emissions reductions might be obtained from the electricity sector is through reducing emissions from coal").

Part III then demonstrates how the framework facilitates analysis of the co-pollutant benefits of two specific proposals. Part III critiques a narrow proposal offered by several states and provides a preliminary analysis of EPA's Proposed Clean Power Plan, released just as this article was going to press. Some states are urging EPA to set its guideline based only upon source-specific, emission-rate improvements (a relatively weak standard) and to then allow states to meet that standard through a wider and more flexible array of compliance options.[17] That approach would fail to achieve significant reductions of either GHGs or co-pollutants, and if met through trading mechanisms the approach would present all of the GHG and co-pollutant risks of trading programs without any compensating increase in stringency. In contrast, EPA's Proposed Clean Power Plan adopts a system-wide approach, but questions remain about whether EPA's proposed state targets are stringent enough to fully realize the potential of a system-wide approach to achieve significant reductions and spark deep transformative incentives. Ultimately, this essay reveals that careful design will be necessary to ensure that § 111(d)'s potential to reduce both GHG and co-pollutant emissions is realized.

I. SECTION 111(D) IMPLEMENTATION

A. Introduction to § 111(d)

With the question of the CAA's applicability to GHGs clearly settled by the Supreme Court's holding in *Massachusetts v. EPA* that GHGs are "air pollutants" under the CAA,[18] EPA has been steadily applying a variety of CAA provisions to GHG emissions sources.[19] Section 111(d) establishes a process for setting standards for pollutants from existing sources that are not regulated under the programs of the CAA that address hazardous and criteria pollutants[20]—like GHGs.

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17 *See infra* note 143 and accompanying text.

18 Massachusetts v. Envtl. Prot. Agency, 549 U.S. 497, 528–29 (2007). EPA thereafter determined that greenhouse gases endanger public health and welfare, triggering numerous Clean Air Act control provisions. *See* Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009).

19 EPA has already developed GHG motor vehicle standards, Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards, 75 Fed. Reg. 25,324 (May 7, 2010) (to be codified at 40 C.F.R. pts. 531, 533, 536–38), and has required states to impose case-by-case permitting requirements on large new and modified GHG sources through the CAA's Prevention of Significant Deterioration Program. *See* Kaswan, *supra* note 6, at 80.

20 Clean Air Act, 42 U.S.C. § 7411(d)(1)(A)(i) (2006). In addition, § 111(d) is triggered only when EPA has set NSPSs for the pollutant from the type of source in question. *Id.* at § 7411(d)(1)(a)(ii). EPA has proposed NSPSs for new power plants. *See* Standards of Performance

For emissions from existing sources that fall under § 111(d), EPA must develop "emissions guidelines" that reflect the "best system of emission reduction" that "has been adequately demonstrated."[21] EPA can create nuanced subcategories and tailored guidelines that reflect applicable facility differences, including control costs, physical limitations, or geographic-specific factors.[22] In developing its guidelines, EPA is to consider not just the individual pollutant but also cost, other pollutants, energy use, and long-term and wider-scale implications.[23] Using the federal guidelines as a starting point, states must develop implementation plans that demonstrate that they will impose performance standards at least as stringent as the federal guidelines,[24] unless they meet certain criteria for imposing less stringent requirements.[25]

To date, EPA's implementation of § 111 requirements for GHGs has focused almost exclusively on power plants.[26] EPA has issued proposed new source performance standards ("NSPS") for new natural gas and coal-fired power plants. As of this writing, the proposed standards would require new natural gas facilities to perform at the level of a

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for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 1429 (Jan. 8, 2014).

21 40 C.F.R. § 60.22(b)(5) (2007).

22 *Id.*

23 *See* MARY D. NICHOLS ET AL., STATES' § 111(D) IMPLEMENTATION GROUP INPUT TO EPA ON CARBON POLLUTION STANDARDS FOR EXISTING POWER PLANTS 18–19 (2013) (quoting Sierra Club v. Costle, 657 F.2d 298, 330 (D.C. Cir. 1981)), *available at* http://www.georgetownclimate.org/sites/default/files/EPA_Submission_from_States-FinalCompl.pdf. The statute defines a "standard of performance" as "a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any *nonair quality health and environmental impact* and energy requirements) the Administrator determines has been adequately demonstrated." Clean Air Act, 42 U.S.C. § 7411(a)(1) (emphasis added). Although the statutory language refers only to "nonair" environmental impacts, EPA regularly considers the full range of environmental impacts, including emissions of air pollutants in addition to the directly regulated pollutant.

24 42 U.S.C. § 7411(d)(1).

25 States can impose less stringent requirements if they can demonstrate that applying the federal guidelines would impose unreasonable costs given facility characteristics, would be physically impossible to implement, or if the state can otherwise show that a less stringent standard is more reasonable. 40 C.F.R. § 60.24(f). Moreover, the CAA explicitly allows states to avoid imposing expensive requirements on facilities close to shutdown; it indicates that states may consider "the remaining useful life of the existing source." 42 U.S.C. § 7411(d)(1)(B).

26 EPA agreed to implement § 111 for power plants and oil refineries in a 2010 settlement agreement resolving litigation brought by states and environmental groups. *See* Kaswan, *supra* note 6, at 87. As of early 2014, EPA has not initiated any rulemaking for refineries or for any other industrial categories.

modern natural gas combined cycle unit and new coal-fired power plants to capture and sequester carbon emissions.[27]

After several years debating implementation options, EPA released its Proposed Clean Power Plan on June 2, 2014,[28] in compliance with the goals and deadline established in President Obama's June 2013 Climate Action Plan.[29] Unlike the proposal for new power plants, which created discrete standards for natural gas and for coal-fired power plants,[30] EPA's Proposed § 111(d) Rule takes a system-wide approach that allows states considerable flexibility in reducing emissions from existing power plants.[31] Arguably, the statute gives the agency more flexibility for existing than for new sources.[32] In addition, the politics of new versus existing source regulation differ. Numerous states have already adopted measures to reduce emissions from existing sources, including cap-and-trade programs, renewable portfolio standards, and

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27 *See* Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, *supra* note 20 (citing proposed rule for new sources). In its initial proposal for new power plants, EPA had created one category for fossil-fuel power plants that provide baseload power, and based the performance standard on emissions from combined cycle natural gas units. Facing substantial opposition to the combination of categories, EPA withdrew that proposal and published a new proposal with separate standards for natural gas facilities and coal-fired power. *See EPA Regulation of Greenhouse Gas Emissions from New Power Plants*, CTR. FOR CLIMATE & ENERGY SOLUTIONS, http://www.c2es.org/federal/executive/epa/ghg-standards-for-new-power-plants (last visited Feb. 16, 2014).

28 *See* PROPOSED CLEAN POWER PLAN, *supra* note 3.

29 Press Release, White House Office of the Press Secretary, Presidential Memorandum—Power Sector Carbon Pollution Standards (June 25, 2013) (available at http://www.whitehouse.gov/the-press-office/2013/06/25/presidential-memorandum-power-sector-carbon-pollution-standards). Final rules are required by June 2015. *Id.*

30 In setting standards for new sources, EPA initially proposed a single category for fossil fuel power plants but retreated from that approach and ultimately proposed separate standards for coal- and natural-gas plants. *See* Alice Kaswan, *EPA's New Source Proposal: The Category Question*, CTR. FOR PROGRESSIVE REFORM BLOG (Sept. 23, 2013), http://www.progressivereform.org/CPRBlog.cfm?idBlog=4BD6CD17-94FA-9A5B-98EEFA9DFFA2BD81; *see also* RICHARDSON ET AL., *supra* note 16, at 34 (observing the difficulty of expanding the scope of industrial categories beyond their traditional definitions).

31 *See* PROPOSED CLEAN POWER PLAN, *supra* note 3. President Obama's June 2013 Climate Action Plan had encouraged EPA to adopt a flexible approach. *See* Press Release, *supra* note 29, at Section (1)(c)(iii) (encouraging EPA to "develop approaches that allow the use of market-based instruments, performance standards, and other regulatory flexibilities"). EPA indicated early on that it was likely to adopt a flexible approach. *See* U.S. ENVTL. PROT. AGENCY, CONSIDERATIONS IN THE DESIGN OF A PROGRAM TO REDUCE CARBON POLLUTION FROM EXISTING POWER PLANTS (2013), *available at* http://www2.epa.gov/sites/production/files/2013-09/documents/20130923statequestions.pdf.

32 *See* CERONSKY & CARBONELL, *supra* note 4, at 10; Mullins & Enion, *supra* note 4.

energy efficiency programs.[33] Many of these states would prefer to have EPA adopt a flexible approach that allows existing programs to continue rather than being required to adopt a different type of control.[34] And industry might support a flexible approach because it is probable (although not certain) that a more flexible approach would be less expensive than traditional controls.

Another key preliminary issue is the relative roles of EPA and the states.[35] The Proposed Clean Power Plan creates federally mandated but state-specific targets, and then gives states maximum flexibility to develop plans to meet their individual targets.[36] It also gives states the option of developing multi-state plans that demonstrate how a group of states, together, would meet the aggregated reduction targets for the participating states.[37] This essay's comparative analysis of regulatory mechanisms for reducing GHGs is relevant to both EPA's policy choices and to the states' policy choices as they develop their individual or multi-state plans.

B. Regulatory Options

Before identifying regulatory options, it is useful to identify the technical mechanisms for reducing power sector emissions.[38] First, coal-fired power plants could make a number of "inside the fence" changes while continuing as coal-fired power plants: for example, they could increase combustion efficiency, shift to coal with a higher Btu, co-fire coal with natural gas or biomass, and reduce the moisture content of

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[33] *See* NICHOLS ET AL., *supra* note 23; *see also U.S. States and Regions: Climate Action*, CTR. FOR CLIMATE & ENERGY SOLUTIONS, http://www.c2es.org/us-states-regions (last visited Feb. 20, 2014) (website documenting numerous existing state and regional climate programs).

[34] *See* NICHOLS ET AL., *supra* note 23.

[35] Robert Sussman, a recent Senior Policy Counsel to the EPA Administrator, provides a succinct summary of the issues and options for assigning state emission targets in an article that likewise arose from this VELJ symposium. *See* Sussman, *supra* note 4, at 126–30.

[36] PROPOSED CLEAN POWER PLAN, *supra* note 3, at 39–43.

[37] *Id.* at 41, 360. The multi-state option could facilitate compliance for states that are already engaged in multi-state initiatives, like the Regional Greenhouse Gas Initiative, or that choose to engage in such initiatives to comply with § 111(d). *See generally See* JANIE HAUSER, HOW CAN MULTI-STATE COMPLIANCE PROGRAMS IN STATE IMPLEMENTATION PLANS UNDER SECTION 110 OF THE CLEAN AIR ACT INFORM THE POTENTIAL USE OF MULTI-STATE, MARKET-BASED MECHANISMS FOR COMPLIANCE WITH SECTION 111 OF THE CLEAN AIR ACT? (2013), *available at* http://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/6667/Hauser%20FINAL%20Masters%20Project.pdf?sequence=1; NICHOLS ET AL., *supra* note 23, at 26–27, 30–31.

[38] *See generally* LASHOF ET AL., *supra* note 4.

coal before combustion.[39] Second, some coal-fired power plants could be re-tooled to switch their fuel source entirely from coal to natural gas.[40] Measured at the power plant, without considering the more complex issue of life cycle emissions,[41] natural gas combustion generates roughly half the carbon emissions per unit of energy[42] and causes much less co-pollutant harm than coal-fired power.[43]

Moreover, unlike many private industries, the energy sector operates as an integrated system and provides a wide array of additional options for reducing overall power sector emissions.[44] Thus, a third option for reducing power sector emissions would be for utilities to shift energy generation from higher-emitting sources, like coal-fired power, to lower- or non-emitting sources, like natural gas or renewables. In other words, in response to energy demand, they could "dispatch" no- or low-emission sources rather than high emission sources, leading to less

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39 *See generally* ENVTL. PROT. AGENCY, AVAILABLE AND EMERGING TECHNOLOGIES FOR REDUCING GREENHOUSE GASES FROM COAL-FIRED ELECTRIC GENERATING UNITS 25–29 (2010) (describing technologies for reducing emissions from coal-fired power plants); Dallas Burtraw et al., *Retail Electricity Price Savings from Compliance Flexibility in GHG Standards for Stationary Sources*, 42 ENERGY POL'Y 67, 68–69 (2012) (summarizing multiple mechanisms for reducing emissions at coal-fired power plants); CLEAN AIR TASK FORCE, *supra* note 10 (describing multiple strategies for reducing emissions at coal-fired power plants).

In theory, individual facilities could also implement carbon capture and sequestration ("CCS"). The Proposed Clean Power Plan does not consider CCS a sufficiently cost-effective or available option for determining the available mechanisms for emission reductions. PROPOSED CLEAN POWER PLAN, *supra* note 3, at 144. It does, however, allow states or utilities to implement CCS as a § 111(d) compliance option. *Id.*

40 *See* CERONSKY & CARBONELL, *supra* note 4, at 11.

41 Given substantial methane emissions from natural gas production and transport, the comparative fuel cycle emissions of coal and natural gas are less clear and are strongly contested. *See* Mark Fulton et al., *Comparing Life-cycle Greenhouse Gas Emissions from Natural Gas and Coal*, WORLDWATCH INST. (Aug. 25, 2011), http://www.worldwatch.org/system/files/pdf/Natural_Gas_LCA_Update_082511.pdf. Resolution of this issue is beyond the scope of this paper.

42 *See Frequently Asked Questions*, U.S. Energy Info. Admin, http://www.eia.gov/tools/faqs/faq.cfm?id=73&t=11 (last visited June 4, 2014) (providing a table that indicates that various forms of coal combustion generate 214-229 pounds of CO_2 per million Btu of energy, in comparison with 117 pounds of CO_2 per million Btu for natural gas combustion).

