United States Government Accountability Office

Report to the Ranking Member, Committee on Energy and Natural Resources, U.S. Senate

August 2014

EPA REGULATIONS AND ELECTRICITY

Update on Agencies' Monitoring Efforts and Coal-Fueled Generating Unit Retirements

GAO-14-672

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GAO Highlights

Highlights of GAO-14-672, a report to the Ranking Member, Committee on Energy and Natural Resources, U.S. Senate

Why GAO Did This Study

EPA recently proposed or finalized four regulations affecting coal-fueled electricity generating units, which provide about 37 percent of the nation's electricity supply. These regulations are the: (1) Cross-State Air Pollution Rule; (2) Mercury and Air Toxics Standards; (3) Cooling Water Intake Structures regulation; and (4) Disposal of Coal Combustion Residuals regulation. In 2012, GAO reported that, in response to these regulations and other factors such as low natural gas prices, companies might retire or retrofit some units. GAO reported that these actions may increase electricity prices and, according to some stakeholders, may affect reliability–the ability to meet consumers' demand—in some regions. In 2012, GAO recommended that DOE, EPA, and FERC develop and document a formal, joint process to monitor industry's progress responding to these regulations. In June 2014, EPA proposed new regulations to reduce carbon dioxide emissions that will also affect these units.

GAO was asked to update its 2012 report. This report examines (1) agencies' efforts to respond to GAO's recommendation and (2) what is known about planned retirements and retrofits. GAO reviewed documents, analyzed data, and interviewed agency officials and stakeholders.

What GAO Recommends

GAO is not making new recommendations but believes it is important that these agencies jointly monitor industry progress and fully document these steps as GAO recommended in 2012. The agencies concurred with GAO's findings.

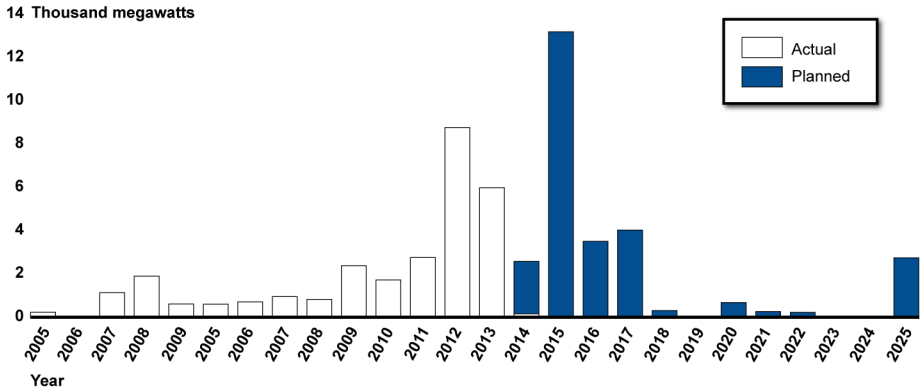
View GAO-14-672. For more information, contact Frank Rusco at (202) 512-3841 or ruscof@gao.gov.

What GAO Found

The Department of Energy (DOE), the Environmental Protection Agency (EPA), and the Federal Energy Regulatory Commission (FERC) have taken initial steps to implement a recommendation GAO made in 2012 that these agencies develop and document a joint process to monitor industry's progress in responding to four proposed or finalized EPA regulations affecting coal-fueled generating units. GAO concluded that such a process was needed until at least 2017 to monitor the complexity of implementation and extent of potential effects on price and reliability. Since that time, DOE, EPA, and FERC have taken initial steps to monitor industry progress responding to EPA regulations including jointly conducting regular meetings with key industry stakeholders. Currently, these monitoring efforts are primarily focused on industry's implementation of one of four EPA regulations—the Mercury and Air Toxics Standards—and the regions with a large amount of capacity that must comply with that regulation. Agency officials told GAO that in light of EPA's recent and pending actions on regulations including those to reduce carbon dioxide emissions from existing generating units, these coordination efforts may need to be revisited.

