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EPA Standards for Greenhouse Gas Emissions from New Power Plants

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November 15, 2013

Congressional Research Service
7-....
www.crs.gov
R43127

CRS REPORT
Prepared for Members and
Committees of Congress

Summary

As President Obama announced initiatives addressing climate change on June 25, 2013, a major focus of attention was the prospect of greenhouse gas (GHG) emission standards for fossil-fueled—mostly coal-fired—electric generating units (EGUs). EGUs (more commonly referred to as power plants) are the largest anthropogenic source of greenhouse gas emissions, accounting for about one-third of total U.S. GHGs. If the country is going to reduce its GHG emissions by significant amounts, as the President has committed to do, emissions from these sources will almost certainly need to be controlled.

The President addressed this issue by directing EPA to re-propose GHG emission standards for new EGUs by September 20, 2013. He also directed the agency to propose guidelines for existing power plants by June 2014, and finalize them a year later.

EPA had already proposed standards for new sources in April 2012, but the public comment period had generated more than 2.5 million comments—the most ever for a proposed EPA rule—and the agency had not yet finalized the rule.

The re-proposed standards were released September 20. They would set an emissions limit of 1,100 pounds of carbon dioxide (CO_2) per megawatt-hour (MWh) of electricity generated by new coal-fired EGUs, and a standard of either 1,000 or 1,100 lbs/MWh (depending on size) for new natural gas-fired plants. Coal-fired plants would find it impossible to meet the standard without controls to capture, compress, and store underground about 40% of the CO_2 they produce—a technology referred to as carbon capture and storage (CCS).

Under the Clean Air Act, the EPA Administrator has a great deal of flexibility in setting these standards. The statute requires that New Source Performance Standards (NSPS) reflect the degree of emission limitation achievable through application of the best system of emission reduction that has been "adequately demonstrated." The Administrator can take costs, health impacts, environmental impacts, and energy requirements into account in determining what has been adequately demonstrated.

Many in the electric power and coal industries maintain that CCS has not been adequately demonstrated. Given the high cost and energy use of CCS components, they view the re-proposed standards as effectively prohibiting the construction of new coal-fired power plants.

EPA, on the other hand, states that the components of CCS technology have been demonstrated on numerous facilities. Details are provided in the preamble to the proposed rule. Despite this, the agency concludes that no coal-fired EGUs (other than DOE-sponsored or other demonstration projects) will be built in the next 10 years regardless of whether the rule is finalized, and therefore no units will be required to use CCS before EPA must review the standard. Given the projected low cost and abundance of natural gas, all new fossil-fueled units are likely to be powered by gas, according to EPA. The standard proposed for these facilities (combined cycle natural gas units) can be met without add-on emission controls, according to the agency.

Although the September 20 proposal would only affect new EGUs, the potential impacts of the rule's issuance extend beyond these sources, because the agency is obligated under Section 111(d) of the Clean Air Act to promulgate guidelines for *existing* sources within a category when it promulgates GHG standards for *new* sources. The President directed EPA to propose such guidelines by June 2014 and to finalize them a year later. Using these guidelines, states will be

required to develop performance standards for existing sources. These could be less stringent than the NSPS—taking into account, among other factors, the remaining useful life of the existing source—but the standards could have far greater impact than the NSPS, given that they will affect all existing sources.

Many in Congress oppose GHG emission standards. In the 113th Congress, hearings have been held and several bills to prohibit or limit EPA GHG standards have been introduced. The proposed standards have stirred new interest in congressional action.

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Introduction

Since 2009, the Environmental Protection Agency (EPA) has begun to address emissions of greenhouse gases (GHGs)[1] from both mobile and stationary sources, using broad regulatory authority provided by Congress decades ago in the Clean Air Act. Although Congress has never specifically directed EPA to regulate emissions of GHGs, the Clean Air Act as enacted in 1970 and as amended in 1977 and 1990 gave the agency authority to identify air pollutants and promulgate regulations to limit their emission.

From the late 1990s until 2007, EPA and various interested parties debated whether that authority covered greenhouse gases. This debate was settled by the Supreme Court in April 2007, in *Massachusetts v. EPA*. In a 5-4 decision, the Court found that greenhouse gases are unambiguously air pollutants:

> The Clean Air Act's sweeping definition of 'air pollutant' includes '*any* air pollution agent or combination of such agents, including *any* physical, chemical ... substance or matter which is emitted into or otherwise enters the ambient air... (emphasis added). ... Carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons are without a doubt 'physical [and] chemical ... substances[s] which [are] emitted into ... the ambient air.' The statute is unambiguous.[2]

Since the Court's *Massachusetts* decision, EPA has addressed GHG emissions in a number of steps, among them:

- In December 2009, the agency laid the groundwork for regulations by finding that emissions of greenhouse gases may reasonably be anticipated to endanger public health and welfare, and that GHGs from new motor vehicles cause or contribute to that endangerment.
- In May 2010, the agency promulgated GHG emission standards for model year 2012-2016 cars and light trucks.
- In January 2011, the agency began requiring permits and the imposition of Best Available Control Technology on new stationary sources (and major modifications of existing sources) that emit more than a threshold amount of GHGs.
- In September 2011, EPA promulgated GHG emission standards for model year 2014-2018 medium- and heavy-duty trucks.
- In October 2012, the agency promulgated a second phase of GHG emission standards for cars and light trucks, covering model years 2017-2025.[3]

[1] Six greenhouse gases, or groups of gases, are addressed by EPA regulatory actions: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). Of these, carbon dioxide, produced by combustion of fossil fuels, is by far the most prevalent, accounting for 85% of annual emissions of the combined group when measured as CO_2 equivalents.

[2] Massachusetts v. EPA, 549 U.S. 497, 529 (2007). For additional discussion, see CRS Report RS22665, *The Supreme Court's Climate Change Decision: Massachusetts v. EPA*, by (name redacted).

[3] For a more complete listing of the actions EPA and other agencies have taken in the wake of the Court's *Massachusetts* decision, see CRS Report R41103, *Federal Agency Actions Following the Supreme Court's Climate Change Decision in* Massachusetts v. EPA*: A Chronology*, by (name redacted).

As extensive as these actions may seem, they have had relatively minor impacts on GHG emissions to date. The rules are prospective, and in most cases have not yet taken effect.

The auto and truck manufacturing industries have been the major focus of the GHG regulations; in both cases, they are eager to improve fuel economy (coincidentally reducing GHG emissions), because the high cost of fuel has affected consumer purchasing decisions over the last five years.