43 *See* NAT'L RESEARCH COUNCIL, HIDDEN COSTS OF ENERGY: UNPRICED CONSEQUENCES OF ENERGY PRODUCTION AND USE 6 (2010). According to the National Research Council, the mean co-pollutant damages caused by coal-fired power plants are 3.2 cents per kWh, in comparison with mean damages of 0.16 kWh from natural gas plants. *Id.* at 7–8. *See also* Nicholas Z. Muller, *The Design of Optimal Climate Policy with Air Pollution Co-benefits* 34 RESOURCE & ENERGY ECON. 696, 699 (2012). Although recent EPA regulations will reduce co-pollutant harm from coal-fired power plants, they will remain a significant pollution source. *See infra* note 78 and accompanying text (observing benefits of reductions beyond existing co-pollutant controls).

44 *See* NICHOLS ET AL., *supra* note 23, at 18.

utilization and possibly increased retirement of coal-fired facilities.[45] Fourth, utilities could invest in renewable energy supplies, such as wind, solar, tidal power, or biomass, and use these sources to displace existing emissions. Fifth, reducing consumer electricity demand through enhanced industrial and consumer energy efficiency could reduce "business-as-usual" emissions.[46]

Differing regulatory options incorporate these emission reduction paths to varying degrees. This essay analyzes several paradigmatic options: (1) traditional, facility-specific emission-rate standards; (2) broader emissions averaging mechanisms; (3) direct system-wide requirements; and (4) cap-and-trade programs.[47] The first two are "source-based" options that focus only on changes at EGUs themselves. The last two account for system-wide changes that could occur outside of EGUs but nonetheless reduce their emissions. These categories are not mutually exclusive; EPA and/or the states could combine various features to achieve an overall emissions reduction goal.

1. Traditional Facility-Specific Standards

Under the most traditional CAA approach, EPA would subdivide power plants into separate categories based upon fuel source (coal, natural gas, and oil).[48] This type of traditional guideline would likely be framed in terms of an expected emissions rate for each category—a certain amount of carbon emissions per amount of power generated

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45 *See* CLEAN AIR TASK FORCE, *supra* note 10, at 3, 10–12 (describing substantial reductions that could be achieved by switching dispatch from coal-fired power to natural-gas power plants, many of which are underutilized). For example, Colorado's Clean Air—Clean Jobs Act passed legislation that prompted regulated utilities to develop plans to retire high-emission coal-fired power plants. *See* NICHOLS ET AL., *supra* note 23, at 14.

46 *See* SARA HAYES & GARRETT HERNDON, ACEEE, TRAILBLAZING WITHOUT THE SMOG: INCORPORATING ENERGY EFFICIENCY INTO GREENHOUSE GAS LIMITS FOR EXISTING POWER PLANTS (2013), *available at* http://www.aceee.org/sites/default/files/publications/researchreports/e13i.pdf; LASHOF ET AL., *supra* note 4, at 35–41 (detailing potential energy efficiency improvements).

47 *See e.g.*, JEREMY M. TARR, JONAS MONAST, & TIM PROFETA, REGULATING CARBON DIOXIDE UNDER SECTION 111(D) OF THE CLEAN AIR ACT: OPTIONS, LIMITS, AND IMPACTS 7 (2013), *available at* http://nicholasinstitute.duke.edu/climate/policydesign/regulating-carbon-dioxide-under-section-111d#.U1Ht1-ZdWWE (summarizing options).

48 *See* Litz et al., *supra* note 4, at 17 (stating that "[i]n the past, emissions reductions have come from individual source categories covered by narrow standards of performance"). One other option would be for EPA to establish a single category for power plants and then require coal-fired power plants to switch their fuel source to natural gas. Although EPA might create a flexible approach that allows facilities to take this step, it is unlikely to require it directly, so this option is not considered further. *See* DALLAS BURTRAW ET AL., GREENHOUSE GAS REGULATION UNDER THE CLEAN AIR ACT: A GUIDE FOR ECONOMISTS 6 (2011) (suggesting option, but indicating that such an approach would be unlikely).

(e.g., a certain amount of CO_2 per million Btu of heat input or to produce a kWh (kilowatt hour) of electricity).[49] Assuming EPA created subcategories based on fuel source, the primary emission reduction mechanism would consist of inside-the fence measures that did not require a fundamental shift in fuel source,[50] and that would achieve relatively modest reductions in carbon and co-pollutant emissions.[51]

Although facility-specific measures would not lead to significant reductions on paper, in practice they could potentially result in much more dramatic emissions reductions if polluting facilities retire rather than adopt the required controls. Given substantial variation in efficiency among existing coal-fired power plants, some coal-fired power plants could meet the standard with no required changes while others would be unable to meet the standard without significant investments.[52] Analysts predict that the least efficient facilities will respond to a traditional standard by retiring rather than investing in efficiency improvements.[53] They would likely be replaced by shifts in dispatch to lower-emitting fossil fuel sources (like natural gas) or by implementing energy efficiency and renewables.[54] Thus, a standard that required even a modest reduction in coal plant GHG emissions might cause utilities to retire coal plants altogether, resulting in a system-wide percentage GHG reduction that is much greater than would be achieved if each individual plant simply complied with the required emissions rate standard.

2. Emissions-Rate Averaging

Emissions-rate averaging presents a second regulatory option.[55] Rather than requiring each facility to meet the same emissions-rate

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49 *See* Mullins & Enion, *supra* note 4, at 10,883.

50 *See infra* notes 105 to 106 (describing studies detailing mechanisms for on-site emissions reductions).

51 *See infra* notes 105 to 107 and accompanying text (discussing stringency of traditional emission-rate standards).

52 *See* RICHARDSON ET AL., *supra* note 16, at 48–50. Natural gas power plants also exhibit substantial variations in heat rates, a variation correlated to some degree with facility vintage. *Id.* at 57–58.

53 *See* Burtraw et al., *supra* note 39, at 73.

54 *See id.* (predicting that the retirements prompted by a modest performance standard imposed on coal-fired facilities would be offset by increased natural gas "and a much smaller increase in renewable generation capacity").

55 *See id.* at 70; JONAS MONAST ET AL., REGULATING GREENHOUSE GAS EMISSIONS FROM EXISTING SOURCES: SECTION 111(D) AND STATE EQUIVALENCY 4–5 (2011); RICHARDSON ET AL., *supra* note 16, at 38 (describing trading rule based upon a performance standard), 43–44 (describing market-based "flexible performance standard").

standard, the guideline could require that all facilities in a given category collectively achieve a targeted average emission rate. An averaging approach would create systemic incentives to switch dispatch to more efficient units within each industrial category and to invest in efficiency improvements where cost-effective.[56]

EPA could set emissions-rate averages based on fuel-source based subcategories, like coal, natural gas, and oil-fired units, or create a single emissions-rate average target for a single category representing all fossil fuel power plants. Fuel-based averages would, on paper, lead to modest shifts in emissions to more efficient facilities using the same fuel (e.g., dispatch could shift from more heavily-emitting coal-fired power plants to more efficient coal-fired power plants). Although fuel-specific averages do not create direct incentives to switch from coal to natural gas, in practice, the added price to operate coal-fired power plants could lead utilities to rely less on coal-fired power and shift dispatch to natural gas facilities.[57]

If EPA established a single average for all power plants to meet, instead of setting fuel-specific averages, that approach would create more significant emission reductions. Because average emissions rates for natural gas plants are much lower than for coal-fired power plants, a single average for all power plants would create direct and strong incentives to shift from coal to natural gas. Utilities could shift dispatch from coal-fired to natural gas plants or even "fuel-switch"—that is re-tool coal-fired power plants to run on natural gas.

3. Direct System-Wide Requirements

Under a system-wide approach, the "best system of emissions reduction" is defined in light of the full range of mechanisms for reducing emissions: including both inside-the fence, site-specific adjustments (targeted by traditional standards) or shifts among existing power plants (achieved by emissions averaging), as well as outside-the-fence emission reduction opportunities like consumer energy efficiency and renewables.[58] In addition, utility planning decisions to retire

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56 *See* Burtraw et al., *supra* note 39, at 70.

57 CLEAN AIR TASK FORCE, *supra* note 10, at 12.

58 *See* CERONSKY & CARBONELL, *supra* note 4, at 8–9; NICHOLS ET AL., *supra* note 23, at 16–19; Jonas Monast et al., *Avoiding the Glorious Mess: A Sensible Approach to Climate Change and the Clean Air Act* 11 (Nicholas Inst. for Envtl. Policy Solutions, Working Paper, 2010). *See also* Mullins & Enion, *supra* note 4; Litz et al., *supra* note 4; Wannier et al., *supra* note 4 (describing federal standard that states could meet with state or regional cap-and-trade programs).

One complexity is that EPA or the states will have to compute the degree to which consumer energy efficiency programs and renewable energy lead to actual emissions reductions at existing heavily-emitting coal-fired power plants or build new natural gas facilities to replace existing coal-fired power plants could reduce emissions from existing power plants.

Under a system-wide approach characterized by direct requirements, states could implement all or some of these measures. They could impose emission rate standards on existing facilities, develop consumer energy efficiency programs and standards, establish renewable portfolio standards, engage in long-term utility planning to phase out more polluting facilities and build less polluting facilities, or otherwise require emission-reduction steps. The state would have to demonstrate how these programs would lead to emissions reductions that achieve the target.

One of the key challenges to using a system-wide approach is determining the appropriate form: whether the targets should be framed as emissions-rate standards or mass-based standards.[59] "Inside-the-fence" measures that require facility-specific or average improvements in emissions rates are best targeted by emission rate standards that define the amount of carbon generated per unit of energy created. The "outside-the-fence" measures associated with a system-wide approach, like utility planning to replace coal-fired power with natural gas, renewable energy, and consumer energy efficiency, do not change the emissions rates of existing facilities; instead they reduce demand from existing fossil-fuel fired EGUs and, accordingly, reduce overall emissions. These reductions are best captured by a mass-based standard

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power plants. EPA has experience addressing these challenges in the context of traditional pollution regulation. *See* HAYES & HERNDON, *supra* note 46; LASHOF ET AL., *supra* note 4, at 15–18. EPA has provided guidance on assessing the impact of energy efficiency and renewables on absolute emission levels in state implementation plans for criteria pollutants. *See* U.S. ENVTL. PROT. AGENCY, ROADMAP FOR INCORPORATING ENERGY EFFICIENCY/RENEWABLE ENERGY POLICIES AND PROGRAMS INTO STATE AND TRIBAL IMPLEMENTATION PLANS (2012). *See generally* JEREMY M. TARR, SARA HAYES, & JONAS MONAST, ENERGY EFFICIENCY AND GREENHOUSE GAS LIMITS FOR EXISTING POWER PLANTS: LEARNING FROM EPA PRECEDENT (2013), *available at* http://nicholasinstitute.duke.edu/sites/default/files/publications/ni_r_13-04_0.pdf (describing challenges associated with tying energy savings to covered sources, measuring energy savings, and quantifying the CO_2 reductions associated with energy savings); Konschnik & Peskoe, *supra* note 4, at 8–15 (discussing feasibility of quantifying the contribution of energy efficiency to emissions reductions). The Proposed Clean Power Plan addresses mechanisms and invites comment on how to translate energy efficiency and renewable energy into estimated emissions reductions. *See* PROPOSED CLEAN POWER PLAN, *supra* note 3, at 482–89.

59 Sussman, *supra* note 4, at 124 (observing that EPA must determine whether to set its standard as an emission rate limit or as a mass-based emission limit).

that measures changes in absolute emissions—the total tons of carbon reduced.[60]

A system-wide approach makes use of both inside-the-fence and outside-the-fence mechanisms, and so, to have an overall target, some degree of conversion is required. If an emissions-rate target is used, then mass-based reductions must be translated into their emissions-rate equivalent. If a mass-based target is used, then emissions-rate improvements must be translated into their mass-based equivalent.[61] In the Proposed Clean Power Plan, EPA proposes to resolve this dilemma by creating a carbon intensity standard for each state, a form of emissions-rate based standard. The agency calculated the contribution of mass-based measures by determining the amount of energy that could be generated by new renewable energy and the amount of energy that could be saved by enhanced energy efficiency. The agency then determined the carbon emissions anticipated from EGUs themselves (after application of achievable controls and dispatch shifts). EPA then divided the EGU's expected carbon emissions by the total amount of energy generated or saved through all measures, not just the source-specific measures, to determine the state's overall carbon intensity target.[62] Recognizing that some states might prefer to work with a mass-based standard, however, EPA gives states the option of converting the state-specific carbon-intensity standards into mass-based targets.[63]

4. System-Wide Approach Implemented Through Cap and Trade

Another commonly suggested mechanism for achieving system-wide reductions is a cap-and-trade program, an option that could be coupled with other direct system-wide requirements or stand on its own. This option is supported by many states who hope that their existing state and

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60 *See* MONAST ET AL., *supra* note 55, at 8 (noting that "to ensure that [EPA] can allow such cumulative emission-targeted programs to go forward, it would need to create a metric that measures the program based on the mass of GHGs emitted rather than the emission rate").

Numerous commentators have proposed mass-based targets. *See* KY ENERGY & ENVT. CABINET, GREENHOUSE GAS POLICY IMPLICATIONS FOR KENTUCKY UNDER SECTION 111(D) OF THE CLEAN AIR ACT (2013), *available at* http://eec.ky.gov/Documents/GHG%20Policy%20Report%20with%20Gina%20McCarthy%20letter.pdf (proposing a mass-based emissions target); MONAST & HOPPOCK, *supra* note 5, at 17 (suggesting that EPA could set state targets by measuring total statewide CO_2 emissions).

61 The states, or the agency would have to project future energy demand to determine how lower emission rates translate into lower overall emissions. *See, e.g.*, NICHOLS ET AL., *supra* note 23, at 22–23.

62 *See* PROPOSED CLEAN POWER PLAN, *supra* note 3, at 349.