According to GAO's analysis of public data, power companies now plan to retire a greater percentage of coal-fueled generating capacity and retrofit less capacity with environmental controls than the estimates GAO reported in July 2012. About 13 percent of coal-fueled generating capacity—42,192 megawatts (MW)—has either been retired since 2012 or is planned for retirement by 2025, which exceeds the estimates of 2 to 12 percent of capacity that GAO reported in 2012 (see fig.). The units that power companies have retired or plan to retire are generally older, smaller, more polluting and not used extensively, with some exceptions. For example, some larger generating units are also planned for retirement. In addition, the capacity is geographically concentrated in four states: Ohio (14 percent), Pennsylvania (11 percent), Kentucky (7 percent), and West Virginia (6 percent). GAO's analysis identified about 70,000 MW of generating capacity that has either completed some type of retrofit to reduce sulfur dioxide, nitrogen oxides, or particulate matter since 2012 or plan to complete one by 2025, which is less than the estimate of 102,000 MW GAO reported in 2012.

Capacity of Actual and Planned Retirements of Coal-Fueled Generating Units, 2005-2025



Source: GAO analysis of SNL Financial data. | GAO-14-672

Contents

Abbreviations

Btu	British thermal unit
CCR	Disposal of Coal Combustion Residuals from Electric Utilities regulation
CSAPR	Cross-State Air Pollution Rule
DOE	Department of Energy
EIA	Energy Information Administration
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
ISO	Independent System Operator
kWh	kilowatt-hour
MATS	Mercury and Air Toxics Standards
MW	megawatt
NACAA	National Association of Clean Air Agencies
NERC	North American Electric Reliability Corporation
NO_x	nitrogen oxides
RTO	Regional Transmission Organization
SCR	Selective Catalytic Reduction
SNCR	Selective Noncatalytic Reduction
SNL	SNL Financial
SO_2	sulfur dioxide
316(b)	Cooling Water Intake Structures regulation

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

August 15, 2014

The Honorable Lisa Murkowski
Ranking Member
Committee on Energy and Natural Resources
United States Senate

Dear Senator Murkowski:

Coal is a key domestic fuel source, producing about 37 percent of the nation's electricity supply in 2012.[1] Burning coal for electricity production results in the emission of pollutants such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), and mercury and other metals. Coal-fueled electricity generating units are among the largest emitters of these pollutants. Using coal to generate electricity has been associated with human health and environmental concerns by the Environmental Protection Agency (EPA), the primary federal agency responsible for implementing many of the nation's environmental laws. For example, according to EPA data, SO_2 and NO_x have been linked to respiratory illnesses and acid rain.[2] In addition, coal-fueled generating units emit large quantities of carbon dioxide, the primary greenhouse gas contributing to climate change, and can use significant quantities of water and create large amounts of waste products that require disposal.

In 2012, we examined the potential impacts of key regulations on coal-fueled generating units and issued two reports.[3] In July 2012, we issued a report that examined the actions owners of power plants could take in response to several pending regulations and potential implications of

[1]Department of Energy, Energy Information Administration (EIA), *Electric Power Annual 2012* (December 2013). EIA is a statistical agency within the Department of Energy that collects, analyzes, and disseminates independent information on energy issues.

[2]SO_2 and NO_x emissions contribute to the formation of fine particulate matter, and NO_x contributes to the formation of ozone. Fine particulate matter may aggravate respiratory and cardiovascular diseases and is associated with asthma attacks and premature death. Ozone can inflame lung tissue and increase susceptibility to bronchitis and pneumonia.

[3]GAO, *EPA Regulations and Electricity: Better Monitoring by Agencies Could Strengthen Efforts to Address Potential Challenges*, GAO-12-635 (Washington, D.C.: July 17, 2012) and *Electricity: Significant Changes Are Expected in Coal-Fueled Generation, but Coal Is Likely to Remain a Key Fuel Source*, GAO-13-72 (Washington, D.C.: October 29, 2012).

these actions.[4] At that time, EPA had recently proposed or finalized four regulations, as required or authorized, that aimed to address certain health or environmental impacts associated with coal-fueled electricity generating units. These regulations included the: (1) Cross-State Air Pollution Rule (CSAPR); (2) Mercury and Air Toxics Standards (MATS); (3) Cooling Water Intake Structures regulation, which we refer to as 316(b); and (4) Disposal of Coal Combustion Residuals from Electric Utilities regulation (CCR).[5] Currently, MATS is the only one of the four regulations that has been in effect; the other regulations have been either in active litigation or have undetermined regulatory compliance periods. In July 2012,[6] we reported that it was uncertain how power companies would respond to these regulations, but that available information suggested they would retrofit some units with controls to reduce pollutants or take other steps to reduce adverse impacts.[7] We also reported that when it was not economic to take these actions—whether due to the cost of undertaking these retrofits or because of other changes that have occurred in the electric power sector, such as lower prices for natural gas—power companies may retire some units. We reported estimates that 2 to 12 percent of coal-fueled capacity could be retired, and that some regions, particularly the Midwest, could see more significant levels of retirements. These retirements could affect the amount of coal-fueled generating capacity and the amount of electricity actually generated from coal. Available information also suggested that, while these actions may not cause widespread concerns about reliability—the ability to meet the needs of consumers even when

[4]GAO-12-635.