The stationary source permitting requirement has yet to affect most sources. As of early September 2013, EPA and the states have issued only 110 GHG permits to stationary sources since the requirement was implemented in January 2011. (For comparison, EPA estimates that there are more than 6 million stationary sources.) EPA set the emission threshold for requiring permits at a high level, exempting most new sources of GHGs; and few new facilities have been constructed in the recession's aftermath.[4]

Ultimately, if EPA is to reduce the nation's GHG emissions, as the President has committed to do, it will have to issue emission standards for broad categories of existing stationary sources. EPA took the first step toward setting such standards on April 13, 2012, with the proposal of standards for new electric generating units (EGUs). In a June 25, 2013, memorandum to the EPA Administrator, the President directed the agency to re-propose those standards by September 20, 2013, finalize them "in a timely fashion after considering all public comments," and propose guidelines for existing EGUs by June 1, 2014.[5] The re-proposed standards for new sources were announced on September 20, 2013.[6]

As shown in **Table 1**, EGUs—principally, coal-fired power plants—are the most significant U.S. source of greenhouse gases, accounting for about one-third of the nation's total emissions. With the principal mobile source categories already subject to GHG regulations, EPA will have addressed the sources of more than half of all U.S. emissions once it promulgates regulations for existing EGUs.

New Source Performance Standards (NSPS)

To control GHG emissions from stationary sources, EPA intends to use Section 111 of the Clean Air Act, which requires the agency to set New Source Performance Standards (NSPS) when, in the Administrator's judgment, a category of sources causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare. As noted, EPA proposed the first such NSPS/GHG standard, for electric generating units, on April 13, 2012,

[4] The number of permits was provided in a personal communication from EPA's Office of Air Quality Planning and Standards on September 18, 2013. At a House Energy and Commerce hearing on June 29, 2012, EPA Assistant Administrator Gina McCarthy stated that EPA and the states had issued 44 permits for greenhouse gas emissions. Previously, in a March 2012 *Federal Register* notice, the agency stated that EPA and state permitting authorities had issued 18 permits and had received an additional 50 permit applications. See U.S. EPA, "Prevention of Significant Deterioration and Title Five Greenhouse Gas Tailoring Rule Step 3, GHG Plantwide Applicability Limitations and GHG Synthetic Minor Limitations," 77 *Federal Register* 14233, March 8, 2012.

[5] Office of the Press Secretary, The White House, "Power Sector Carbon Pollution Standards," Memorandum for the Administrator of the Environmental Protection Agency, June 25, 2013, at http://www.whitehouse.gov/the-press-office/2013/06/25/presidential-memorandum-power-sector-carbon-pollution-standards.

[6] A pre-publication copy of the proposal, as well as background information, can be found on EPA's website at http://www2.epa.gov/carbon-pollution-standards/2013-proposed-carbon-pollution-standard-new-power-plants.

and following extensive public comment, at the President's direction, re-proposed the standard on September 20, 2013. The agency has also committed to the promulgation of NSPS for petroleum refineries, although it is unclear when those standards will be proposed.[7]

Table 1. U.S. Greenhouse Gas Emissions, 2010, by Source Category

(in million tons of CO_2 equivalent)

Source	2010 Emissions	% of Total U.S. GHG Emissions
Electricity Generation	2306	34%
—Coal-fired	1840	27%
—Natural gas fired	405	6%
—Oil-fired	31	<1%
Transportation	1834	27%
—Passenger cars	769	11%
—Light-duty trucks	320	5%
—Medium and heavy duty trucks	390	6%
—Aircraft[a]	144	2%
Industry[b]	1394	20%
Agriculture	495	7%
Commercial	382	6%
Residential	365	5%

Source: U.S. EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010,* April 15, 2012.

a. Excludes international use of aviation fuel, which would add another 1% (72 million tons).

b. Numerous industries, including iron and steel production, petroleum refining, cement kilns, and others.

Under Section 111, the EPA Administrator is required to set standards for categories of new (or substantially modified) major sources if, in her judgment, they cause or contribute significantly to air pollution which may reasonably be anticipated to endanger public health or welfare.[8] Over the past four decades, EPA Administrators have used this authority to set emission standards for numerous sources of conventional pollutants, such as sulfur dioxide or nitrogen oxides. The standards are to reflect the degree of emission limitation achievable through application of the

[7] On December 23, 2010, EPA announced that it was settling a lawsuit filed by 11 states, two municipalities, and three environmental groups over its 2008 decision not to establish New Source Performance Standards for GHG emissions from petroleum refineries. According to the agency, refineries are the second-largest direct stationary source of GHGs in the United States and there are cost-effective strategies for reducing these emissions. The agency agreed to propose NSPS for new refinery facilities and emissions guidelines for existing facilities by December 10, 2011, and to make a final decision on the proposed actions by November 10, 2012. As of this writing (September 2013), the standards and guidelines had not been proposed.

[8] The language is similar to the endangerment and cause-or-contribute findings EPA promulgated for motor vehicles on December 15, 2009 ("Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act," 74 *Federal Register* 66496).

best "adequately demonstrated" system of emission reduction. The Administrator can take costs, health impacts, environmental impacts, and energy requirements into account in setting the standards; she can distinguish among classes, types, and sizes of sources; and she must review the standards at least every eight years.

Regulating Existing Sources Under Section 111

In addition to standards for new sources, Section 111 requires that EPA develop guidelines applicable to GHG emissions from *existing* units whenever it promulgates GHG standards for new sources in a category (Section 111(d)). Using the guidelines, states would be required to develop performance standards for existing sources. These standards could be less stringent than the NSPS, taking into account, among other factors, the remaining useful life of the existing source to which the standard applies. Nevertheless, these standards might have far greater impact than the NSPS, given that existing power plants are the largest U.S. source of GHG emissions.

The authority to control existing sources is particularly important in sectors like the electric utility industry, where old units can continue operating for decades. The average coal-fired power plant in the United States is more than 40 years old. Without the authority to control emissions from such existing facilities, it could be decades before emissions from most power plants would be controlled.

How quickly Section 111(d) standards will be applied to existing sources has been an open question, however. EPA must first propose and promulgate guidelines, following which the states will be given time to develop implementation plans. In the President's June 25 memorandum, he requested that EPA:

> (i) issue proposed guidelines for modified, reconstructed, and existing power plants by no later than June 1, 2014;
>
> (ii) issue final guidelines by no later than June 1, 2015; and
>
> (iii) include in the guidelines addressing existing power plants a requirement that states submit to EPA the implementation plans required under section 111(d) of the Clean Air Act by no later than June 30, 2016.