63 *Id.* at 41.

regional cap-and-trade programs can be used to fulfill the upcoming federal standard.[64]

Under a cap-and-trade program, the cap provides a mass-based target.[65] The government then distributes or auctions allowances equal to the cap. Facilities subject to the cap could reduce emissions or could purchase allowances to cover their emissions. Unlike traditional standards, which directly affect only power plants themselves, a cap would create incentives to reduce emissions throughout the power sector, whether through facility-specific improvements, fuel-switching, shifting dispatch, or investment in demand reduction and renewables that would reduce emissions from existing sources.[66]

5. Conclusion: Regulatory Options in Context

The foregoing describes a number of basic policy mechanisms in their relatively pure form, a structure that facilitates comparative assessment. Commentators have proposed variations that combine features of these regulatory approaches. For example, the Natural Resources Defense Council ("NRDC") has proposed that EPA adopt emissions-averaging, but would provide credits for investments in consumer energy efficiency and renewable energy.[67] Professor David Driesen has proposed adopting facility-specific, mass-based caps—caps that would again encourage utilities to explore alternatives to fossil fuels rather than focusing solely on reducing fossil fuel emissions rates.[68] In

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64 *See* NICHOLS ET AL., *supra* note 23, at 7 (observing that states would like to use their existing programs to comply with federal requirements); Litz et al., *supra* note 4, at 17 (describing the likelihood that states will want to use their carbon trading program to comply with § 111(d)). *See generally* Mullins & Enion, *supra* note 4 (discussing viability of cap and trade under § 111(d)).

65 For purposes of § 111(d), the cap would not necessarily equal the state's mass-based target. If the cap-and-trade program included non-EGU sectors, then the cap would reflect economy-wide reductions, not just EGU reductions. Some of the quirks associated with the potential mis-match between the § 111(d) targets and state carbon cap-and-trade programs are discussed below in the section devoted to achieving in-sector reductions. *See infra* section III(E).

66 *See* Burtraw et al., *supra* note 39, at 71.

67 *See* LASHOF ET AL., *supra* note 4. The Clean Air Task Force has proposed that EPA set fuel-specific rate-based targets but then provide states with mass-based budgets that allow them to meet the requirements through a wide variety of mechanisms. CLEAN AIR TASK FORCE, *supra* note 10.

68 David A. Driesen, *Cap Without Trade: A Proposal for Resolving the Emissions Trading Problem under Clean Air Act § 111*, 43 ENVTL. L. REP. 10555 (2013). West Virginia officials have argued that BSER should be determined on a facility-specific basis and be translated into facility-specific mass-based caps that would then be aggregated to determine a statewide mass-based budget. *See* WV DEP'T OF ENVTL. PROT., WEST VIRGINIA PRINCIPLES TO CONSIDER IN ESTABLISHING CARBON DIOXIDE EMISSION GUIDELINES FOR EXISTING POWER PLANTS (2014), *available at*

addition, instead of setting emission rate standards or absolute reduction goals, EPA could set state-specific emissions intensity targets keyed to gross domestic product, as a number of states have suggested in a joint letter to EPA (as one among many options).[69] The analytical framework provided in this essay focuses on the basic contours of common regulatory tools but could also be used to analyze these and other variations that may yet emerge.

II. COMPARING THE CO-POLLUTANT CONSEQUENCES OF § 111(D) OPTIONS

This section provides a framework for analyzing the multiple parameters that determine the co-pollutant consequences of alternative regulatory options. The first parameter focuses on the distribution of emission reductions, a factor that is important for evaluating co-pollutant implications but not a significant factor for carbon emissions. The next three parameters are relevant to evaluating the efficacy of options from both a co-pollutant and a GHG perspective. The second parameter—stringency—directly implicates the extent to which both GHG and co-pollutant reductions are achieved. The third parameter—transformative incentives—refers to an option's capacity to trigger deep changes in our energy system that reduce both GHGs and co-pollutants. The fourth parameter—focusing on real versus paper emission reductions—is likewise important to ensuring that regulatory options achieve reductions in both GHGs and co-pollutants in excess of what would occur under business-as usual conditions. Lastly, the fifth parameter—in-sector versus out-of-sector reductions—implicates the extent of energy sector reductions and associated co-pollutant benefits.

A. Distributional Outcomes

Before assessing the likely distributional implications of alternative regulatory options, I first address whether power plant GHG controls could offer significant distributional benefits and clarify certain background assumptions. The essay then provides a conceptual analysis of the co-pollutant implications of alternative regulatory options.

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http://www.governor.wv.gov/Documents/WVDEP%20Principles%20for%20Existing%20EGU%20CO2%20Regulation.pdf.

[69] *See* NICHOLS ET AL., *supra* note 23, at 20.

1. Will GHG Policies Have Meaningful Distributional Impacts?

As a threshold matter, it is important to assess whether GHG policies could offer distributional benefits. Although distributional outcomes are not critical for GHG emissions, location matters for co-pollutant emissions. The differences in distributional outcomes between traditional and market-based regulatory options have long been a lightning rod for dispute in the environmental justice context, where environmental justice advocates contend that market-based systems cause emissions hot spots.[70]

Nonetheless, Professor David Adleman, in a recent article addressing toxic emissions, suggests that such concerns are misplaced and that GHG trading programs for stationary sources are unlikely to cause adverse toxics hot spots.[71] He argues that mobile and small area sources contribute the most toxics and that stationary sources are such a small component of overall toxics emissions that the modest shifts in emissions prompted by GHG trading programs are unlikely to lead to significant percentage differences in existing toxic emissions in most locations. As a consequence, they are thus unlikely to lead to increasing disparities in the distribution of toxic pollution.[72]

Professor Adelman's insights clearly demonstrate the importance of addressing pollution from non-stationary sources and the limited impact that trading programs will have on the relative distribution of toxic pollution. They do not, however, eliminate concerns about the distributional consequences of GHG trading programs, particularly in the energy sector. Professor Adelman's work focused on toxic emissions, not criteria pollutants. Power plants remain a major source of highly damaging criteria pollutants, including sulfur and nitrogen oxides and particulates.[73] Moreover, while Professor Adelman's work reveals

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[70] *See, e.g.*, Richard T. Drury et al., *Pollution Trading and Environmental Injustice: Los Angeles' Failed Experiment in Air Quality Policy*, 9 DUKE ENVTL. L. & POL'Y F. 231, 250, 270–71 (1999); Alice Kaswan, *Environmental Justice and Domestic Climate Change Policy,* 38 ENVTL. L. REP. 10287 (2008). In California, environmental groups filed a complaint with EPA, alleging that California's GHG cap-and-trade program would cause a disparate impact in violation of EPA's Title VI regulations, which state that state agencies receiving federal funds cannot take actions having such disparate impact. Complaint at 2, Coal. for a Safe Envt. v. Cal. Air Res. Bd., EPA File No. 09R-12-R9, *available at* http://ggucuel.org/wp-content/uploads/6.8.12-CSE-v.-CARB-TItle-VI-complaint2.pdf.

[71] David E. Adelman, *The Collective Origins of Toxic Air Pollution: Implications for Greenhouse Gas Trading and Toxic Hotspots*, 88 IND. L.J. 273 (2013).

[72] *Id.* at 321, 326.

[73] *See* Adelman, *supra* note 71 and accompanying text; *see also* BOYCE & PASTOR, *supra* note 7, at 8 (detailing stationary sources', including power plants', contribution to pollution from criteria pollutants).

that a trading program will not lead to large enough differences in toxic emissions to significantly impact one area's overall toxics levels relative to other areas, heavily polluted areas suffering from cumulative harm from multiple sources are nonetheless likely to highly value even small reductions in cumulative harm, particularly given the intractability of effectively addressing the multiple sources they experience.[74]

Another factor that affects the relative importance of GHG policies to co-pollutant reductions is the degree to which existing and new co-pollutant controls will directly control the co-pollutants of concern, independent of GHG regulations. Coal-fired power plants, which generate high levels of co-pollutants,[75] will soon be subject to new pollution controls that will significantly reduce their toxics and criteria pollutant emissions.[76] In addition, these and other new controls on coal-fired power plants' water use and waste disposal are likely to lead some utilities to retire coal-fired power plants rather than invest in pollution controls.[77] The simultaneous air pollution controls and retirements will somewhat mute the distributional implications of differing § 111(d) policies. For example, if a § 111(d) approach were to lead to increases in emissions at some coal-fired power plants, the higher degree of pollution control will moderate the co-pollutant emission consequences of those increases. Nonetheless, § 111(d) controls are expected to provide substantial co-pollutant benefits notwithstanding more stringent pollution controls,[78] and co-pollutant benefits therefore remain salient.

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74 *See* Alice Kaswan, *GHG Trading and Co-Pollutants: Expanding the Focus*, CPRBLOG (Sept. 9, 2013), http://www.progressivereform.org/CPRBlog.cfm?idBlog=038F9D48-C60E-14A7-E161BD89C2256287.

75 *See supra* note 43 (describing high levels of co-pollutants from coal relative to natural gas).

76 New toxics controls will reduce mercury emissions from coal-fired power plants by ninety percent and reduce other air toxics as well. Mercury and Air Toxics Standards, 77 Fed. Reg. 9304, 9306 (Feb. 16, 2012) (codified at 40 C.F.R. pts 60, 63). Indirectly, the mercury control technology will also reduce particulate and sulfur dioxide emissions. *Id.* at 9305 (discussing benefits attributable to the reduction of these co-pollutants). In addition, the Cross-State Air Pollution Rule is expected to reduce nitrogen and sulfur dioxide emissions, reductions designed to reduce ozone and particulate pollution. Cross-State Air Pollution Rule, 76 Fed. Reg. 48,208 (Aug. 8, 2011) (codified at 40 C.F.R. pts 51, 52, 72) The agency projected a seventy-three percent reduction in sulfur dioxide emissions and a fifty-four percent reduction in nitrogen oxide emissions. *See Cross-State Air Pollution Rule*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/airtransport/CSAPR/basic.html (last visited May 19, 2014).

77 *See* Monast & Hoppock, *supra* note 5, at 4, 13–14.

78 Section 111(d) standards proposed by the Clean Air Task Force are anticipated to reduce annual SO_2 emissions by "approximately 450,000 tons per year and NO_X reductions of 400,000 tons per year in 2020," resulting in "over 2,000 avoided deaths, 1,000 avoided emergency room visits, and 15,000 asthma attacks in 2020," with a "monetized value of $19 billion in 2020 (expressed in 2013 dollars)." Clean Air Task Force, *supra* note 10, at 25. The proposal provides an example of potential benefits; the specific benefits will vary by the specific features of

2. Assessing Distributional Impacts

Before turning to the distributional implications of alternative regulatory approaches, a couple of general observations are warranted. First, as noted above, this analysis provides a conceptual overview of potential distributional impacts; it does not quantify the co-pollutant consequences of alternative regulatory approaches. Second, it should be noted that assessing emissions distributions does not provide the complete picture of distributional *impacts*. While the quantity of emissions is a highly relevant variable, other factors are significant, including the size of impacted populations, meteorological conditions that determine actual exposure, cumulative harms, and the impacted population's underlying vulnerability to pollution.[79]

Finally, it bears emphasis that this essay focuses on the distribution of environmental, not economic, impacts. To the degree CAA § 111(d) prompts or intensifies systemic shifts in the U.S. energy system, including the retirement of existing facilities and development of alternatives, those shifts will have distributional economic impacts on affected communities, disrupting livelihoods for some and increasing opportunities for others. In addition, the degree to which § 111(d) raises energy prices implicates economic justice concerns.[80] These important economic impacts are, however, beyond the scope of this essay.

3. Traditional Regulation

Under a traditional regulatory approach, EPA would set an emissions rate standard for each category of power plants (e.g., coal-fired, natural gas, oil-fired). Existing efficiencies for coal-fired power plants vary substantially, so a single performance standard could lead to emissions reductions at some facilities and little to no reductions at efficient facilities that already meet the performance standard.[81] As a

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particular proposals. EPA has stated that the Proposed Clean Power Plan provides co-pollutant benefits that go beyond existing and proposed co-pollutant regulation. PROPOSED CLEAN POWER PLAN, *supra* note 3, at 566. An EPA fact sheet on the plan states that it will lead to a twenty-five percent reduction in co-pollutant levels. EPA FACT SHEET, BY THE NUMBERS: CUTTING CARBON POLLUTION FROM POWER PLANTS 2 (2014), *available at* http://www2.epa.gov/sites/production/files/2014-06/documents/20140602fs-important-numbers-clean-power-plan.pdf.

79 *See* BOYCE & PASTOR, *supra* note 7, at 17–18; Muller, *supra* note 43, at 697 (describing wide variations in co-pollutant harm based upon location).

80 Daniel A. Farber, *Pollution Markets and Social Equity: Analyzing the Fairness of Cap-and-Trade*, 39 ECOLOGY L.Q. 1, 48–53 (2012).

81 *See* RICHARDSON ET AL., *supra* note 16, at 54. One analyst has posited a standard that would already be met by eighty-seven percent of existing power plants, a standard that would not

consequence, reductions would occur only at the least efficient facilities, not at already-efficient facilities. Overall, however, by pushing less efficient facilities to become more efficient, the regulations would tend to equalize carbon emissions rates from existing power plants.

On paper, these carbon emissions reductions would also produce modest co-pollutant reductions. At coal-fired power plants, which are most likely to be affected by the § 111(d) standards, co-pollutant emissions generally track carbon emissions and will decrease in tandem.[82] A regulatory wrinkle could also magnify the co-pollutant benefits at some facilities: if coal-fired facilities invest in efficiency improvements, that investment could potentially trigger more stringent new source requirements for co-pollutants, leading to enhanced co-pollutant controls.[83] Under these circumstances, carbon rules could thus trigger disproportionately greater co-pollutant controls.[84]

Although a traditional standard would have modest equalizing impacts, in practice its distributional impacts could be much greater if—as analysts predict—the standard prompts many inefficient coal-fired power plants to retire rather than retrofit.[85] In that case, the distributional consequences would depend upon both the co-pollutant impacts of the

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lead to any reductions at the vast majority of facilities. *See* TARR, MONAST, & PROFETA, *supra* note 47, at 8 (describing Gumerman study comparing the impact of different regulatory options on coal-fired power plants).