[5]These four EPA regulations address air pollution from electricity generating units, death of aquatic life as a result of water withdrawal for use for cooling at certain electricity generating units, and disposal of coal combustion residuals from certain generating units, respectively. CSAPR limits certain emissions of air pollutants in 28 states because of the impact they would have on air quality in other states. MATS establishes emissions limitations on mercury and other toxic pollutants. The Cooling Water Intake Structures regulation (316(b)) establishes requirements for water withdrawn and used for cooling purposes that reflect the best technology available to minimize adverse environmental impact. The proposed CCR regulation would govern the disposal of coal combustion residuals, such as coal ash, in landfills or surface impoundments.

[6]GAO-12-635.

[7]Compliance with regulations may involve using various technologies or making infrastructure changes to reduce adverse impacts; for example, installing liners at facilities used to store coal combustion wastes to minimize leaching of contaminants into groundwater.

generating equipment fails unexpectedly, or other factors affect the electricity system, they may contribute to reliability challenges in some regions and these actions would likely increase electricity prices in some regions. In October 2012,[8] we also reported that two broad trends were affecting power companies' decisions related to coal-fueled generating units—recent environmental regulations and changing market conditions, such as the recent decrease in the price of natural gas. We found that power companies may build new generating units, upgrade transmission systems to maintain reliability, and increasingly use natural gas to produce electricity as coal units are retired, and remaining coal units become somewhat more expensive to operate.

Two federal agencies have responsibilities for overseeing actions power companies take in response to federal regulations and mitigating some potential adverse implications. The Federal Energy Regulatory Commission (FERC) is generally responsible for ensuring that certain electricity and transmission prices are "just and reasonable," as well as approving and enforcing standards for reliability. The Department of Energy (DOE) works to modernize the electricity system, enhance the security and reliability of the nation's energy infrastructure, and facilitate recovery from any disruptions. DOE also has authority to compel generating units to produce electricity in certain emergency situations. In our July 2012 report, we recommended that DOE, FERC, and EPA develop and document a formal, joint process consistent with each agency's respective statutory authorities to monitor industry's progress in responding to the EPA regulations until at least 2017 and that each agency, to the extent practical, leverage resources and share the results of its efforts with the other agencies. DOE and EPA agreed with this recommendation, and FERC disagreed, stating that the agencies were working to establish a more formal approach to coordination to the extent that FERC's authority allows.

You asked us to examine actions these agencies' have taken in response to our recommendation in our July 2012 report and provide updated information on planned coal-fueled generating unit retirements and retrofits. The objectives of our review were to examine: (1) DOE's, FERC's, and EPA's efforts to respond to our recommendation that the agencies develop and document a formal, joint process to monitor

[8]GAO-13-72.

industry's progress in responding to EPA regulations and (2) what is known about power companies' current plans to retire or retrofit affected coal–fueled generating units.

To address these objectives, we reviewed relevant documents and interviewed knowledgeable officials from EPA, FERC, and DOE, and other key stakeholders. We interviewed and obtained information from a sample of stakeholders who were identified and interviewed as part of our July 2012 review. Stakeholders we interviewed and obtained information from included six Regional Transmission Organizations (RTO),[9] the North American Electric Reliability Corporation (NERC),[10] and two industry groups that represent power companies. We used data from SNL Financial (SNL)[11] to provide information on historic and planned retrofits and retirements of coal-fueled generating units. Information regarding planned retrofits and retirements reflect publicly reported plans as identified by SNL. To assess the reliability of these data, we interviewed and corresponded via e-mail with knowledgeable SNL staff, analyzed the data to identify any problems with completeness and accuracy, and, where possible, corroborated the data with other available information. We determined the data were sufficiently reliable for our purposes. We also analyzed information on retirements and retrofits provided by RTOs. To assess the reliability of these data, we interviewed and corresponded

[9]Independent operators of the transmission system can be referred to as RTOs or Independent System Operators (ISO). RTOs and ISOs have similar functions, including operating the transmission system and longer-term regional planning, but ISOs tend to be smaller in geographic size or—for the ISOs in Texas and Canada—not subject to FERC jurisdiction over rates and tariffs. For the purposes of this report, we use the term RTOs to refer to both RTOs and ISOs.