Following approval of the plans, the act envisions case-by-case determinations of emission limits. Thus, it is likely to be several years before existing power plants or other stationary sources are subject to emission limits for GHGs.

EPA's NSPS Proposals for EGU Greenhouse Gas Emissions

As noted, the President directed EPA in his June 25 memorandum to re-propose the NSPS standards for power plant carbon pollution. To understand what issues the agency has addressed in the re-proposed standards, this report discusses both the 2012 proposal and the September 2013 re-proposal.

Emission Limits[9]

The re-proposed standard would set a limit of 1,100 pounds of carbon dioxide (CO_2) per megawatt-hour (MWh) of electricity generated for coal-fired EGUs, and a standard of 1,000 or 1,100 lbs/MWh (depending on the size of the unit) for new natural gas-fired plants. The standard is to be measured on a gross output basis;[10] it requires reduction of emissions whether the electricity is used on site (e.g., for the operation of pollution control equipment) or is sold to customers.

The standards can be met by new natural gas combined cycle plants without add-on emission controls. Coal-fired plants, however, would find it impossible to meet the 1,100 lb. standard without controls to capture and store some of the CO_2 they produce. EPA estimates that a supercritical pulverized coal-fired power plant without such controls produces roughly 1,800 lbs. CO_2 /MWh of electricity, so a plant subject to the standard would need to reduce emissions by about 40%.

Carbon capture and storage (CCS) technology that might be used to reduce CO_2 emissions has been the subject of much recent research and demonstration.[11] It poses a number of challenges, not the least of which is the additional energy it consumes. The energy required to run equipment that can remove CO_2 from an emission stream (referred to as the "parasitic load") is currently in the range of 30% on most demonstration projects. In addition, a CCS-equipped unit might incur costs for underground storage of the captured CO_2 (unless it is used for enhanced oil recovery) and possibly significant costs for building and operating a pipeline to transport the CO_2 to the storage location.

To address the concerns of those who maintain that CCS technology is not yet available, or who expect the technology to improve (bringing down costs) as research and demonstration continue, the agency's 2012 proposal included an alternative under which coal-fired facilities would have been allowed to average their emissions over a 30-year period: during the first 10 years, such facilities could have emitted up to 1,800 lbs. CO_2 /MWh; the facility would then have needed to reduce emissions to 600 lbs/MWh for the following 20 years. This option is not included in the September 2013 re-proposal, but the proposal does include two optional compliance periods. Compliance can be measured using a rolling average of emissions for 12-month periods or it can be measured using the rolling average for 84-month periods. If the facility chooses the longer compliance measurement period, it would gain flexibility to exceed the proposed standard over longer periods of time, but it would need to meet a lower standard overall: EPA has proposed

[9] It generally takes several weeks after the EPA Administrator signs a proposed or final rule before the official version appears in the *Federal Register*. In the meantime, a pre-publication copy of the proposal, as well as background information, can be found on EPA's website at http://www2.epa.gov/carbon-pollution-standards/2013-proposed-carbon-pollution-standard-new-power-plants. Hereinafter, the proposal is referred to as the "Re-Proposed Carbon Pollution Standard."

[10] Re-Proposed Carbon Pollution Standard, p. 16.

[11] CRS has multiple reports on CCS technology. For an overview, see CRS Report R42532, *Carbon Capture and Sequestration (CCS): A Primer*, by (name redacted). For a discussion of available policy tools to encourage the development of CCS, see CRS Report R41325, *Carbon Capture: A Technology Assessment*, by (name redacted). For a discussion of the Department of Energy's efforts to develop CCS technology, see CRS Report R42496, *Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy*, by (name redacted), and CRS Report R43028, *FutureGen: A Brief History and Issues for Congress*, by (name redacted).

somewhere in a range of 1,000 to 1,050 lbs/MWwh for the 84-month standard. The agency requests comments on the appropriate number.

NSPS are different from other Clean Air Act emission standards in that, once a standard is final, it applies to sources that commenced construction after the date of *proposal* in the *Federal Register*, rather than taking effect after the date of the final standard's promulgation.[12] EPA has identified only three facilities with construction permits that might be affected by this retroactive application of a final standard: the Wolverine project in Rogers City, MI; a Washington County, GA, project; and a Holcomb, KS, project.[13] The developers of the latter two maintain that they have commenced construction. Assuming this is the case, these sources would not be considered new sources and would not be subject to the NSPS. The status of the third facility, the Wolverine project, is less certain, but EPA is proposing to exempt it from the NSPS, stating:

> The EPA has not formulated a view as to the project's status in the development process or as to whether the proposed 1,100 lb CO_2/MWh standard or some other CO_2 standard of performance would be representative of BSER [Best System of Emission Reduction] for this project, and invites comment on these questions.[14]

EPA's Cost-Benefit Analysis

EPA's Regulatory Impact Analysis (RIA) for the 2012 proposal concluded that "even in the absence of this rule, existing and anticipated economic conditions in the marketplace will lead electricity generators to choose technologies that meet the proposed standards."[15] EPA repeats this conclusion in nearly identical language in the RIA for the September 2013 proposal.[16] The economic conditions referred to include the abundance and low projected cost of natural gas, the many state requirements that increasing amounts of electricity come from renewable sources, and the increasing cost of coal-fired electricity due to higher coal prices and new emission standards for emissions of conventional and toxic air pollutants. These factors combined make it likely that almost all new generation will come from natural gas combined cycle or renewable sources, according to EPA.

In preparing the 2012 NSPS proposal, EPA ran the Integrated Planning Model—a model developed by ICF Inc. that EPA and many industry sources have used to analyze the impacts of regulations since the 1980s—to analyze the sensitivity of the results to various assumptions. (The agency does not appear to have conducted new model runs for the 2013 re-proposal, but it reviewed its analysis using the Energy Information Administration's latest Annual Energy Outlook [AEO2013] and concluded that the 2012 results held.)[17]

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[12] Clean Air Act Section 111(a)(2).

[13] Re-Proposed Carbon Pollution Standard, pp. 163-166.

[14] Ibid., p. 164. The developer of the Wolverine project maintains that uncertainty regarding EPA's Mercury and Air Toxics Standards delayed the start of construction. Ibid., note 126.