82 Professors Boyce and Pastor have tracked carbon pollution's "co-pollutant intensity"—the intensity of co-pollutant pollution associated with carbon emissions—in various sectors. *See* BOYCE & PASTOR, *supra* note 7, at 21–36. Power plants have a relatively high co-pollutant intensity, so reductions in carbon at power plants are likely to be associated with reductions in co-pollutants, although there is substantial variation among power plants. *Id.* at 29. In contrast to carbon rules for coal-fired plants, mechanisms to reduce carbon emissions at natural gas plants could lead to small co-pollutant increases. *See* Holland, *supra* note 7 (describing slight increase in nitrogen oxide emissions associated with efforts to decrease carbon dioxide emissions from natural gas facilities).

83 *See* Sarah K. Adair et al., *New Source Review and Coal Plant Efficiency Gains: How New and Forthcoming Air Regulations Affect Outcomes*, 70 ENERGY POL'Y 183–192 (2014). New source requirements apply to modifications of existing facilities that increase emissions. These requirements could be triggered if efficiency upgrades prompted utilities to increase utilization, which in turn increased absolute co-pollutant emissions notwithstanding a decrease in their emission rates. *Id.* at 15.

84 If New Source Review requirements are triggered, then the indirect costs associated with direct facility requirements would also increase, a factor of concern to impacted utilities. *Id.* at 3–4.

85 Dallas Burtraw and colleagues predict that all coal-fired power "plants with an initial heat rate greater than approximately 11,000 Btu/kWh will necessarily retire because they do not have the technical opportunity to achieve the standard." Burtraw et al., *supra* note 39, at 74. *See also* TARR, MONAST, & PROFETA, *supra* note 47, at 8 (predicting retirements of coal-fired power plants in response to a uniform facility-specific standard).

retirements themselves and on how utilities make up for the reduction in supply.

The co-pollutant impacts of facility retirements would depend upon how heavily a utility used the retiring facility, with larger distributional impacts from the retirement of heavily-used facilities and less distributional impact from retirements of little-used facilities.[86] The distributional impacts of retirements on co-pollutant emissions would also depend upon the type of coal used, as co-pollutant intensity varies by type of coal and on whether the retiring facilities had pollution controls or not, with larger distributional benefits if the retiring facility lacked controls.[87] In addition, as noted above, co-pollutant emissions have differing degrees of harm depending upon where they are emitted, so the co-pollutant benefits of retirements could vary depending upon the location of the retirements.[88]

In addition, retirements could increase utilities' use of remaining fossil-fuel sources, including coal, natural gas, and oil-fired units. Because emissions rate standards do not place an absolute limit on emissions, emissions could increase so long as the facility complies with the applicable emissions rate requirement.[89] Thus, although

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86 *See* Burtraw et al., *supra* note 39, at 73 (noting that some retirements would lead to large changes in capacity but not in generation because they are not currently used to generate much power).

87 *See* NAT'L RESEARCH COUNCIL, *supra* note 43, at 6; Muller, *supra* note 43, at 709–10 (listing co-pollutant benefits associated with different forms of coal-fired power), 714 (observing that co-pollutant damages from coal-fired power vary depending upon whether the facilities have installed pollution controls). As noted above, EPA's adoption of new pollution control requirements for many pollutants will somewhat mute the environmental benefits associated with facility retirements since the comparison case—of continued operation—would be to a facility with, not without, pollution controls.

88 NAT'L RESEARCH COUNCIL, *supra* note 43, at 87. While a detailed analysis of the co-pollutant impacts associated with the facilities likely to retire is beyond the scope of this essay, analysts have provided general predictions on the location of likely retirements. Nathan Richardson and his co-authors anticipate that the greatest reductions would occur at inefficient facilities in the western states, where co-pollutant emissions pose less harm than in the mid-west and eastern states. RICHARDSON ET AL., *supra* note 16, at 55; *see* Muller, *supra* note 43, at 711. Other analysts have predicted retirements in both the West North Central Region, where co-pollutant benefits are not as significant, and in the East North Central region, where co-pollutant benefits could be more substantial. *See* TARR, MONAST, & PROFETA, *supra* note 47, at 8 (describing Gumerman's prediction that a facility-specific limitation on coal-fired power plants would lead to fifty-four retirements in the West North Central region and to thirty-one retirements in the East North Central region). If retirements in the East North Central region are in the Ohio River Valley, where co-pollutant harms are high, then retirements in this region could have substantial co-pollutant benefits. *See* Muller, *supra* note 43, at 711.

89 RICHARDSON ET AL., *supra* note 16, at 39; William H. Pedersen, *Should EPA Use Emissions Averaging or Cap and Trade to Implement §111(d) of the Clean Air Act?*, 43 ENVTL. L. REP. 10731, 10732–33 (2013).

retirements of the least efficient plants would likely reduce overall co-pollutant emissions, they could lead to some localized increases.[90] If retired coal-fired power plant capacity is replaced with natural gas, then the localized increases will be smaller than if capacity were replaced with higher-emitting coal-fired power, although this impact will be somewhat dampened by new pollution controls on coal-fired power plants.[91]

The distributional impact of retirements could also be muted if utilities invest in non-generating alternatives rather than shifting emissions. Facility retirements could trigger increased investments in and reliance on renewable energy or consumer demand reduction, mitigating the distributional impacts of facility retirements.[92]

4. Market-Based Regulation—Emissions Averaging and Cap and Trade

a. The Distributional Implications of Market-Based Programs

As typical market-based programs, both emissions averaging and trading programs have potentially uneven emissions distributions. A given company could choose to buy allowances (under a cap-and-trade program) or emission rate credits (under an emissions-averaging program) and, as a consequence, maintain or increase emissions rather than reducing them. Given the correlation between GHGs and co-pollutants, maintaining or increasing emissions could lead to an uneven distribution that does not distribute co-pollutant benefits as broadly as a traditional regulatory approach. Of course, co-pollutant emissions associated with these trades would be addressed by increasingly more stringent CAA controls on co-pollutants, but § 111(d)'s role in achieving additional reductions remains relevant.[93]

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90 *See* TARR, MONAST, & PROFETA, *supra* note 47, at 9 (observing that carbon emissions—and, presumably, associated co-pollutant emissions—would increase in the East North Central region notwithstanding likely retirements of thirty-one existing coal-fired power plants). A detailed analysis of likely shifts is a complex inquiry given the multiplicity of factors that could influence dispatch decisions, including economic variables, transmission systems, reliability concerns, political factors, etc.

91 *See supra* note 76 and accompanying text (describing effect of new direct co-pollutant controls).

92 *See* Burtraw, *supra* note 39, at 73 (observing that facility retirements induced by a traditional standard might be offset by a small increase in renewable generation capacity). Burtraw analyzed only changes in electricity generation; given the purported cost-effectiveness of energy efficiency, facility retirements might well trigger state and utility investment in consumer energy efficiency.

93 *See* Kaswan, *supra* note 6, at 98–100.

Professors Boyce and Pastor detail a hypothetical scenario illustrating potential distributional concerns: a heavily polluting facility located in a heavily populated area that already suffers from cumulative environmental harms might purchase allowances from a natural gas facility located in a sparsely populated and less polluted area.[94] In that instance, the GHG trade would have an adverse distributional impact because it would maintain or worsen pollution in a more polluted area and would affect a larger population. Boyce and Pastor do not claim that this result is inevitable, and in fact analysis of several trading programs did not reveal intensifying hot spots.[95] Their analysis highlights, however, the distributional uncertainty of trading programs and the risk of non-optimal distributions.[96]

Market-based programs are designed to incentivize increased operation of more efficient facilities while discouraging the operation of less efficient facilities—an incentive structure that would shift emissions to more efficient facilities but nonetheless provide overall co-pollutant reduction benefits. However, under both emissions-rate averaging and cap-and-trade programs there is no guarantee that less efficient facilities would operate less; utilities would have the flexibility to continue operating them so long as they paid for the necessary credits or allowances.[97] A number of factors could explain utility decisions to continue to operate less efficient facilities notwithstanding greater costs, including political factors, reliability concerns, or rate regulations that do not incentivize minimizing costs.

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94 BOYCE & PASTOR, *supra* note 7, at 2. Boyce and Pastor posit an oil refinery purchase, but the analysis applies equally to purchase by an uncontrolled coal-fired power plant.

95 In some instances, like the Acid Rain Program, trading programs have achieved substantial emissions reductions without creating localized hot spots. *See* Evan J. Ringquist, *Trading Equity for Efficiency in Environmental Protection? Environmental Justice Effects from the SO_2 Allowance Trading Program*, 92 SOC. SCI. Q. 297, 297 (2011); Jason Corburn, *Emissions Trading and Environmental Justice: Distributive Fairness and the USA's Acid Rain Programme*, 28 ENVTL. CONSERVATION 323 (2001).

96 While market-based and averaging programs create incentives to operate more efficient facilities, they do not preclude the operation of inefficient and heavier polluting facilities, as long as the utility is willing to pay the allowance costs. *See* NICHOLS ET AL., *supra* note 23, at 24.

97 *See* Burtraw et al., *supra* note 39, at 75 (noting that flexible standards would allow an inefficient plant "to remain in operation if it chose to do so"); CLEAN AIR TASK FORCE, *supra* note 10, at 18 (observing that trading programs "allow boiler owners whose sources exceed the emission standards to continue to generate electricity while complying with the standards by purchasing credits").

b. Distributional Implications of Emissions Averaging

The distributional consequences of an emissions-averaging approach could be impacted by an additional variable—how EPA establishes its industrial categories. If the category were based on all fossil fuel plants, including both natural gas and coal, then utilities would have an incentive to increase their use of more efficient natural gas plants to bring down the average. That would shift electricity generation from coal plants to natural gas plants, with a corresponding decrease in emissions from coal-fired power plants and potential increase in emissions at natural gas plants. Shifts from coal to natural gas not only change the location of co-pollutant emissions but their intensity, given the higher co-pollutant levels associated with coal-fired power plants.[98]

If the categories were fuel-based, with separate average targets for coal, natural gas, and oil-fired facilities rather than an emissions-rate average for all fossil-fuel power plants, then there could be distributional shifts in generation from less efficient to more efficient coal-fired facilities.[99] These responses would likely reduce overall co-pollutant emissions but increase emissions at certain facilities, with the impacts of those shifts depending upon the degree of harm in each location.[100] Finally, if the emissions average is stringent enough, utilities might meet the standard by utilizing only the most efficient facilities and make up for the reduced supply by shifting dispatch to natural gas plants, which would reduce coal-fired emissions and increase (to a lesser degree) emissions from more efficient natural gas plants.[101] Reduced supply could also be met by increased energy efficiency or renewables.

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98 *See supra* note 43 (discussing coal-fired power's higher co-pollutant intensity).

99 *See* Burtraw et al., *supra* note 39, at 70 (noting that greater utilization of efficient plants would generate credits, suggesting likelihood of shift from less efficient to more efficient plants).

100 As noted above, the degree of harm depends upon a variety of factors, including the pollution controls on the increasing facility, population levels, cumulative exposures, and underlying vulnerability. If generation were to shift to more efficient plants in the mid-west or eastern states, for example, that could cause adverse distributional results due to high population levels, though the degree would depend upon pollution controls.

101 *Cf.* CLEAN AIR TASK FORCE, *supra* note 10, at 17 (observing that if an emissions-rate standard for coal-fired power plants were converted to an emissions budget, utilities would likely meet the emissions budget by increasing their utilization of natural gas plants, "increasing gas units' total emissions (but not their emission rates) . . . while lowering overall emissions rates and levels in the fossil-fueled electricity system as a whole"). Dispatch shifts could also occur through the market forces generated by an emissions trading system. If coal-fired power plants were required to hold allowances for emissions, increasing the cost of operation, that change in operating costs could create a market incentive to shift dispatch to less-polluting natural gas. *See* CLEAN AIR TASK FORCE, *supra* note10, at 12.

c. Distributional Implications of Cap and Trade

As with emissions averaging, a cap-and-trade program would incentivize reductions at the least efficient and highest-carbon facilities. Because all measures that reduce emissions would help meet the cap, a cap-and-trade program would create direct incentives to not only shift generation to more efficient coal-fired and natural gas-fired facilities but to non-fossil fuel alternatives as well, such as end-use efficiency and renewables. As a consequence, by encouraging non-emitting alternatives, a cap-and-trade program could potentially lead to more widespread decreases in emissions than emissions averaging.

5. System-Wide Approach with Direct Requirements

If states were to impose direct emissions-rate requirements on existing sources, the on-paper consequences would likely be similar to what would occur if EPA established direct emission-rate guidelines for existing sources: an overall equalizing of emissions, with reductions at less efficient facilities and no reductions at facilities that already meet the standard. Similarly, in practice such direct requirements could prompt inefficient coal-fired power plants to retire rather than retrofit to meet the emission-rate standard. Under a system-wide approach, a state could directly promote emission reductions from EGUs by developing renewable energy to replace EGU power generation and by developing consumer energy efficiency programs to reduce electricity demand and its associated emissions. Thus, source-specific emission-rate limits coupled with programs to promote non-emitting sources could lead to smaller shifts in emissions to existing power plants than would occur under an approach that imposed only source-specific emission-rate requirements.

6. Conclusion: Distributional Outcomes

Simplistic conclusions about the relative distributional impacts of various regulatory options are impossible. Traditional, facility-specific standards would tend to equalize emission rates but could lead to increases at more efficient facilities. Thus, facility-specific standards do not eliminate the risk of emissions increases at some facilities. Emissions averaging would lead to shifts in emissions within regulated categories, with the degree and extent of the shifts dependent upon how the categories are established. In practice, both traditional facility-specific standards and averaging could lead to retirements that prompt more widespread shifts than might appear on paper. Cap-and-trade approaches would also lead to shifts in the distribution of emissions from coal-fired power to natural-gas, as well as, potentially, some displacement of emissions by energy efficiency and renewables. Direct system-wide requirements that include emission rate standards would have the same distributional consequences as traditional requirements but, due to system-wide initiatives, might replace more emissions with consumer energy efficiency and renewables.

B. Magnitude of Absolute Reductions: Stringency

While the distribution of co-pollutants is an important issue in evaluating alternative GHG reduction policies, the magnitude of overall co-pollutant levels is also a relevant consideration. Two factors could influence the relative stringency of the § 111(d) standard: the breadth of available reduction strategies and cost-effectiveness.