[10]NERC develops and enforces reliability standards. Under the Energy Policy Act of 2005, FERC is responsible for approving and enforcing standards to ensure the reliability of the bulk power system. FERC certified NERC to develop and enforce reliability standards, subject to FERC review. These standards outline general requirements for planning and operating the bulk power system to ensure reliability. NERC annually assesses seasonal and long-term reliability.

[11]SNL's "Energy" database combines information from multiple sources including EIA, FERC, and others. Data used in this report reflect information collected through a variety of means including the EIA-860 form that collects generator-level specific information about existing and planned generators and associated environmental equipment at electric generating units. Some data are updated annually, but SNL updates others more frequently. The data we used were current in the SNL system as of May 30, 2014. As plans may change, actual future retrofits and retirements may differ from the data in these plans.

via e-mail with knowledgeable officials, analyzed the data to identify any problems with completeness and accuracy, and, where possible, corroborated the data with other available information. We determined the data we used were sufficiently reliable for our purposes.

We conducted this performance audit from May 2014 to August 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Because of the abundance of coal and its historically low cost, coal-fueled electricity generating units provide a large share of the electricity produced in the United States. In 2012, according to Energy Information Administration (EIA) data, there were 1,309 coal-fueled generating units in the United States,[12] with a total of 309,680 megawatts (MW) of net summer generating capacity—about 29 percent of the total net summer generating capacity in the United States.[13] In addition to coal, electricity is produced by using other fossil fuels, particularly natural gas and oil; nuclear power; and renewable sources, including hydropower, wind, geothermal, and solar. Historically, coal-fueled generating units have provided about half of the electricity produced in the United States—an amount that has declined in recent years, falling to 37 percent in 2012.

[12]EIA, *Electric Power Annual 2012* (December 2013). The number of generating units is based on information from the EIA-860 form that includes information on generating units with 1 MW or greater of combined nameplate capacity. Not all of these coal-fueled units would be subject to each of the four regulations. Additionally, noncoal electric generating units are subject to some of the regulations. Each regulation defines which units will be subject to it. For example, MATS applies to coal- and oil-fueled electricity utility steam generating units that have over 25 MW capacity and meet other requirements. We use the term electricity generating units rather than the specific regulatory definitions to refer to units subject to one or more regulations.

[13]EIA, *Electric Power Annual 2012* (December 2013). Generating capacity is measured in MW and refers to the maximum capability of a unit to produce electricity. A unit with 1,000 MW of capacity can generate up to 1,000 megawatt-hours of electricity in 1 hour, enough to provide electricity for up to 1 million homes. Net summer generating capacity refers to a generating unit's capacity to produce electricity during the summer when electricity demand for many electricity systems and losses in efficiency are generally the highest.

To address concerns over air pollution, water resources, and solid waste, several environmental laws, including the Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act, were enacted. As required or authorized by these laws, EPA recently proposed or finalized four key regulations that will affect coal-fueled units. As outlined in table 1, these regulations are at different stages of development and have different compliance deadlines.

Table 1: Major Milestones and Status of Four Key EPA Regulations that Impact Coal-Fueled Electricity Generating Units

Regulation	Date proposed	Date finalized	Compliance deadline
Cross-State Air Pollution Rule (CSAPR)	August 2010	August 2011	Deadlines have not been determined. First phase was to begin in 2012 but the rule has not taken effect because of pending litigation. On April 29, 2014, the Supreme Court reversed a ruling by the U.S. Court of Appeals for the D.C. circuit vacating CSAPR and remanded the case for further proceedings.
Mercury and Air Toxics Standards (MATS)	May 2011	February 2012[a]	April 2015 for existing generating units. Up to 1-year extension (to April 2016) for installation of controls through permitting authorities possible. Up to 1 additional year possible through Clean Air Act Administrative Order (to April 2017).
Cooling Water Intake Structures regulation (316(b))	April 2011	May 2014	Deadlines will be established on a site-specific basis by permitting authorities (generally state agencies). According to EPA officials, permitting authorities must include entrainment controls in all permits issued 45 months after the effective date of the rule (60 days after publication in the Federal Register), and will determine the compliance schedule for entrainment; facilities must comply with the impingement requirements as soon as practicable after the entrainment requirements are determined.
Disposal of Coal Combustion Residuals from Electric Utilities regulation (CCR)	June 2010	Under a consent decree, EPA was ordered by the court to finalize a regulation by December 19, 2014	Depends on which option is finalized.