[15] U.S. EPA, *Regulatory Impact Analysis for the Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units*, March 2012, p. ES-3, at http://www.epa.gov/carbonpollutionstandard/pdfs/20120327proposalRIA.pdf. Hereinafter "EPA 2012 RIA."

[16] U.S. EPA, *Regulatory Impact Analysis for the Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units*, September 2013, p. 1-3, at http://www2.epa.gov/sites/production/files/2013-09/documents/20130920proposalria.pdf. Hereinafter, "EPA 2013 RIA."

[17] See EPA 2013 RIA, pp. 5-6 through 5-8.

The IPM scenarios tested included a high electricity demand scenario, a low gas recovery scenario (which results in higher prices for natural gas), and a scenario combining both assumptions. None of these assumptions caused the model to project construction of new coal-fired capacity.[18] The analyses found that "the price of natural gas would have to increase to approximately $10/mmBtu [million Btu] for coal boilers without CCS to become competitive with combined cycle natural gas units, which is projected to be very unlikely."[19] Similarly, the 2013 RIA states, "It is only when natural gas prices exceed $10/MMBtu on a levelized basis (in 2011 dollars) that new coal-fired generation without CCS approaches parity with NGCC [Natural Gas Combined Cycle].... "[20] The RIA adds:

> For context, a natural gas price level of $10/MMBtu (in 2011 dollars) is higher than any annual natural gas price to the electric power sector since at least 1996, when the EIA data series stops. In addition, the highest projected average annual natural gas price during the analysis period in any of the [EIA's] AEO2013 scenarios cited in this chapter is $6.64/MMBtu in the Low Oil and Gas Resource scenario.[21]

With no new coal plants on the horizon (except for those already under construction or demonstration projects), EPA sees little quantifiable impact from its prospective NSPS promulgation. As the 2013 RIA states:

> EPA anticipates that the proposed EGU New Source GHG Standards will result in negligible CO_2 emission changes, energy impacts, benefits or costs for new units constructed by 2020. Likewise, the Agency does not anticipate any notable impacts on the price of electricity or energy supplies. Additionally, for the reasons described above, the proposed rule is not expected to raise any reliability concerns, since reserve margins will not be impacted and the rule does not impose any requirements on existing facilities.[22]

The 2012 RIA argued the case for the rule as a backstop, in case its projections of market conditions were inaccurate:

> This NSPS provides legal assurance that any new coal-fired plants must limit CO_2 emissions. Rather than relying solely on changeable energy market conditions to provide low emissions from new power plants in the future, this rule prevents the possible construction of uncontrolled, high-emitting new sources that might continue to emit at high levels for decades, contributing to accumulation of CO_2 in the atmosphere.… In addition, EPA intends this rule to send a clear signal about the future of CCS technology that, in conjunction with other policies such as Department of Energy (DOE) financial assistance, the agency

[18] EPA 2012 RIA, pp. 5-10 through 5-14.

[19] EPA 2012 RIA, p. 5-1. The RIA added, elsewhere, the following caveats: "It is important to note that this analysis is based on assumptions regarding the average national cost of generation at new facilities. As reported by the EIA [DOE's Energy Information Administration], there is expected to be significant spatial variation in the costs of new generation due to design differences, labor wage and productivity differences, location adjustments, among other potential differences. EPA acknowledges that there is some uncertainty around these estimates, and is unable to provide estimates for all variants. However, the results are expected to hold for the majority of situations. The analysis also does not explicitly consider new units designed to combust waste coal or petroleum coke (pet coke), which may be affected by this rule, but also may exhibit different local economics." (footnotes omitted) See EPA2012 RIA, p. 5-17.

[20] EPA 2013 RIA, p. 5-24. The RIA appears to use $10/MMBtu as an approximation, but in at least one instance, it states that parity between new coal-fired and natural gas-fired units would require natural gas prices of $10.94/MMBtu. See EPA 2013 RIA, p. 5-48.

[21] Ibid., p. 5-49. (footnotes omitted)

[22] Ibid., p. 5-54.

> estimates will support development and demonstration of CCS technology from coal-fired plants at commercial scale….[23]

The proposed rule, in EPA's view, will assist in the deployment of CCS technology, by removing regulatory uncertainty that may have hindered its deployment:

> The rule will reduce regulatory uncertainty by defining requirements for emission limits for GHG from new fossil fuel-fired EGU sources. In addition, the EPA intends this rule to send a clear signal about the current and future status of CCS technology. Identifying partial implementation of CCS technology as the best system of emission reductions (BSER) for coal-fired power plants promotes further development of CCS, which is important for long-term CO_2 emission reductions.[24]

An example of how the absence of a regulatory requirement has hindered the development of CCS technology is provided in the re-proposed rule's preamble:

> In 2011, AEP [American Electric Power] deferred construction of a large-scale CCS retrofit demonstration project on one of their coal-fired power plants because the state's utility regulators would not approve cost recovery for CCS investments without a regulatory requirement to reduce CO_2 emissions. AEP's chairman was explicit on this point, stating in a July 17, 2011 press release announcing the deferral:
>
> "We are placing the project on hold until economic and policy conditions create a viable path forward … We are clearly in a classic 'which comes first?' situation. The commercialization of this technology is vital if owners of coal-fueled generation are to comply with potential future climate regulations without prematurely retiring efficient, cost-effective generating capacity. But as a regulated utility, it is impossible to gain regulatory approval to recover our share of the costs for validating and deploying the technology without federal requirements to reduce greenhouse gas emissions already in place. The uncertainty also makes it difficult to attract partners to help fund the industry's share."[25]

Besides addressing regulatory uncertainty, the promulgation of New Source Performance Standards, even if the standards have little or no effect on new sources, serves as the precondition for standards affecting existing units. The latter are described in Section 111(d) of the Clean Air Act as "standards of performance for any existing source ... to which a standard of performance under this section would apply if such existing source were a new source." EPA would have no legislative authority to promulgate such standards if it did not first establish standards for new sources.

Questions Regarding the Re-proposed Rule

Many in the electric power and coal industries view the proposed and re-proposed standards, if either were finalized, as effectively prohibiting the construction of new coal-fired power plants other than those granted exemptions. Whether carbon capture and storage (CCS) technology has been "adequately demonstrated" is the key question they raise. Other questions involve whether

[23] EPA 2012 RIA, pp. ES-3 and ES-4.