Unlike most industries, which have a limited number of options for reducing emissions, the utility sector can reduce emissions through a variety of mechanisms, including not only onsite improvements but also shifting dispatch to less-polluting fuels, investing in low-or no-emitting sources, and enhancing consumer energy efficiency. The broader the range of reduction options, the more stringent the standard can be. Therefore, standards based upon system-wide opportunities have the potential to be significantly more stringent than those limited to inside-the-fence, source-based controls.[102]

Cost-effectiveness can also affect stringency. Although cost-effectiveness is a major factor in regulatory policy choices in its own right,[103] here I focus on how cost-effectiveness could influence stringency and, accordingly, the degree of co-pollutant reductions. Policymakers are more likely to set stringent standards if the cost of achieving them is low.[104]

1. Traditional Source-Specific Regulation

Focusing on "inside the fence" solutions limits the breadth of reduction opportunities. As a consequence, most analysts conclude that developing technology-based, fuel-based, emissions-rate standards for

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102 *See* BURTRAW ET AL., *supra* note 48, at 6; LASHOF ET AL., *supra* note 4, at 10, 16; Sussman, *supra* note 4, at 120.

103 *See* Kaswan, *supra* note 6, at 72–73.

104 *See generally* RICHARDSON ET AL, *supra* note 16, at 37 (suggesting that cost savings can justify deeper reductions); *see also* A. DENNY ELLERMAN ET AL., EMISSIONS TRADING IN THE US: EXPERIENCE, LESSONS, AND CONSIDERATIONS FOR GREENHOUSE GASES 29, 34 (2003) (suggesting that policymakers set more stringent mobile source standards due to cost savings from trading opportunities).

existing coal-fired power plants would lead to modest emissions reductions from the power sector, with reductions from two-to-five percent.[105] Co-firing with biomass or with natural gas could reduce GHG emissions by an additional few percentage points.[106] Most of these measures, with the possible exception of co-firing with biomass,[107] would provide modest associated co-pollutant reductions.

However, stringency in practice could be much greater than stringency in theory. If, as predicted, a substantial number of coal-fired power plants retire rather than invest in greater efficiency, the traditional standards could lead to much larger GHG and co-pollutant emissions reductions.[108] Although designed to require only source-specific results, the ensuing retirements could trigger a systemic response and be replaced by greater reliance on more efficient coal-fired power, greater reliance on natural gas, and emerging reliance on renewable energy sources and demand reduction.

A study by Dallas Burtraw and his colleagues compared the actual emission reduction consequences of alternative approaches.[109] In their study, they set a modest reduction target and held it constant for

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105 EPA has estimated that more efficient boilers and operational adjustments could improve existing coal-fired power plant efficiency by about two-to-five percent. *See* RICHARDSON ET AL., *supra* note 16, at 36. Some suggest the reduction could be in the five to ten percent range. *See* Nathan Richardson et al., *The Return of an Old and Battle-Tested Friend: The Clean Air Act*, 176 RESOURCES 25, 28 (2010); *see generally* ENVTL. PROT. AGENCY, AVAILABLE AND EMERGING TECHNOLOGIES FOR REDUCING GREENHOUSE GASES FROM COAL-FIRED ELECTRIC GENERATING UNITS 25–29 (2010) (describing technologies for reducing emissions from coal-fired power plants); Burtraw et al., *supra* note 39, at 68–69 (summarizing multiple mechanisms for reducing emissions at coal-fired power plants).

106 *See* BURTRAW ET AL., *supra* note 48, at 10–11. EPA, in its Proposed Clean Power Plan, analyzed the opportunity for emissions reductions from on-site measures at the nation's coal-fired power plant fleet and concluded that achievable and affordable source-specific mechanisms could reduce emissions by six percent. PROPOSED CLEAN POWER PLAN, *supra* note 3, at 352. EPA excluded certain on-site measures in reaching the six percent estimate, including co-firing with biomass or with natural gas, or fuel-switching from coal to natural gas. *Id.* at 145-46, 502-503. In addition, EPA did not evaluate reduction opportunities at non-coal-fired power plants (like oil- and gas-fired plants), *id.* at 142 n. 95, explaining that it had insufficient data to analyze. *Id.* at 170 n. 123.

107 A recent study suggests that biomass combustion generates as or more co-pollutants as coal combustion. *See* MARY S. BOOTH, P'SHIP FOR POL'Y INTEGRITY, TREES, TRASH, AND TOXICS: HOW BIOMASS ENERGY HAS BECOME THE NEW COAL (2014), *available at* http://www.pfpi.net/wp-content/uploads/2014/04/PFPI-Biomass-is-the-New-Coal-April-2-2014.pdf.

108 *See supra* note 85 and accompanying text (describing likely retirements from imposition of a traditional standard). *See also* TARR, MONAST, & PROFETA, *supra* note 47, at 9 (describing Gumerman study indicating that a facility-specific standard would lead to many more retirements of coal-fired power plants than more flexible standards designed to achieve the same degree of emissions reduction).

109 *See* Burtraw et al, *supra* note 39.

traditional, averaging, and cap-and-trade programs.[110] The study found that a traditional performance standard would lead to the largest total decrease in emissions from coal-fired power plants by triggering plant retirements. A traditional performance standard would reduce coal-fired generation eighty-five percent more than a flexible averaging approach, fifty percent more than a cap-and-trade program that auctioned allowances, and ten times more than a cap-and-trade approach that distributes allowances to utilities for free.[111] Thus, a traditional performance standard, by inducing retirements that reduce generation from coal-fired power plants,[112] could reduce absolute emissions by much more than would be predicted by a performance standard that presumes continued operation and relatively small reductions. Retirements of coal-fired power plants, the most polluting energy source, would lead to significant co-pollutant reductions.

This is not to say that a traditional performance standard necessarily leads to greater emissions reductions. Burtraw's analysis used the same emissions reduction target for all three approaches. If EPA set more stringent targets for programs offering flexible mechanisms, they would achieve greater reductions in coal-fired emissions than predicted under Burtraw's model. Moreover, although analysts predict substantial retirements from traditional emission-rate standards, it is not certain whether utilities would, in fact, shut down coal-fired facilities or, instead, meet the standard and continue to operate and emit at a relatively high rate.[113]

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[110] *See id.* at 69.

[111] *See id.* at 72–73. Changes in generation are estimated as follows, Traditional Standard: -74 BkWh; Flexible compliance (averaging): -40BkWh; Cap and trade with auction: -49 BkWh; Cap and trade with free allowance distribution: -7 BkWh. Changes in generation in capacity from coal-fired power are even more dramatic due to retirements of inefficient facilities that reduce overall capacity but, due to low levels of use, result in less significant reductions in generation. *See* Butraw et al*., supra* note 39, at 73, 76 (observing that if traditional standards set heat rate targets rather than emissions rate targets, then they would also induce retirements and generate large reductions in emissions, though with some variation from emission rate targets).

[112] If, however, utilities respond to plant retirements by increasing emissions from other coal-fired power plants rather than shifting to natural gas, renewable energy, or reducing demand, emissions reductions would not be substantial. *See* LASHOF ET AL., *supra* note 4, at 42 (suggesting that in light of unused capacity in the coal-fired power sector, "a substantial share of the existing coal capacity could retire without producing substantial CO_2 emission reductions if that generation were replaced by increased utilization of the remaining coal-fired power plants").

[113] EPA's Proposed Clean Power Plan suggests that measures to reduce emission rates at existing facilities are relatively inexpensive, particularly because greater facility efficiency results in savings that help offset the cost of the investment in improvements. PROPOSED CLEAN POWER PLAN, *supra* note 3, at 167–68. Thus, analysts may have over-predicted facility retirements.

2. Emissions Averaging

If EPA sets fuel-specific averages, the range of options for meeting the standard would remain small and would not provide a basis for substantially greater stringency. However, emissions averaging could provide a more cost-effective way to meet emissions standards since utilities could shift dispatch to more efficient facilities and avoid expensive improvements. That greater cost-effectiveness could potentially justify a somewhat more stringent standard than would be set if each facility were required to meet the same standard.

If, instead, EPA developed an emissions rate average target for fossil-fuel power plants as a single category, then the sought-after emissions rate target would take into account natural gas as well as coal-fired emissions rates and reflect utilities' ability to shift dispatch or fuel source from coal to natural gas. The greater breadth of options could therefore justify a more stringent emissions rate standard than one based on what is achievable for power plants using a given fuel source. In addition, to the extent using natural gas is cheaper than changing operations at coal-fired power plants, a sector-wide average would reduce the cost of achieving reductions and justify a more stringent target than would be justified under traditional requirements or fuel-specific averaging.

3. Cap-and-Trade Programs

A cap-and-trade program would offer even greater breadth than emissions averaging approaches because EPA could determine the "best system of emission reduction" based upon the full range of options that could ultimately drive power sector reductions and set the target based on the implementation of all of these options. If the standard took into account reductions in existing power plant emissions that could be achieved through increasing demand-side energy efficiency and renewables, then the target could be more stringent than a target that assumed the continued business-as-usual operation of existing power plants.[114] By encouraging shifts to non-fossil-fuel sources, this approach would also increase co-pollutant benefits.[115]

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[114] *See* NICHOLS ET AL., *supra* note 23, at 18 (observing that demand reduction and alternative energy "achieves emissions reductions far beyond the level that can be achieved by improving the operations of individual fossil plants"). The NRDC suggests that energy efficiency could be the most significant driver of power sector emissions reductions, with energy efficiency enabling retirements and reduced use of coal-fired power plants. LASHOF ET AL., *supra* note 4, at 25.

[115] *See id.* at 76–77 (indicating that economic benefits, measured by the value of both co-pollutant and carbon emission reductions, are higher where carbon standards can be met with

On the cost-effectiveness front, cap-and-trade programs are often promoted because they provide a less expensive mechanism for reducing emissions.[116] The entities that can reduce emissions cheaply are likely to reduce emissions so they can sell allowances or credits to entities facing higher costs. The system thus encourages low-cost reducers to make most of the reductions and allows high-cost reducers to avoid the expense and purchase allowances. Holding the emissions reduction target constant, initial studies comparing the cost of traditional facility-specific emissions standards with more flexible approaches for coal-fired power plants have found substantial cost savings from a flexible approach.[117]

Under a cap-and-trade program, EPA could consider not only the lower costs of shifting emissions to less polluting facilities within the existing universe of facilities but also the lower cost of indirect measures, such as demand-reducing consumer energy efficiency, that could ultimately reduce power sector emissions. Consumer energy efficiency is widely considered the most cost-effective energy sector emissions-reduction strategy,[118] and incorporating the expectation that states would promote this avenue would reduce the cost of achieving reductions and could correspondingly increase the stringency of the target.

4. System-Wide Approach with Direct Requirements

A system-wide approach to meet an emission reductions target that used direct requirements rather than a cap-and-trade program could, like cap and trade, rely upon a wide variety of emission reduction strategies and could, accordingly, justify a more stringent target than a guideline based upon only one or two mechanisms for reducing emissions. However, to the degree direct requirements result in states and utilities undertaking more expensive approaches, the decreased cost-effectiveness could potentially motivate policymakers to be less stringent.

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demand-side management than when they must be met solely through direct electricity sector reductions).

116 *See generally* Burtraw et al., *supra* note 39, at 69.

117 *See id.* at 72, 75. Burtraw assumes a given level of reductions and calculates the relative impact on electricity prices assuming the same reduction target. The data on differing reduction costs is, however, also relevant to assessing the viability of more stringent standards rather than lower electricity prices.

118 LASHOF ET AL., *supra* note 4, at 36 (describing cost savings from energy efficiency).

5. Conclusion: Stringency

If EPA based the standard only on facility-specific reduction options, then, at least on paper, these traditional performance standards would not be as stringent as an approach that included additional reduction opportunities. In practice, however, a traditional performance standard might indirectly achieve the same or greater reductions by triggering retirements of coal-fired facilities and could thus be as or more stringent in practice as market-based or other system-wide mechanisms. An emissions-averaging approach based on fuel source would achieve only modest reductions. An emissions-averaging approach based on power plants as a single category could achieve greater reductions given likely shifts from coal to natural gas. A system-wide approach, like cap and trade, that considered the full range of options, including lower-cost options like energy efficiency, could justify a more stringent target and achieve greater reductions. Direct system-wide requirements would also include a wide range of strategies that could enhance stringency, but cost considerations could potentially reduce the stringency policymakers are willing to impose.

C. Transformative Incentives

To be effective, climate policies must not only generate short-term emissions reductions but create incentives for a more sustainable energy infrastructure. Given persistent failure to attain ambient air quality standards, the issue of transformative incentives is as important for co-pollutants as it is for GHGs.

1. Traditional Regulation

On paper, a traditional approach to § 111(d) could create some incentive to improve the operation of existing facilities and reduce emissions to some degree but would not create longer-term systemic incentives. With fuel-based emission-rate standards, facilities would adopt the required controls and have little incentive to explore new alternatives.[119] Efficient facilities that already meet the performance standard would have no incentive to invest in further efficiency improvements, even if such improvements were relatively inexpensive.

In practice, however, if a traditional standard were stringent enough to induce inefficient-coal-fired power plants to retire,[120] it would create

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119 *See* Craig N. Oren, *Is the Clean Air Act at a Crossroads?*, 40 ENVTL. L. 1231, 1256–57 (2010).

120 *See supra* note 85 and accompanying text.

more substantial transformative incentives as utilities compensate for the reduced supply. Retired facilities are unlikely to be replaced by new coal-fired power plants,[121] so the retirements could prompt utilities to turn to more sustainable options, including consumer energy efficiency, alternative energy, or natural gas-fired plants.[122] Once again, a traditional approach could potentially be more robust in its indirect consequences than it is on paper.