Source: GAO analysis of EPA information. | GAO-14-672

Note: Proposed and finalized dates refer to when the regulations were published in the Federal Register and differ from when EPA signed the regulations except for the final 316(b) regulation, which has not been published in the Federal Register as of June 4, 2014, but was signed in May 2014.

[a]In April, 2014, a federal appellate court rejected challenges to various aspects of MATS–White Stallion Energy Center, LLC v. E.P.A., 748 F.3d 1222 (D.C. Cir. 2014)—including challenges to EPA's decision to not consider costs in determining whether regulation of mercury and other covered emissions from existing generating units is appropriate under the Clean Air Act.

These four regulations have potentially significant implications for public health and the environment. In particular, EPA projected that, among other benefits, CSAPR would reduce SO_2 emissions by 73 percent and NO_x emissions by over half in covered states, reducing asthma and related human health impacts. In addition, EPA projected that MATS would reduce mercury emissions by 75 percent from coal-fueled electricity generating units, reducing the impacts of mercury on adults and children.

In addition to these four regulations, on June 2, 2014, EPA proposed new regulations to reduce carbon dioxide emissions from existing fossil-fueled generating units that, if finalized, will impact the electricity industry, including coal-fueled generating units, aiming for overall reductions equivalent to 30 percent from 2005 emissions levels by 2030.[14] The proposed regulations include state-specific goals for carbon dioxide emissions and guidelines for states to follow in developing, submitting, and implementing plans to achieve these goals, which would be due in June 2016, although, under some circumstances, a state may submit an initial plan by June 2016 and a completed plan up to 2 years later.

In addition to DOE, FERC, and EPA, other key stakeholders have certain responsibilities for overseeing actions power companies take in response to the regulations and have a role in mitigating some potential adverse implications. These other stakeholders include state environmental and electricity regulators and system planners that coordinate planning decisions regarding transmission and generation infrastructure to maintain the reliable supply of electricity to consumers. System planners and operators attempt to avoid reliability problems through advance planning of transmission and, in some cases, generation resources, and coordinating or determining operational decisions such as which generating resources are operated to meet demand throughout the day. The role of a system planner can be carried out by individual power companies or RTOs. System planners' responsibilities include analyzing expected future changes in generation and transmission assets, such as the retirement of a generating unit; customer demand; and emerging reliability issues. For example, once a power company notifies the system

[14]The proposed regulation does not require a specific percentage reduction for each state from 2005 levels—each state has its own emission reduction target—but EPA estimates that, collectively, state targets could achieve a 30 percent overall reduction from 2005 emission levels.

planner that it is considering retiring a generating unit, the system planner generally studies the electricity system to assess whether the retirement would cause reliability challenges and identify long- or short-term solutions to mitigate any impacts. The solutions could include building new generating units, reducing demand in specific areas, building new transmission lines or adding other equipment.

DOE, EPA, and FERC Are Coordinating Efforts to Monitor Industry's Response to Key EPA Regulations in Response to GAO's Recommendation

DOE, EPA, and FERC have taken initial steps to implement the recommendation we made in our July 2012 report that these agencies develop and document a formal, joint process to monitor industry progress in responding to the four EPA regulations. Since that time, DOE, EPA, and FERC have taken initial steps collectively and individually to monitor industry progress responding to EPA regulations including jointly conducting regular meetings with key industry stakeholders. However, recent and pending actions on the four existing regulations, as well as EPA's recently proposed regulations to reduce carbon dioxide emissions from existing generating units may require additional monitoring efforts, according to DOE, EPA, and FERC officials.