[24] EPA 2013 RIA, p. 1-4.

[25] Re-Proposed Carbon Pollution Standard, pp. 203-204. (footnote omitted) The AEP press release can be found at http://www.aep.com/newsroom/newsreleases/Default.aspx?id=1704.

the cost of compliance, assuming CCS is available, and the increased energy required to capture and store carbon should lead the Administrator to propose a less stringent standard. Whether the proposed standard is barred by statutory language that prohibits the Administrator from requiring the installation and operation of any particular emission reduction system is another issue that has been raised.

Has CCS Been Adequately Demonstrated?

EPA maintains that the components of CCS technology have been demonstrated on numerous facilities. In the preamble to the 2012 proposal, the agency stated, "… at present, CCS is technologically feasible for implementation at new coal-fired power plants and its core components (CO_2 capture, compression, transportation, and storage) have already been implemented at commercial scale."[26] Specifically, the agency said:

- Capture of CO_2 from industrial gas streams has occurred since the 1930s using a variety of approaches to separate CO_2 from other gases.
- Carbon dioxide has been transported via pipelines in the U.S. for nearly 40 years. Approximately 50 million metric tons of CO_2 are transported each year through 3,600 miles of pipelines. Moreover, a review of the 500 largest CO_2 point sources in the United States shows that 95% are within 50 miles of a possible geologic sequestration site, which would lower transportation costs.
- With respect to carbon sequestration/storage, there are at least four commercial integrated CCS facilities sequestering CO_2 into deep geologic formations and applying a suite of technologies to monitor and verify that the CO_2 remains sequestered.[27]

Similar statements are made in the re-proposal.[28]

Critics of the agency maintain that even if the components have been demonstrated, there is no plant that captures and stores CO_2 on the scale of a large coal-fired power plant. There are several large power plants currently under development that will demonstrate CCS at commercial scale when completed, but none of these is currently operational, and several planned projects have been abandoned for a variety of reasons.[29]

In the supporting materials for the re-proposed rule, EPA identified five plants that are incorporating CCS on a commercial scale: Southern Company's Kemper County (Mississippi) Energy Facility; SaskPower's Boundary Dam CCS Project in Estevan, Saskatchewan, Canada; Summit Power's Texas Clean Energy Project, near Odessa, Texas; the Hydrogen Energy

[26] 77 *Federal Register* 22414, April 13, 2012.

[27] Ibid., p. 22415 (footnotes omitted).

[28] See Re-Proposed Carbon Pollution Standard, pp. 218-224.

[29] For details on the demonstration projects, see CRS Report R42496, *Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy*, by (name redacted), and Congressional Budget Office, *Federal Efforts to Reduce the Cost of Capturing and Storing Carbon Dioxide*, June 2012. One of the uncertainties faced by CCS is how to address liability concerns associated with CCS technology. For a discussion of this issue, see CRS Report RL34307, *Legal Issues Associated with the Development of Carbon Dioxide Sequestration Technology*, by (name redacted) and (name redacted).

California Project in Kern County, California; and NRG Energy's post-combustion carbon capture project at the company's W.A. Parish generating station southwest of Houston, Texas.[30] Three of these (the latter three) are still in the planning stages, and the other two (Kemper and Boundary Dam) are still under construction. Both of the latter have experienced large cost overruns.

Should Cost and/or Energy Considerations Have Led EPA to Propose a Less Stringent Standard?

Although it maintains that CCS has been adequately demonstrated, EPA stated in 2012, based on DOE estimates, that "using today's commercially available CCS technologies would add around 80 percent to the cost of electricity for a new pulverized coal (PC) plant, and around 35 percent for a new advanced gasification-based (IGCC) plant."[31] The statement was not specific, but presumably referred to the cost of capturing and storing a plant's total CO_2 emissions. The Congressional Budget Office, in a June 2012 report, reached essentially the same conclusion.[32] Since the proposed rule would require capture of only 40% of a coal-fired plant's carbon emissions, the added cost would be lower. The preamble to the proposed rule states that an 1,100 lb./MWh standard would add 20% to the cost of electricity from a supercritical pulverized coal plant, without accounting for revenues from the use of the CO_2 for enhanced oil recovery.[33]

Much of the increased cost results from what is termed a "parasitic" energy load: capturing all of a coal-fired plant's CO_2 emissions, and compressing, transporting, and injecting them underground would use as much as 30% of the electricity that the plant produces. As CBO explained it, a CCS-equipped plant will cost more to build and operate for two main reasons:

- The equipment a CCS plant requires to capture and compress CO_2 is large, complex, and expensive; and
- Capturing and compressing CO_2 consumes a substantial fraction of the plant's total output. Consequently, to produce the same amount of electricity for customers, a plant with CCS capabilities has to be bigger than a plant without them.[34]

Both EPA and the Congressional Budget Office, among others, assume that the cost and energy penalty can be reduced through research, development, and demonstration, and both view EPA regulation as one of the policy tools that could lead to reduced cost by forcing the development of better technology. Experience suggests that such "learning by doing" will lower the cost, but the road to what might be a competitive technology can be a long one, and given the availability of

[30] See Re-Proposed Carbon Pollution Standard, pp. 21-22, 28-29, and 236-237. Six other U.S. plants are listed by EPA in the Re-Proposed Carbon Pollution Standard preamble as proposing to capture or actually having captured CO_2 for enhanced oil recovery or other commercial uses (see pp. 233-236). With the exception of the Dakota Gasification Company plat in North Dakota, however, most of these carbon capture projects are relatively small.

[31] 77 *Federal Register* 22415-22416, April 13, 2012. EPA appears to have lowered its cost estimate in the 2013 RIA, in large part by considering possible net revenues from the use of recovered CO_2 for enhanced oil recovery (EOR). See the discussion in Chapter 5 of the EPA 2013 RIA.

[32] Congressional Budget Office, *Federal Efforts to Reduce the Cost of Capturing and Storing Carbon Dioxide*, June 2012, pp. 7-9.

[33] Re-Proposed Carbon Pollution Standard, p. 240.

[34] Ibid., p. 7.

other power sources (such as natural gas, renewables, and nuclear) with lower or no carbon emissions, it is not clear that the electric power industry will be motivated to pursue it.