2. Emissions Averaging

Assuming fuel-specific categories, an emissions averaging approach would lead to modest shifts in the use of existing power plants as utilities shift dispatch to the more efficient plants within each category. An emissions averaging approach would also create the strongest incentives for efficiency improvements within each category because all efficiency improvements (whether at inefficient or already-efficient) facilities would lower the overall average and reduce the cost of buying credits.[123]

If EPA instead created a single category for all power plants, an emissions averaging approach would encourage not only dispatch shifts to more efficient plants within each category but also shifts from coal to natural gas. An emissions averaging approach would not, however, create strong incentives for renewable energy or energy efficiency.[124] In fact, by reducing costs and lowering the risk of plant retirements, emissions averaging might, in practice, create less of a transformative

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121 *EPA Regulation of Greenhouse Gas Emissions from New Power Plants*, *supra* note 27.

122 The degree to which utilities would turn to energy efficiency would depend to some extent upon the incentives and disincentives created by state utility regulations. Traditional utility rate regulation ties revenue to sales, creating a disincentive for consumer energy efficiency. Some states have "decoupled" revenue and sales, removing the incentive to maximize energy generation and removing utilities' disincentive to encourage consumer energy efficiency. *See* Ralph Cavanaugh, NRDC Switchboard, *Report: "Decoupling" is Transforming the Utility Industry* (Jan. 31, 2013), http://switchboard.nrdc.org/blogs/rcavanagh/report_decoupling_is_transform.html. Thus, the capacity for § 111(d) regulations to have a transformative effect will depend to some extent upon state-based utility regulation.

123 *See* Burtraw et al., *supra* note 39, at 74–75. At the same time, unlike a traditional standard that imposes the same requirement on every facility, an averaging approach allows a utility to continue operating an inefficient facility if it is willing to pay the price in emission credits. *See id.* at 75–76.

124 Recognizing that averaging alone does not create incentives for energy efficiency or renewables, the NRDC has proposed an approach that is framed in terms of achieving emissions rate averages but allows utilities to obtain credits from investments in energy efficiency and renewable energy. *See* LASHOF ET AL, *supra* note 4.

incentive to non-fossil fuel alternatives than a traditional requirement that triggered widespread retirements.

3. Cap and Trade

Assuming a sufficiently stringent cap-and-trade program and a robust carbon price, a cap-and-trade program would generate fewer investments in reducing emissions at coal-fired facilities because emissions could be reduced and the cap could be met through less expensive mechanisms.[125] Although it would lead to fewer investments at existing coal-fired power plants, a cap-and-trade program could nonetheless create broader transformative incentives because it encourages alternative investments in low- and no-carbon options.[126]

A cap-and-trade program's transformative potential is dependent upon both the carbon price and the utilities' sensitivity to price changes. Transformative investments will occur only to the extent justified by the carbon price, which is, in turn a function of the cap's stringency in relation to actual energy demand or the presence of a sufficiently robust price floor.[127] As discussed below, existing GHG cap-and-trade programs are struggling to set caps tightly enough to generate a meaningful price signal; careful attention to stringency is necessary to achieve a trading program's transformative potential.

In addition, in the energy sector, transformative incentives can be influenced by the price sensitivity created by state utility regulation.[128] Utilities are less price sensitive where rates are not competitive and they have the authority to pass through costs to consumers. The less price-sensitive, the less the transformative impact of a carbon price.[129] Where utilities are not price-sensitive, greater transformative change may occur

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125 *See* Burtraw et al., *supra* note 39, at 74 (predicting that cap-and-trade programs would be "less effective at achieving improvements in plant performance" because these program achieve emissions reductions through other channels, including switching from coal to natural gas generation).

126 The capacity of market-based programs to generate ongoing transformative incentives is considered one of their trademark benefits. *See e.g.*, Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1349–50 (1985).

127 The more stringent the cap, the greater the demand for and consequent price of allowances. If allowance prices are high, facilities will be willing to make relatively expensive investments like renewable energy or more expensive measures to reduce emissions, to reduce their need for allowances. If allowance prices are low, in contrast, then facilities will purchase allowances rather than investing in long-term emission reduction strategies. If a cap is not sufficiently stringent, then a price floor can serve a similar function by setting a minimum allowance price to help maintain transformative incentives.

128 *See* BURTRAW ET AL., *supra* note 48, at 13.

129 *Id.* (observing that publicly owned utilities appear to have invested less in energy-efficiency measures due to their ability to pass costs onto customers).

through direct requirements like performance standards, demand reduction measures, and renewable portfolio standards.[130]

4. System-Wide Approach with Direct Requirements

Like cap and trade, a system-wide blend of requirements that contemplates reductions through direct energy efficiency, renewables, shifts in dispatch, facility retirements, and investments "inside the fence" would have a broad transformative impact. Moreover, by directly implementing relevant programs rather than relying on the price signals generated by a cap-and-trade program, direct requirements avoid the "lax cap" risk presented by cap-and-trade programs.

Although direct requirements promote transformation consistent with imposed requirements, they could potentially constrain innovation. For example, if a state set facility-specific emission rate standards that dictate particular technologies or approaches, then the standards could decrease innovative potential in comparison with more open-ended reduction requirements that encourage as-yet unexplored mechanisms for achieving reduction goals.

5. Conclusion: Transformative Incentives

On paper, a traditional performance standard approach would not generate strong systemic transformative incentives. In practice, however, if coal-fired power plants respond to the requirements by retiring rather than investing in efficiency improvements, traditional standards could generate significant system-wide transformative incentives to develop alternatives to replace lost supply or reduce demand. Emissions averaging would create incentives to improve emissions rates within the power sector, with more transformative incentives to shift from coal to natural gas if all power plants are in a single category. An emissions rate averaging approach would not, however, create strong transformative incentives to reduce emissions through consumer energy efficiency or renewable energy.[131] A cap-and-trade program would have broader systemic incentive effects than emissions averaging, but its efficacy in creating transformative incentives would depend upon the stringency of the cap and utilities'

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130 RICHARDSON ET AL., *supra* note 16, at 41 (suggesting that performance standards could be more effective at encouraging power plant investments than market signals where utilities are not price sensitive).

131 NRDC has proposed establishing an emissions averaging approach that would allow utilities to obtain credit towards the required emissions rate average through energy efficiency and renewables. *See* LASHOFF, *supra* note 4.

price sensitivity. Direct, system-wide requirements would have a broad transformative impact, with somewhat greater certainty of implementation than cap and trade but also some risk of rigid requirements that hinder innovation.

D. Real Emission Reductions

The choice of regulatory instrument can also impact the relative certainty of achieving actual change, an issue of equal importance to GHG and to co-pollutant reduction goals. Two types of change are at issue: actual reductions in *emissions rates* and actual reductions in *absolute emissions*. As discussed further below, a key variable in the effectiveness of regulatory instruments at achieving either of these goals is the degree to which business-as-usual emissions are more or less than projected.

1. Traditional Emission-Rate Standards and Emissions Averaging

Traditional standards or emissions averaging approaches that require facilities to reduce their emissions rates would, not surprisingly, provide a fairly high degree of certainty that emissions rates from existing power plants will go down. Of course, these results would depend upon effective implementation: EPA would have to come up with the guidelines, states would have to develop plans for implementing them, industry would have to comply, and the states and EPA would have to enforce. However, assuming adequate implementation, at least some degree of reduction in emissions rates would be achieved.

In terms of absolute emission levels, rather than emission rates, the degree of certainty depends upon whether electricity demand is increasing or decreasing. If, for example, an economic recession occurred, then emission rate standards would ensure that emissions would decrease. In contrast, if economic growth were to spark greater demand, then facilities would likely generate more electricity and higher emissions; their improved emission rates would not preclude higher overall emissions. Under conditions of economic growth, therefore, emission rate standards do not prevent increases in absolute emissions.

2. Cap and Trade

Cap-and-trade programs provide less certainty than emission rates standards that emissions rates will, in fact, decrease. A cap-and-trade program's efficacy in reducing emissions rates depends upon the stringency of the cap.[132] If energy demand is less than projected due to unrealistic forecasts, unexpected economic recession, or robust consumer energy efficiency measures, then the cap could be higher than the level of actual emissions. When the cap is above actual emissions, utilities will not need to change emissions, and there will be no incentive to invest in measures that would reduce emission rates.[133] In contrast, if energy demand is robust and the cap is lower than business-as-usual emissions, then facilities would have some incentive to invest in measures to improve emission rates. The likelihood that they would do so would, however, depend upon how the cost of such investments compares with the cost of other emission reduction strategies, including shifting dispatch to less polluting facilities, energy efficiency, and renewables.

The certainty of achieving reductions in absolute emissions, rather than reductions in emissions rates, depends on whether energy demand is decreasing or increasing. If energy demand is less than projected and the cap is higher than actual emissions, then allowances will be available to cover all facility emissions, and they will not only have no incentive to invest in measures to reduce emissions rates, they will also have no incentive to reduce their absolute emissions. This result has occurred in several trading programs, including the early years of Los Angeles' RECLAIM program and the European Union's Emissions Trading Scheme.[134] Cap-and-trade programs can be designed to reduce

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132 *See* Lesley K. McAllister, *The Overallocation Problem in Cap-and-Trade: Moving Toward Stringency*, 34 COLUM. J. ENVTL. L. 395, 396–97 (2009).

133 In Los Angeles' RECLAIM program, a regional cap-and-trade program, actual emissions were less than the cap, *id.* at 411–12, allowances were cheap and plentiful, and power plants did not invest in pollution controls. *See id.* at 419–20. To address the RECLAIM program's failure to incentivize pollution controls, Los Angeles regulators ultimately supplemented the trading program with traditional, direct, retrofit requirements on the area's largest sources because direct requirements provided greater certainty that facilities would adopt controls to reduce emission rates. Lesley K. McAllister, *Beyond Playing "Banker:" The Role of the Regulatory Agency in Emissions Trading*, 59 ADMIN. L. REV. 269, 290 (2007).

134 See McAllister, *supra* note 132, at 419–21 (discussing RECLAIM program's lack of reductions due to inflated cap); *id.* at 411–12 (discussing ETS' lack of reductions due to inflated cap); *see also* LARRY PARKER, CONG. RESEARCH SERV., RL34150, CLIMATE CHANGE: THE EU EMISSIONS TRADING SCHEME (ETS) GETS READY FOR KYOTO 4–6 (2007). The European Commission has decided to address the surplus by holding back some allowances from auction ("backloading") and is considering deeper structural reforms to improve the system. *Climate Action, The EU Emissions Trading System (EU ETS)*, EUROPEAN COMM'N, http://ec.europa.eu/clima/policies/ets/index_en.htm (last visited Feb. 10, 2014).

Actual emissions have also been substantially below the emissions cap in the northeastern states' Regional Greenhouse Gas Initiative (RGGI) program to reduce power plant emissions. *See* ENV'T NORTHEAST, RGGI EMISSION TRADING TRENDS 1 (2011) (observing that actual emissions from participating facilities were fifty-one tons lower than the 188 ton cap). However, the fact the risk of excessive allowances,[135] but "lax caps" that lead to few if any actual emissions reductions remain a significant concern in trading program design.

Conversely, if energy demand grows due to a burgeoning economy, mobile source electrification, or higher air conditioning demand in response to a warmer climate, then the cap in a cap-and-trade program could provide a more certain reduction in actual emissions than a system that imposed emissions rate standards. Emissions rate standards reduce the rate of emissions, but they do not limit aggregate emissions.[136]

3. System-Wide Approach with Direct Requirements

To the degree that a system-wide approach imposes emission-rate standards, either through facility-specific requirements or through an emissions averaging system, it would create a relatively high degree of certainty that emissions rates would go down, regardless of economic conditions. Assuming a system-wide approach has a mass-based target, this approach would also provide a high degree of certainty that absolute emissions would go down notwithstanding higher-than expected demand-growth, since the jurisdiction would be obligated to reach the mass-based target regardless of energy demand. If demand is lower than expected, then the jurisdiction might lessen its requirements because fewer efforts would be needed to meet a mass-based target. Although the target might well be met, it might not represent a significant decrease in actual business-as-usual emissions due to the decreased demand.

4. Conclusion: Real Emission Reductions

Traditional emissions-rate standards and emissions averaging approaches provide greater certainty that emissions *rates* will go down, relative to mass-based approaches like cap and trade. They also provide greater certainty that absolute emissions will go down in contexts where

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that allowances are auctioned (albeit at low prices) created a small carbon price notwithstanding the excess allowances. Moreover, the participating states have agreed to reduce the cap by forty-five percent. *See* Press Release, RGGI Inc., RGGI States Make Major Cuts to Greenhouse Gas Emissions from Power Plants (Jan. 13, 2014) (available at http://www.rggi.org/docs/PressReleases/PR011314_AuctionNotice23.pdf).

135 For example, price floors, implemented through allowance auctions, can restrict allowance supply if the price gets too low. California has adopted this type of price floor. *See* Jean-Philippe Brisson et al., *California's Cap-and-Trade Regulations: Design Elements and Outstanding Issues*, 42 ENV'T. REP. 2908, 2910–11 (2011).

136 *See supra* note 89 and accompanying text.

actual emissions are below projections. In contrast, if actual emissions are higher than projected, then mass-based approaches like cap and trade or direct requirements to meet an absolute emissions target provide greater certainty that absolute emission reductions will be achieved.

E. Reductions from the Power Sector

A key difference between cap and trade and all of the other approaches is whether reductions occur in the regulated sector. Comprehensive cap-and-trade programs that extend beyond the power sector do not guarantee that reductions will occur at power plants. Power plants could buy allowances generated by reductions from other kinds of facilities like refineries. The co–pollutant implications of achieving industrial rather than power sector emission reductions would depend upon the relative co-pollutant intensity of the trading facilities. The offset provisions in most GHG cap-and-trade programs have more significant co-pollutant implications. Offsets could represent emissions reductions achieved through, for example, increased carbon sequestration in forests rather than reduced power generation.[137] The use of offsets limit the electricity sector co-pollutant benefits that would otherwise arise if power plants themselves had to reduce their GHG emissions.[138]

However, for a cap-and-trade program to be consistent with § 111(d), which specifically focuses on emissions in discrete industrial categories—here the power sector—affected entities will likely have to demonstrate minimum reductions from the power sector itself and would not be permitted to rely on non-power sector reductions or offsets to meet the § 111(d) requirement.[139] States could still use cap-and-trade

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[137] California's comprehensive cap-and-trade program allows facilities to show compliance through forest sequestration offsets. *See* California Air Resources Board, *Compliance Offset Program*, CALIFORNIA.GOV (Feb. 20, 2014) http://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm.