DOE, EPA, and FERC Have Taken Initial Steps to Coordinate Efforts to Monitor Industry Progress

DOE, EPA, and FERC have taken initial steps to implement the recommendation we made in our July 2012 report. In that report we found the agencies had undertaken individual monitoring efforts of varied scale and scope and engaged in informal coordination, but lacked a formal documented process for routinely monitoring industry progress toward compliance with the regulations. As such, we recommended that these agencies develop and document a formal, joint process to monitor industry progress in responding to EPA regulations. We concluded that such a process was needed until at least 2017 to monitor the complexity of implementation and extent of potential effects on price and reliability. Since that time, DOE, EPA, and FERC have taken initial steps collectively to monitor industry progress responding to EPA regulations including jointly conducting regular meetings with key industry stakeholders. Currently, these monitoring efforts are primarily focused on industry implementation in regions with a large amount of capacity that must comply with the MATS regulation—the only one of the four regulations that has taken effect.

According to EPA officials, DOE, EPA, and FERC officials have met three times since our July 2012 report to coordinate the efforts under way at each agency to monitor industry's progress implementing the MATS regulation and other related issues, including EPA's development of

recently proposed regulations to reduce carbon dioxide emissions from existing generating units. In addition, in May 2013, staff from DOE, EPA, and FERC jointly developed a coordination memorandum that was intended to identify how the agencies would work together to address the potential effects of EPA's regulations on reliability.[15] According to one EPA official, the memorandum was intended to be an evolving document that the agencies would revisit as appropriate, for example, as additional EPA regulations are finalized.

In addition to actions taken by the agencies to coordinate with each other, officials at DOE, EPA, and FERC told us the agencies are jointly coordinating with RTOs and other planning authorities on a regular basis to monitor industry progress toward responding to EPA regulations primarily focused on identifying potential impacts on reliability. EPA, DOE, and FERC officials told us that they do not formally analyze the information they obtain through these meetings; however, these officials told us that, based on information obtained during these meetings, they do not anticipate widespread reliability concerns. Specifically, EPA has organized regular monthly meetings with the three agencies and key stakeholders that play a role in the maintenance of the reliability of the electric power system and the implementation of relevant EPA regulations. These meetings have included outreach and education, information gathering, and technical assistance. The meetings EPA holds have included a separate monthly conference call with the three agencies and each of the four RTOs that have a large amount of generating capacity in their regions that must comply with the MATS regulation.[16] The meetings include discussion of the region's capacity and resource adequacy concerns, announced and potential retirements, air pollution

[15]According to the memorandum, the primary, though not exclusive, focus of the memorandum and of the three agencies' joint efforts is on issues related to the implementation of MATS, because MATS has been finalized and establishes specific requirements that must be achieved within well-defined time frames.

[16]These four RTOs include PJM Interconnection, which serves all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia; Midcontinent ISO, which serves parts of Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Montana, North Dakota, South Dakota, Texas, and Wisconsin, as well as the Canadian province of Manitoba; the Southwest Power Pool, which serves parts of Arkansas, Kansas, Louisiana, Mississippi, Missouri, Nebraska, New Mexico, Oklahoma, and Texas; and the Electric Reliability Council of Texas, which serves parts of Texas.

control equipment in use and retrofit plans, and other information such as reliability assessments under way in the region. As part of these meetings, officials told us that the RTOs provided information of varying levels of detail to the agencies, including information on retirement notifications and associated impacts as determined by the reliability studies completed by the RTOs; the status and findings of reliability assessments they conduct; data on the generating capacity of units with planned, announced, or completed retirements and retrofits; and data on planned outages. RTO officials told us they each gathered information about the plans for generating units in the areas they oversee. Officials from several RTOs told us that they gathered this information by surveying owners of generating units to identify, among other things, information on decisions related to retiring or retrofitting specific generating units.

According to EPA officials, the agencies' monitoring and technical assistance efforts are primarily focused on implementation of the MATS requirements because it has taken effect and includes requirements that must be achieved within well-defined time frames.[17] The MATS regulation was finalized in February 2012 and calls for a 3-year compliance period for existing generating units with the deadline of April 16, 2015, but permitting authorities may provide an extra year for certain generating units that request additional time to comply. Agency officials and stakeholders told us that state agencies are generally providing the 1-year extension for generating units—providing these units a total of 4 years to comply. In addition, according to the National Association of Clean Air Agencies (NACAA), as of May 2014, all but 9 of over 100