Legal challenges to EPA's judgment that such a costly technology can be considered "adequately demonstrated" and that the degree of emission reduction required is "achievable" as required by Section 111 would have to be filed in the D.C. Circuit Court of Appeals.[35] D.C. Circuit decisions on NSPS have made clear that while EPA has some discretion in determining what is "adequately demonstrated," that discretion is not unlimited. In 1973, in *Essex Chemical Corp. v. Ruckelshaus*, the court explained that to be adequately demonstrated, a system must be one "which has been shown to be reasonably reliable, reasonably efficient, and ... [not] exorbitantly costly in an economic or environmental way."[36] In turn, an "achievable" standard is one that is "within the realm of the adequately demonstrated system's efficiency and which, while not at a level that is purely theoretical or experimental, need not necessarily be routinely achieved within the industry prior to its adoption."[37] In *Portland Cement Ass'n v. Ruckelshaus* the same year, the circuit made clear that "adequately demonstrated" does not confine EPA to presently available technology: "The Administrator may make a projection based on existing technology, though that projection is subject to the restraints of reasonableness and cannot be based on 'crystal ball' inquiry."[38] Much later, in 1999, the D.C. Circuit in *Lignite Energy Council v. EPA* reiterated the point: "Because it applies only to new sources, we have recognized that section 111 looks toward what may fairly be projected ... , rather than the state of the art at present."[39] Where data are not currently available, the court continued, EPA "may compensate ... through the use of other qualitative methods, including the reasonable extrapolation of a technology's performance to other industries."[40]

Despite the potentially high cost of currently available CCS technology, the agency stated in both its 2012 and 2013 Regulatory Impact Analyses that it does not anticipate that the rule will have any impacts on the price of electricity, employment or labor markets, or the US economy.[41] Other than demonstration projects supported by DOE or other incentives, EPA sees no new coal-fired units incorporating CCS in the next 10 years: given the low cost and projected abundance of natural gas, all new fossil-fueled units are likely to be powered by gas.

> EPA's finding of no new, unplanned conventional coal-fired capacity (and therefore, no projected costs or quantified benefits) is robust beyond the analysis period (past 2030 in both EIA and EPA baseline modeling projections) and across a wide range of alternative potential market, technical, and regulatory scenarios that influence power sector investment decisions.[42]

[35] Section 307(b) of the Clean Air Act. This discussion of relevant court cases was prepared by (name redacted) in CRS's American Law Division.

[36] 486 F.2d 427, 433 (D.C. Cir. 1973).

[37] Id. at 433-434.

[38] 486 F.2d 375, 391 (D.C. Cir. 1973).

[39] 198 F.3d 930,934 (D.C. Cir. 1999), quoting Portland Cement Ass'n v. Ruckelshaus, 486 F.2d 375, 391 (D.C. Cir. 1973).

[40] 198 F.3d at 934.

[41] EPA 2012 RIA, p. ES-3; EPA 2013 RIA, p. 5-54.

[42] EPA 2013 RIA, p. 2-3.

Should EPA Promulgate Separate Standards for Coal- and Gas-Fired Units?

Unlike the standard proposed in 2012, the September 2013 re-proposal would set separate standards for coal-fired and gas-fired EGUs. In this regard, the re-proposal is similar to most New Source Performance Standards promulgated previously for conventional pollutants (such as sulfur dioxide) emitted by electric generating units. As EPA noted in the preamble to the 2012 proposal, in setting standards for conventional pollutants or air toxics, it was not appropriate to combine coal-fired and gas-fired units in a single category, because "although coal-fired EGUs have an array of control options for criteria and air toxic air pollutants to choose from, those controls generally do not reduce their … emissions to the level of conventional emissions from natural gas-fired EGUs."[43]

Critics of the 2012 GHG proposal took EPA's statement a step further, stating frequently that combining coal-fired and gas-fired units in a single category, as the 2012 proposal did, was "unprecedented."[44] This is not actually the case: in 1998, EPA promulgated NSPS for emissions of nitrogen oxides (NOx) that imposed a single emission standard on all fossil-fueled EGUs.[45] In *Lignite Energy Council v. U. S. EPA*,[46] the D.C. Circuit Court of Appeals squarely addressed the argument that a single fuel-neutral standard was impermissible and rejected that argument, thus upholding EPA's authority to issue a single standard applicable to all fossil-fueled sources.

Nevertheless, EPA reversed course in the 2013 re-proposal, and now proposes to set separate standards for coal-fired and gas-fired units.

Is the Standard Barred by Statutory Language?

Critics of the proposed 2012 standard maintained that in setting the standard at 1,000 lbs. CO_2/MWh, EPA would effectively have required coal-fired power plants to add CCS to any new unit. The same argument is likely to be used against the re-proposed standard for coal-fired units. The critics maintain that such a requirement violates Section 111(b)(5) of the Clean Air Act, which states that unless she determines that it is not feasible to prescribe or enforce a standard of performance, the EPA Administrator is not authorized to require a new source "to install and operate any particular technological system of continuous emission reduction to comply with any new source standard of performance."

Whether a court would find that EPA is imposing a "particular technological system" might come down to an interpretation of the term. There are several different technologies for carbon capture under development. Does the fact that they all result in capturing CO_2 make them a "particular technological system"? Or would a court find that the option of switching fuels to lower

[43] 77 *Federal Register* 22411, April 13, 2012.

[44] See, for example, "Single Carbon Standard for Power Plants Breaks EPA Precedent, Commenters Say," *Daily Environment Report*, June 28, 2012.

[45] U.S. EPA, "Revision of Standards of Performance for Nitrogen Oxide Emissions from New Fossil-Fuel Fired Steam Generating Units; Revisions to Reporting Requirements for Standards of Performance for New Fossil-Fuel Fired Steam Generating Units," 63 *Federal Register* 49442, September 16, 1998. Discussion of that rule's fuel neutral approach begins on page 49445.

[46] 198 F.3d 930, 933 (D.C. Cir. 1999).

emissions means that sources can comply with the standard without having to install and operate a particular technological system?[47]

Guidelines for Existing Power Plants

The potential impacts of the NSPS rule extend beyond new sources, because the agency is obligated under Section 111(d) of the act to promulgate guidelines for *existing* sources within a category whenever it promulgates GHG standards for *new* sources.[48] Using these guidelines, states will be required to develop performance standards for existing sources. These could be less stringent than the NSPS—taking into account, among other factors, the remaining useful life of the existing source to which the standard applies. But the standards could have far greater impact than the NSPS, given that existing plants account for one-third of total U.S. GHG emissions.