[138] *See* PEW CTR. ON GLOBAL CLIMATE CHANGE, GREENHOUSE GAS OFFSETS IN A DOMESTIC CAP-AND-TRADE PROGRAM 3 (2008), *available at* http://www.c2es.org/docUploads/Offsets.pdf.

[139] *See* Litz et al., *supra* note 4, at 19–20 (discussing how multi-sector cap-and-trade programs that allow the use of offsets could be adjusted to comply with § 111(d)); *see also* NATHAN RICHARDSON, INTERNATIONAL GREENHOUSE GAS OFFSETS UNDER THE CLEAN AIR ACT 6–9 (2010), *available at* http://www.rff.org/rff/Documents/RFF-DP-10-24.pdf. Despite the questionable legality of allowing offsets to substitute for electricity sector reductions, some groups have proposed that states be allowed to use offsets to comply with § 111(d) targets. *See* Tiffany Stecker, *Forest Group Asks EPA to Include Offsets in Power Plant Rule*, CLIMATEWIRE (May 14, 2014), *available at*

programs and allow offsets, but the cap-and-trade programs would not automatically fulfill § 111(d) requirements; the states would have to independently demonstrate in their § 111(d) implementation plan that the program is likely to lead to the necessary power sector reductions, and then, in demonstrating ultimate compliance with the standard, would have to show that the reductions occurred. If EPA constrained state cap-and-trade programs in this way, then the co-pollutant benefits of power sector emission reductions would be maintained.

F. Synthesizing the Co-Pollutant Consequences of Each Regulatory Option

The analysis below synthesizes the potential co-pollutant implications of each regulatory option. That assessment demonstrates that the choice of regulatory options is less determinative than how they are implemented.

1. Traditional Emission-Rate Standards

On paper, traditional controls on existing power plants would generate a modest reduction in emissions from the least efficient facilities and tend toward equalizing emission rates within categories. However, the limited options for emissions reductions and high costs would not lead to a very stringent target or (at least on paper) create strong transformative incentives. Traditional emission rate standards would create relatively certain reductions in emissions rates but would not constrain absolute emissions if energy demand increases.

However, because analysts predict that traditional standards will prompt retirements of coal-fired power plants, traditional standards could have more dramatic impacts in practice. Retirements could lead to substantial reductions in GHG and co-pollutant emissions and generate system-wide transformative incentives as utilities seek to make up for the lost supply through the use of renewables and less polluting power plants.

Using an emission rate standard to force facility retirements could, however, present a politically and environmentally risky regulatory strategy. If EPA chooses a traditional approach because of its expectation that it will lead to retirements and thereby achieve deep emission reductions, then it should make that expectation clear or risk charges that it lacks transparency. A direct approach to achieving

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https://pacificforest.org/EE_ClimateWire_140514_ForestgroupasksEPAtoincludeoffsetsinpowerp.html.

emissions reductions would be more straightforward and create less political controversy. Using a traditional emissions-rate standard to indirectly induce facility retirements would also be environmentally risky. If facilities unexpectedly meet the standard rather than retiring,[140] then the reductions and transformative incentives from facility retirements would not, in fact, materialize.

2. Emissions Averaging

Emissions averaging approaches would lead to distributional shifts from less efficient to more efficient facilities, but because facilities could purchase credits it would feature inherent distributional uncertainty. However, because emissions averaging approaches increase the options and lower the cost of reducing emissions, they could lead to a more stringent target than facility-specific traditional standards. The added stringency would be modest if EPA established separate rates for fuel-based subcategories and would be more substantial if EPA created a single category for power plants and set the average accordingly. Averaging within the power sector creates incentives to use more efficient generation within the power sector but does not create strong systemic transformative incentives to invest in energy efficiency or renewables. Averaging creates strong certainty that emissions rates will go down but, like traditional standards, does not ensure that absolute emissions will be reduced in times of increasing demand.

Like direct emissions-rate standards, a strict average could have more dramatic impacts in practice than on paper. If the average is difficult for existing facilities to achieve, notwithstanding the averaging option, then utilities might turn to natural gas and other alternatives rather than making the investments that would be needed to continue operating coal-fired power plants.

3. Cap and Trade

Like emissions averaging, a cap-and-trade program would create incentives for emissions to shift from less efficient to more efficient facilities. Overall, however, distributional results would remain uncertain. To the extent a cap-and-trade program reflects emissions reductions that are achievable throughout the energy system, it has the potential to offer greater overall reductions and better transformative

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140 EPA suggests that measures to improve efficiency are low-cost and easily achievable, *see* PROPOSED CLEAN POWER PLAN , *supra* note 3, at 167-68, suggesting that facility retirements could be less likely than some analysts predict.

incentives than both traditional requirements on individual facilities (at least as such requirements operate in theory) or emissions averaging approaches. Compared to rate-based approaches, cap-and-trade programs offer less certainty that emissions rates and absolute emissions will go down if energy demand is less than anticipated. However, if energy demand increases, the cap provides greater certainty than rate–based approaches that actual emissions will go down.

These benefits will, however, occur only if market-based programs are stringent enough to prompt reductions and generate transformative incentives, and if utilities respond to price signals. Just as a traditional approach could be more transformative in practice than in theory, market-based approaches could be more transformative in theory than in practice.

4. System-Wide Approach with Direct Requirements

To the degree a jurisdiction imposed facility-specific emission rate requirements on facilities, a system-wide approach with direct requirements would tend to equalize emission rates. By considering the full range of emission reduction options throughout the energy sector, a system-wide approach could lead to greater stringency than facility-specific emission rate standards. Direct requirements could, however, be more costly than other measures, a factor that could decrease stringency. By directly requiring changes throughout the energy system, this approach would be transformative. To the degree it specified particular mechanisms, however, it would not encourage innovation. Direct requirements to reduce emission rates would achieve greater certainty that emission rates would go down than in a cap-and-trade approach, and an overarching mass-based target would provide certainty that emissions would go down even if energy demand increased. However, as with cap-and-trade, if energy demand decreases, the mass-based target might create less certainty that the program will drive actual emissions reductions below business-as-usual levels.

III. KEY LESSONS FOR INTEGRATING CO-POLLUTANT CONSIDERATIONS INTO § 111(D) IMPLEMENTATION

The foregoing analysis lays the groundwork for two last tasks. I first provide several general observations about EPA's § 111(d) options and their implications for co-pollutants. Second, I demonstrate how the framework can provide a useful structure for evaluating specific § 111(d) proposals, including state proposals offering a narrow approach and EPA's more ambitious Proposed Clean Power Plan.

A. Four Observations on Regulatory Options and Co-Pollutants

The first observation is that, in the energy context, the assumption that "traditional regulation achieves better co-pollutant results" is misleading. The emission and co-pollutant outcomes of policy options depend on design and implementation details. Although market-based approaches do create the potential for uneven distributional results, direct emissions-rate standards that result in emissions shifts within the electricity sector likewise create some potential for uneven distributional consequences.[141]

Secondly, the assumption that market-based programs are inherently more stringent than direct regulation is also misleading. Market-based programs that include a wider array of more cost-effective options have the potential to set more stringent targets than traditional emissions-rate regulations, but that potential is not always realized.

The third observation is that stringency, not regulatory form, is likely to be the most critical factor for both GHG and co-pollutant reduction potential. EPA's regulatory options differ substantially in their stringency. Ultimately, the wider the options for reducing emissions, the more stringent a target can be set. Thus, EPA's consideration of system-wide emissions reduction opportunities in setting the emissions standard will be critical to achieving a stringent program that achieves substantial reductions, creates transformative incentives, and achieves real reductions in both emissions rates and business-as-usual absolute emissions. Having a system-wide approach and establishing robust expectations for the use of available mechanisms are more important than whether the standard is met through direct system-wide requirements, some form of trading program, or a combination of the two.

The fourth observation is that given the higher GHG and co-pollutant intensity of coal-fired power, significant reductions in both will require a shift away from coal-fired power to less polluting sources. That transition will not be easy given the intense economic dependence on coal in certain regions of the country.[142] Nonetheless, from both a GHG

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141 The integrated nature of the energy sector and the variations in emissions rates among coal-fired power plants create much more of a risk of distributional shifts in the energy sector than in other industries. In the industrial production contexts, where production decisions are less fluid and variations in emissions rates are less dramatic, direct emission-rate regulation would have more even distributional effects.

142 *See* Sussman, *supra* note 4, at 102, 133 (discussing importance and difficulty of shifting electricity generation away from coal-fired power); WV DEP'T OF ENVTL. PROT., *supra* note 68, at 3–5 (describing importance of coal to many parts of the nation and to West Virginia).

and co-pollutant perspective, continued reliance on coal-fired power and a failure to create requirements or incentives away from coal-fired power will fail to achieve critical global, national, and local benefits.

B. Applying the Framework

1. A Narrow Proposal

Some advocates, particularly from coal-dependent states, have suggested setting the reduction target based solely upon "inside-the-fence" source-specific opportunities. They then suggest that states have the option of converting that emissions-rate target into a mass-based limit and that they then be allowed to use a system-wide approach offering multiple compliance options to meet the target.[143] That approach is appealing to many states because it would reduce the cost of achieving the target and allow states to maintain their use of coal-fired power without costly efficiency investments or retirements.[144] From a GHG and co-pollutant perspective, however, the approach has drawbacks.

As a legal matter, some have argued that whatever mechanisms are available to reduce emissions must be considered in the calculation of the target because such mechanisms are part of the "best system of emission reduction" on which the target is to be based; a target that does not reflect such mechanisms fails to reflect the "best system."[145] In a recent white paper from Harvard Law School, Konschnik and Peskoe refer to this as the "symmetry principle:" all mechanisms that are available to achieve compliance should also be included in determining the level of achievable stringency.[146]

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143 KONSCHNIK & PESKOE, *supra* note 4, at 2 (describing position); WV DEP'T OF ENVTL. PROT., *supra* note 68 (suggesting that EPA's guidelines should be set by reference to "inside-the-fence" measures (at 10), converted to a mass-based level, and that states could meet the standards through a range of compliance mechanisms, including "outside-the-fence" measures (at 14)); *see also* Jean Chemnick, *States Make Closing Arguments on Existing Power Plant Rule*, GREENWIRE (May 6, 2014), http://www.eenews.net/gw/2014/05/06 (describing Kansas proposal that EPA base its emission reduction target on source-specific mechanisms but then give states "flexibility in implementing the standards to help reduce compliance costs") (quoting comments submitted to EPA by Kansas officials).

144 *See* WV DEP'T OF ENVTL. PROT., *supra* 68.

145 *See* KONSCHNIK & PESKOE, *supra* note 4, at 5–6; Chemnick, *supra* note 143 (describing environmentalists' view that, legally, "the standard should fit the tools states can use to meet it"). David Doniger, of the NRDC, describes this proposal as follows, "'That's like I get to have my handicap determined on a round of golf I play with one club, but then when I actually play golf I get to play with all the clubs I have in the bag." KONSCHNIK & PESKOE, *supra* note 4, at 6.

146 *See id.* at 5–6.

An approach that set the standard based only upon source-specific changes but then allowed a broader range of compliance options would not only fail to realize available GHG reduction potential, it would also fail to achieve available co-pollutant benefits, particularly if states are permitted to meet the standard through flexible trading mechanisms. From a distributional perspective, that approach would not offer the benefits of source-specific regulation. Unlike direct emission-rate requirements, a trading approach is less likely to lead heavily-polluting facilities to decrease emissions through retirement and less likely to trigger source-specific improvements.

That consequence—the possibility that existing and coal-fired power plants would continue operating without additional efficiency measures—might be acceptable if compensated for by a significantly larger and more transformative increase in stringency, but this narrow proposal fails to offer any corresponding increase in stringency. Because the target is based only upon source-specific changes and not the much broader array of available mechanisms, it would not be as stringent as a system-wide approach to setting the target, thereby reducing the potential for both GHG and co-pollutant reductions.

In addition, by basing the standard only on reductions achievable at existing power plants and not considering larger systemic changes, the target would provide much less of an incentive for transformative changes in the energy sector. A trading approach would provide some incentive for alternatives like energy efficiency, renewable energy, and other non-site specific innovations relative to source-specific emission-rate modifications, but that incentive will be much smaller if based upon a weak target. A more stringent target that reflected system-side opportunities would, in turn, be more likely to incentivize the transformative changes upon which it is based.

Finally, the proposed approach creates the risk of a "lax" cap that fails to trigger emissions reductions below business as usual. If the target is based upon emissions reductions at existing power plants that are a few percentage points below current emissions and then allows states to meet that target through alternative mechanisms, the target might be met as a result of current market forces that are already decreasing emissions independent of the § 111(d) rule. Analysts predict that these external forces, including shifts to natural gas as a result of low natural gas prices and retirements of coal-fired power plants due to a plethora of environmental regulations, will reduce emissions by five to seven percent below 2012 levels by 2020.[147] To make a difference, § 111(d) should prompt real reductions that go beyond business-as-usual trends.

2. EPA's Proposed § 111(d) Rule

a. Overview

EPA's Proposed Clean Power Plan presents a much broader and more ambitious approach. It establishes state-specific carbon intensity targets, including interim targets that states must meet over a 2020-29 timeframe and final state targets for 2030.[148] Cumulatively, EPA anticipates that the state-specific targets, aggregated together and converted into mass emissions, would achieve a thirty percent reduction relative to 2005 emissions.[149] EPA developed the state targets by considering each state's system-wide emission-reduction opportunities, including both inside-the-fence and outside-the-fence measures.[150] EPA concluded that a system-wide approach was consistent with the Clean Air Act's directive to base the emission guidelines on the "best system of emission reduction" available.[151]

The system-wide approach encompasses four "building blocks." The first is on-site emission rate improvements for coal-fired power plants.[152] Based on its evaluation of the nation's fleet, EPA determined that existing power plants could, on average, reduce carbon emissions by six percent and so presumes in calculating state targets that the coal-fired power plants in each state could reduce emissions by six percent.[153] The second building block includes shifts in dispatch from coal-fired power plants to natural gas plants. EPA evaluated natural gas plant capacity in each state and assumed that existing natural gas plants, many of which are underutilized, could be run at seventy percent capacity.[154] The third building block consists of maintaining or developing zero-carbon alternatives by avoiding nuclear retirements and promoting

147 *See* Sussman, *supra* note 4, at 125.

148 PROPOSED CLEAN POWER PLAN, *supra* note 3, at 40–41.

149 *Id.* at 14.

150 *Id.* at 113.

151 *Id.* at 119–22.

152 EPA did not include potential reductions from natural gas and oil-fired power plants, and seeks comment on whether BSER should include such reductions. *Id.* at 170 n.123, 142 n. 95.

153 PROPOSED CLEAN POWER PLAN, *supra* note 3, at 114; *see also id.* at 141–46 (discussing how EPA calculated the available on-site reduction opportunities).

154 *Id.* at 114; *see also id.* at 146–50 (discussing how EPA calculated the degree to which states could shift dispatch to natural-gas fired facilities).

renewables.[155] To determine the potential for renewable energy in each state, EPA evaluated the renewable portfolio standards within each region to determine perceived achievable levels.[156] The fourth building block identifies energy efficiency opportunities and presumes that every state could generate annual energy efficiency savings of 1.5 percent by 2020-29.[157] Although EPA based each state's target on the application of these four building blocks, EPA does not require states to take the measures used to calculate their targets if they can demonstrate compliance with the target through different combinations of measures.[158] States could, for example, choose to improve emissions rates at existing facilities by more than six percent and rely less on other measures. Or they could rely more on energy efficiency or renewables and invest less in facility efficiency improvements.

Because source-specific efficiency upgrades and shifts from coal to natural gas would affect existing fleets' average emission rates, while renewable energy and energy efficiency would affect absolute emissions rather than emission rates, EPA's state targets convert the expected contribution from renewable energy and energy efficiency into an overall carbon intensity standard for the state's existing EGUs.[159] However, states can choose to convert EPA's state-specific carbon intensity targets into mass-based targets, potentially a preferable option for states with cap-and-trade programs or that otherwise choose to set absolute emissions reduction targets.[160]

Because EPA evaluated emission reduction opportunities in each state individually, the state-specific targets vary dramatically.[161] States with high levels of existing coal-fired power and low existing natural gas capacity start out with a much higher carbon intensity than other states and have less capacity, under building block 3, to shift from coal to natural gas. Their targets therefore set a much higher carbon intensity goal than is set for a state that already has a low carbon intensity and that may have greater opportunities to shift to existing natural gas plants or renewables. Thus, West Virginia, reliant on coal and with little

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155 *Id.* at 114; *see also id.* at 151–52 (describing the promotion of zero-emission energy in more detail).

156 *Id.* at 114.

157 PROPOSED CLEAN POWER PLAN, *supra* note 3, at 114.

158 *Id.* at 355-56.

159 *See supra* note 62 and accompanying text (describing calculation of carbon intensity standard).

160 PROPOSED CLEAN AIR PLAN, *supra* note 3, at 340.

161 *See id.* at 346-48 tbl. 8 (listing interim and final state goals expressed in adjusted output-weighted average pounds of CO_2 per Net MWh).

natural gas capacity, has a 2030 carbon intensity target of 1,620 average pounds of carbon per net MWh, while California, starting from a much lower carbon intensity and with a different array of available opportunities, has a 2030 carbon intensity target of 537 average pounds of carbon per net MWh.[162] In evaluating what states could achieve, EPA also took states' existing initiatives into account so that "early actors" that have already taken steps to reduce carbon emissions would not face as demanding a reduction requirement as states that have not yet initiated carbon-reduction measures.[163]

b. Evaluating the Proposed § 111(d) Rule

As a threshold matter, it is worth noting that EPA has touted the co-pollutant benefits of the Proposed Clean Power Plan, demonstrating EPA's recognition of the salience of co-pollutant impacts. Fact sheets accompanying the rule emphasize not only its carbon reduction benefits but the extent and value of co-pollutant reductions as well.[164] A significant proportion of the quantifiable monetary benefits for the rule derive from its co-pollutant benefits, which are estimated at $23-62 billion by 2030, relative to climate benefits estimated at $30 billion by 2030.[165] While the central goal is carbon reductions, the policy's co-pollutant benefits provide important environmental, political, and economic justifications for the agency's approach.

Distributional Effects

Because EPA has provided states with substantial flexibility, the distributional impacts of EPA's proposed rule are uncertain. Nonetheless, a few observations are possible. The carbon intensity standard increases the likelihood that emissions will shift away from high-emitting and co-pollutant intensive coal-fired power plants and increase at natural gas plants.[166] That would provide co-pollutant benefits near existing coal-fired power plants.[167] Although emissions would increase at some natural gas plants, they are less intensive than

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162 *Id.*

163 *Id.* at 333.

164 *See, e.g.*, EPA FACT SHEET, *supra* note 78 (devoting significant attention to co-pollutant benefits, including reductions in particle and ozone pollution).

165 PROPOSED POWER PLANT RULE, *supra* note 3, at 57–58 tbl. 2. The co-pollutant benefits depend upon how states choose to implement their plans (regional versus state-specific), on discount rates (3 versus 7 percent), and on other variables. *Id.* Many co-benefits are unquantifiable, including reductions in sulfur dioxide, nitrogen oxides, toxics (including mercury), as well as ecosystem and visibility impacts. *Id.*

166 *Id.* at 279, 602.

167 *Id.* at 599–600.

coal-fired emissions. EPA does acknowledge, however, that high concentrations of fine particulates, nitrogen oxides, and ozone could become more frequent near some natural gas plants.[168] If states were to replace coal-fired power with demand-side energy efficiency and renewables, then emissions would not simply shift but be eliminated.

Although the Proposed Clean Power Plan incentivizes shifts away from co-pollutant-intense coal, it does not require such shifts, and states could—and are expected to—continue to rely upon coal-fired power.[169] EPA Administrator Gina McCarthy explained that EPA anticipates that coal-fired power will still provide thirty percent of the nation's electricity supply, down from its current level of thirty-seven percent.[170] Thus, the shifts in emissions from coal-fired power are marked but not dramatic. In addition, source-specific retrofits that enhance the efficiency of coal-fired power plants could have a "rebound" affect as utilities operate the newly efficient plants more heavily, increasing rather than decreasing localized emissions from some coal-fired power plants.[171]

Magnitude of Emissions Reductions

One of the biggest unanswered questions about the rule is the stringency of the emission reduction targets. EPA's system-wide approach provides a wide breadth of measures that could justify significant reductions. And EPA's flexibility allows states to choose the lowest cost options, again increasing the viability of a stringent target. However, based upon a preliminary review, a number of features raise questions about stringency.[172] EPA makes explicit that the targets do not reflect the maximum possible performance under each building block; instead, they represent "reasonable" implementation of each.[173] States do not have to implement all possible measures, and if they do less

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168 *Id.* at 602.

169 PROPOSED POWER PLANT RULE, *supra* note 3, at 377 (stating that "[t]he agency also anticipates – and supports – states' commitments to a wide range of policy preferences that could encompass those of states like Kentucky, West Virginia and Wyoming seeking to continue to feature significant reliance on coal-based generation").

170 Alan Greenblatt, *EPA Chief Says Greenhouse Gas Rules Will Save Country Billions*, NAT'L PUBLIC RADIO (June 2, 2014), http://www.npr.org/blogs/thetwo-way/2014/06/02/318259180/epa-chief-claims-greenhouse-gas-rules-will-save-country-billions.

171 PROPOSED CLEAN POWER PLAN, *supra* note 3, at 156, 600–601. If the efficiency upgrades trigger large enough co-pollutant emissions increases, then they will trigger New Source Review requirements for the increased emissions, mitigating (although not eliminating) the impact of increased emissions. *Id.* at 601.

172 *See generally Clean Air Task Force's Schneider Says EPA Emissions Rule Should Be Strengthened*, E&E NEWS PM (June 9, 2014).

173 PROPOSED CLEAN POWER PLAN, *supra* note 3, at 335.

under one building block they can easily increase their use of another.[174] Although EPA is not compelled to require states to implement every building block to the maximum possible extent, a key question requiring further study is whether higher expectations under one or more building blocks are viable and warranted.

More specific questions arise in connection with individual building blocks. For example, under the first building block, which addresses site-specific emission reduction opportunities, EPA does not include a number of measures that could reduce on-site emissions, such as co-firing with biomass or natural gas.[175] Under "renewable energy," it is not clear that relying on regional renewable portfolio standards already adopted by nearby states represents what is achievable; some regions may be slow to explore existing and achievable opportunities. Improvements to the transmission grid, which could reduce electricity leakage, are not included.[176] Thus, while EPA took the critical step of adopting a system-wide approach and basing the targets on a wide range of emission reduction mechanisms, it is possible that including a wider range of measures could have generated a more stringent standard.[177]

Another potential stringency issue is raised by the duration of the standard, the final step of which must be met in 2030. Even if the standard is determined to be reasonably stringent based on currently available opportunities, it does not appear to provide a mechanism for enhancing stringency if low- and non-carbon opportunities emerge in the future. For example, if new storage mechanisms allow wind and solar to provide more dependable baseload power, or energy efficiency measures prove even more inexpensive and effective than predicted, the rule could fail to require the "best available" mechanisms for reducing emissions as they emerge in the 2020s.

<u>*Transformative Incentives*</u>

In terms of transformative incentives, the rule's adoption of a system-wide approach enables transformative change in a way that requirements focused only on source-specific improvements would not. Nonetheless, as discussed above, stringency is critical to transformative potential, and if the targets are not sufficiently stringent then they will

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174 *Id.* at 335.

175 *See id.* at 501–03.

176 *See id.* at 559.

177 Moreover, because EPA acknowledges that states could meet their targets through these un-included measures, EPA's approach could fail to conform to the "symmetry principle" articulated by Konschnik and Pescoe, who suggest that the compliance opportunities should match the mechanisms used to establish the target. *See supra* note 156 and accompanying text.

not lead to significant shifts to a lower-carbon energy system.[178] EPA's prediction that coal-fired power will retain a strong role, noted above in terms of its distributional implications, suggests that the rule's transformative potential may be somewhat more limited than its potential.

Real v. Paper Reductions

The proposed rule creates certain flexibilities that could potentially implicate whether real reductions occur. The provision allowing states to translate the emissions-rate target into a mass-based target gives states helpful flexibility to translate the target into a mass-based emission limit that would work well with measures that impact absolute emissions, like cap-and-trade programs, renewable energy, and demand-side energy efficiency. At the same time, however, it is possible that a state could game the targets to choose the one that best matches its economic objectives. A state that anticipates economic growth might prefer emissions rate targets that do not constrain absolute emissions, while a state that anticipates declining demand might choose a mass-based target that could be met with little or no effort. The proposed rule requires states to justify their conversion to a mass-based standard,[179] but the risk remains. In addition, EPA has indicated that states can switch from a mass-based goal to a rate-based goal for the final 2030 target.[180] That flexibility appears to reflect the recognition that economic growth and associated energy demand might impede a state's capacity to meet a mass-based standard even if it had improved emission rates.[181] At the same time, however, the flexibility to relinquish a mass-based goal would defeat the advantage of mass-based goals: that they provide a firmer constraint on increases in absolute emissions than rate-based systems.

Reductions in the Regulated Energy Sector

The Proposed Clean Power Plan appears to require that reductions occur within the regulated energy sector. EPA's rule recognizes that states might use multi-sector GHG cap-and-trade programs to fulfill their § 111(d) obligations and that those programs could allow the use

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178 *See supra* note 127 and accompanying text.

179 *See* PROPOSED CLEAN POWER PLAN, *supra* note 3, at 496–97 (observing that states must justify how they anticipate translating an emissions-rate standard into a mass-based goal and noting that the "credibility of state plans will depend upon having consistent and credible emission performance projections").

180 *Id.* at 423.

181 *See id.*

of out-of-sector allowances offsets.[182] Nonetheless, EPA appears to require that state § 111(d) plans with trading programs demonstrate how they will lead to actual energy sector reductions.[183] Thus, individual state or multi-state cap-and-trade programs would not automatically fulfill § 111(d) requirements; the state or states would have to demonstrate the programs likely and ultimate impact on energy sector emissions.

IV. CONCLUSION

Although much of the attention on the advantages and disadvantages of GHG policies for co-pollutant emissions has focused on distributional impacts, this essay reveals that assessments of ancillary co-pollutant benefits depend upon a wider range of variables, including stringency, transformative potential, and relative certainty that reductions in emissions rates and absolute emission levels will be achieved. The analysis also reveals that no single regulatory option inherently improves co-pollutant outcomes. A great deal depends upon how each option is implemented and on each option's real-world impacts (as distinguished from its intended impacts). Although distributional impacts remain important, co-pollutant benefits from energy sector controls will ultimately be driven by stringency and the ability to trigger fundamental energy transformations away from co-pollutant intensive-coal to natural gas, renewables, and energy efficiency. EPA's Proposed Clean Power Plan establishes a system-wide framework that contains the building blocks for meaningful GHG and co-pollutant emissions reductions. What remains to be seen is whether the agency has used the framework to generate targets that are stringent enough to promote a transformative path toward a low-carbon future.

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182 *See id.* at 498–99 (describing numerous variables in trading that could complicate assessments of actual energy sector impacts).

183 In connection with offsets, EPA states that it "is not proposing that out-of-sector GHG offsets could be applied to demonstrate CO_2 emission performance by affected EGUs in a state plan." *Id.* at 429. EPA makes clear that states can adopt trading programs that permit offsets, but that the states will nonetheless have to demonstrate that the program as a whole "achieve[s] the required level of emission performance for affected EGUs." *Id*; *see also* Megan Herzog, *Part III: EPA's Proposed 111(d) Rule: Some Insights and Open Legal Questions*, LEGAL PLANET BLOG (June 6, 2014), http://legal-planet.org/2014/06/06/part-iii-epas-proposed-111d-rule-some-insights-open-legal-questions/.