The average coal-fired power plant is about 40 years old; some are more than 60 years old. The older plants are generally less efficient than newer units, and most operate only a small percentage of the time. Thus, the agency might choose to set a guideline based on a less costly approach than application of CCS to the units' emissions. In presentation slides that the agency has used in stakeholder discussions, emphasis has been placed on improving efficiency as a preferred approach to reducing GHG emissions.[49]

In recent months, considerable attention has been given to a proposal by the Natural Resources Defense Council (NRDC) as to how Section 111(d) guidelines might be structured.[50] Under NRDC's plan, each state would be given an emission "budget" or cap based on the mix of fuels used by EGUs in the state to generate electricity in a base period (2008-2010 in the NRDC proposal). States with more coal-fired generation would receive higher budgets than those with more natural gas or renewable sources. The state budgets would be reduced in phases, with a target reduction of about 26% in GHG emissions overall by 2020, compared to 2005 emission levels—significantly less stringent than the re-proposed standard for new units.

Under this approach, EGUs could comply in a variety of ways: by shifting power dispatch to lower emitting plants (and thus running higher emitting plants less often), by switching fuels, by co-firing lower emitting fuels with coal, by retiring their least efficient plants, by efficiency improvements at existing plants, or by reducing demand. EGUs could average, bank, or trade emission credits; as a result, individual units would have an emissions target, but they could

[47] The situation faced by an EGU under the proposed standard is somewhat analogous to that of an EGU needing to reduce sulfur dioxide emissions. In that case, too, a unit may switch fuels or it may use a specific type of technology (flue gas desulfurization, generally referred to as a "scrubber").

[48] This statutory requirement was addressed in the December 23, 2010, settlement agreement between EPA and 11 states, 2 municipalities, and 3 environmental groups. In the agreement, EPA stated that "it would be appropriate for it to concurrently propose performance standards for GHG emissions from new and modified EGUs under CAA section 111(b) … and emission guidelines for GHG emissions from existing affected EGUs pursuant to CAA section 111(d)…." The agency agreed to propose and take final action on a "rule under Section 111(d) that includes emission guidelines for GHGs from existing EGUs" on the same schedule as that set for the NSPS standards.

[49] See, for example, U.S. EPA, Office of Air Quality Planning and Standards, "Rulemaking for Greenhouse Gas Emissions from Electric Utility Steam Generating Units," Presentation Slides, May, 2011, at http://www.epa.gov/air/tribal/pdfs/presentation-ghggasemissionsutility05-25-2011.pdf.

[50] Natural Resources Defense Council, *Closing the Power Plant Carbon Pollution Loophole*, December 2012, 87 pages, at http://www.nrdc.org/air/pollution-standards/files/pollution-standards-report.pdf.

exceed the target if they had sufficient credits obtained from earlier reductions or from other units in the state's electric system. Since the goal would be to reduce emissions overall, rather than in specific states, states might also combine their markets for allowances, giving individual electric generating units and companies additional flexibility.

Whatever their form, a key question regarding the 111(d) guidelines has been when EPA would propose them. In his Climate Action Plan, the President resolved this question, as noted earlier, directing the agency to propose the guidelines by June 1, 2014, finalize them by June 1, 2015, and require the states to submit implementation plans by June 30, 2016. In cases where a state fails to submit a satisfactory plan, Section 111(d) also gives EPA the authority to prescribe and enforce a federal plan.

Congressional Responses

Many in Congress oppose EPA standards for GHG emissions. The House passed two bills in 2011 (H.R. 1 and H.R. 910) that would have prohibited EPA from promulgating GHG emission standards for any source, and it repeated itself in September 2012 with H.R. 3409, the Stop the War on Coal Act. The Senate did not follow suit.

Legislation to limit or prevent EPA regulatory action is considered possible in the 113th Congress, and may be given a boost by EPA's re-proposal of the Carbon Pollution Standard.

Enacting such legislation faces hurdles similar to those encountered in the last Congress, however. Although the House could take action to block NSPS regulations, the Senate is less likely to do so.[51] If the House and Senate did act to limit executive branch authority, a bill sent to President Obama would almost certainly be subject to a veto, given the President's recent statements regarding the importance of dealing with climate issues.[52]

Conclusion

The debate over EPA's proposed carbon pollution standard for new power plants is largely symbolic, and is characterized by exaggeration on both sides.

- It is symbolic because this rule by itself will have little impact. Its real significance is that without the promulgation of a rule for new sources, EPA cannot, under the Clean Air Act, proceed to regulate *existing* sources. It is the standards for those existing plants that may actually reduce the nation's GHG emissions, and in the process, could have significant impacts on coal-fired electricity.
- It is exaggerated because both EPA and the affected industries describe the rule itself as having far more impact than it will.

[51] The Senate could consider a resolution of disapproval under the Congressional Review Act, which can be brought to the floor under rules that prohibit a filibuster, thus requiring a simple majority vote. For discussion of that option, see CRS Report R41212, *EPA Regulation of Greenhouse Gases: Congressional Responses and Options*.

[52] The President spoke of the importance of addressing climate issues on the night of his re-election in 2012, in his second Inaugural Address, and in the 2013 State of the Union speech, in addition to the June 25, 2013, climate speech.

If EPA (among many sources) is correct that no new coal-fired power plants (other than demonstration projects) will be built in the foreseeable future even in the absence of the proposed rule, then the rule will have little effect. It will have little impact on the coal industry or the electric power industry in the near term, and it will not cause emission reductions from these industries. Both are adjusting to a new set of economic conditions, in which coal finds it harder to compete with natural gas. Gas is projected by most experts to be cheap and abundant for the foreseeable future. Since the early 1990s, new coal-fired plants have accounted for less than 10% of new power-generating capacity (see **Figure 1**). In these conditions, the electric power industry is likely to continue what it has already been doing for two decades: building gas-fired plants (or relying on renewable sources) when it needs new capacity.

The coal industry is unhappy with this, and has tended to place the blame for its current difficulties on EPA; but, actually, the market is the key factor in coal's recent decline. This market is affected by a number of elements, including the development of new technologies that have revolutionized production of natural gas, by state-level requirements for the use of renewable power sources, by stagnant growth in demand for electricity, and by environmental regulations mandated by Congress in the 1990 Clean Air Act amendments that are only now being implemented.

The net result is that coal is simply not competitive with natural gas in most areas of the country when power producers consider new generation facilities in current and foreseeable conditions. EPA's analysis finds that natural gas would need to triple in price for coal to be competitive with it, even without the potential cost of this rule. Further, the agency concludes, in every year since 1996, the economics of gas have made it a more cost-effective choice when planning new power generation.[53] This rule will tilt the playing field even further against new coal-fired generation, but the field was already tilted far in that direction. To say that the rule will effectively prohibit the construction of new coal-fired power plants, as many in the coal and electric power industries do, is to focus on only one among many factors.

While EPA is essentially correct in saying that this rule will have little effect on industry, the agency seems to exaggerate the benefits of the rule. In her speech at the National Press Club on September 20, EPA Administrator McCarthy maintained that

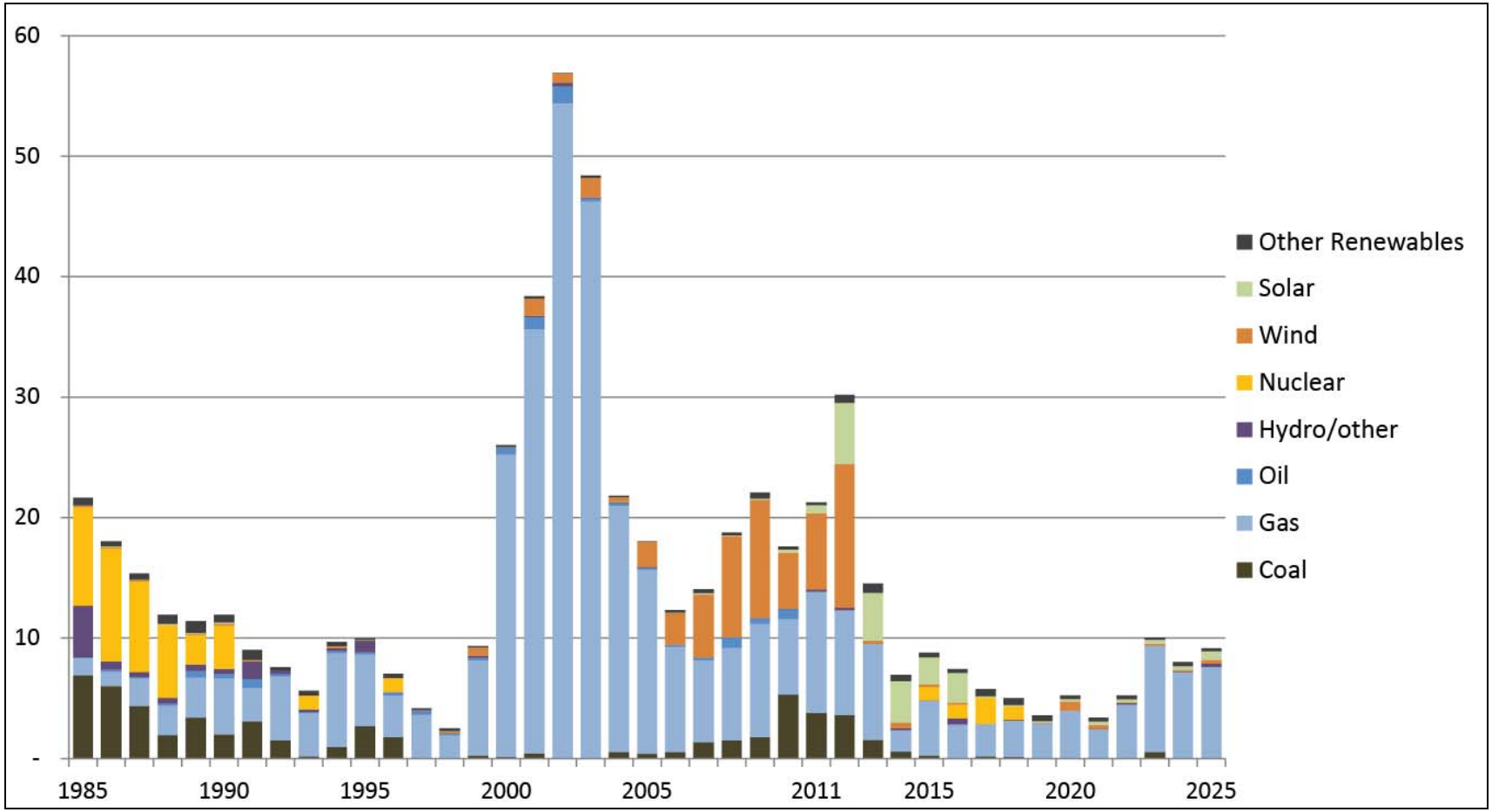
> The standards set the stage for continued public and private investment in technologies like Carbon Capture and Sequestration (CCS). With these investments, technologies will eventually mature and become as common for new power plants as scrubbers have become for well-controlled plants in generation today.[54]

If the standards won't have any cost or impact, because no new coal-fired capacity subject to them will be built, then they will do little to stimulate the development of CCS technology.

[53] EPA 2013 RIA, p. 5-49.

[54] U.S. EPA, Speeches—By Date, "Administrator Gina McCarthy Remarks on Carbon Pollution Standards for New Power Plants—As Prepared," National Press Club, September 20, 2013, at http://yosemite.epa.gov/opa/admpress.nsf/8d49f7ad4bbcf4ef852573590040b7f6/348694303a67e3c685257bec004bec8d!OpenDocument.

Figure 1. Additions to U.S. Electric Generating Capacity, 1985-2025



Source: U.S. Energy Information Administration.

The rule does not mean the end of coal mining, or the end of coal-fired power, however. Existing coal-fired plants, which have amortized much of their capital cost, still generate about 40% of the nation's electricity, even with the low price of natural gas and even with the costs of current environmental regulations. Since power plants can last for decades, coal could play an important role in the nation's energy future for decades to come. Furthermore, as many in the utility industry maintain, power producers have an interest in maintaining a diverse mix of fuel sources. Projections regarding the cost of generation a decade or more in the future are uncertain at best: few would have predicted the current glut of natural gas a decade ago. Energy markets are notoriously volatile and difficult to foresee. With that in mind, coal is likely to remain in the mix, in part as an insurance policy against uncertain future conditions, especially at plants that are already in operation and meeting existing standards for other pollutants.

But here the spotlight returns to EPA. The future of coal and coal-fired electricity could be greatly affected by the next carbon pollution standard, the guidelines for existing units. The fight over that rule, which is due to be proposed in June 2014, should place the current debate in its true perspective.

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