[17]While the proposed 316(b) rule included a requirement for compliance with the impingement mortality standards within 8 years, the final rule requires compliance schedules to be established in each individual permit. EPA officials told us that they do not have plans to undertake coordination activities with the key industry stakeholders for 316(b) similar to the activities being undertaken for MATS because some aspects of the regulation will be implemented on a site-specific basis by the permitting authorities (generally the state agencies). EPA told us that it is conducting outreach on 316(b), but in its analysis supporting the rule, EPA found that no generating units would close due to the rule, and the time frames for units to achieve compliance with the requirements are much longer than they were for MATS.

requests for extensions were granted by the state permitting agencies.[18] In addition to the MATS extension, EPA also provided a mechanism to allow certain units—generating units that are needed to address specific and documented reliability concerns—to request an additional year to come into compliance through the use of Clean Air Act administrative orders—which, if granted, would provide a total of 5 years to comply.[19] According to EPA officials, compliance with the MATS requirements has been less challenging for industry than anticipated, and operators have generally been able to undertake retrofits as part of scheduled maintenance outages; however, certain retrofits, such as the installation of a fabric filter will require additional or longer outages to be completed. According to EPA officials, whether a plant will need to schedule outages for retrofits will depend on a number of factors including the type of controls required for compliance. EPA officials told us they anticipate few administrative orders to be requested.[20] However, if EPA receives a request for an administrative order, EPA has stated in its policy that it will rely on the advice and counsel of reliability experts, including FERC, to identify and analyze reliability risks, but EPA officials will make the final decision on these requests. In May 2012, FERC issued a policy

[18]According to NACAA, the information was collected from state regulatory agencies on MATS compliance extension requests and of the 9 extensions not granted, 5 were under consideration, 2 were returned for more information, and 2 were denied. NACAA received information from 58 agencies in 45 states, D.C., and Puerto Rico; these agencies indicated that approximately six more requests may be forthcoming.

[19]EPA's Office of Enforcement and Compliance Assurance issued a policy memorandum describing its intended approach regarding the use of Clean Air Act Section 113(a) administrative orders for sources that must operate in noncompliance with MATS for up to a year to address a specific and documented reliability concern. EPA, "The Environmental Protection Agency's Enforcement Response Policy For Use of Clean Air Act Section 113(a) Administrative Orders in Relation To Electric Reliability and the Mercury and Air Toxics Standard." EPA's policy states that, to qualify for an administrative order, an owner or operator should (1) provide written notice of its compliance plans to its system planner no later than April 2014 and (2) generally no later than October 2014, submit a written request to EPA for an administrative order.

[20]EPA officials told us that the agency has not received any formal requests and that enforcement policy recommends, however, that facility operators notify planning authorities if they may need to seek an administrative order in the future. EPA told us that as of June 6, 2014, a very small number have notified planning authorities that they may ultimately request an administrative order, and EPA is monitoring these cases closely.

statement detailing how it intends to provide advice to EPA on such requests.[21]

Agencies Have Taken Individual Steps to Monitor Progress and Provide Assistance

In addition to participating in the EPA-facilitated meetings with industry and reviewing information provided from the RTOs through those meetings, DOE, FERC, and EPA have taken other steps to individually monitor or support industry progress implementing EPA regulations.

DOE. DOE is offering technical assistance to state public utility commissioners, generating unit owners and operators, and utilities on implementing the new and pending EPA regulations affecting the electric utility industry. Specifically, according to DOE officials and documents, DOE may provide technical information on cost and performance of the various retrofit control technologies; technical information on generation or transmission alternatives for any replacement power needed for retiring generating units; and assistance to public utility commissions regarding any regulatory evaluations or approvals they may have to make on utility compliance strategies. According to agency officials, while DOE offers technical assistance on implementing new and pending EPA rules, DOE has received limited requests for such assistance.

EPA. According to EPA officials, EPA has conducted outreach to ensure state agencies understand their ability to provide MATS extensions and EPA officials also review information from NACAA on the status of MATS extension requests. In addition, EPA has updated its power sector modeling tool—a model EPA uses to analyze the impact of policies, regulations, and legislative proposals on the power sector—to reflect MATS requirements along with changes in other market conditions.

FERC. FERC officials told us that they monitor information from several sources including the NERC reliability assessments,[22] EIA data on capacity additions, and information from NACAA on the status of MATS extension requests. In addition, FERC obtained industry information on

[21]FERC, "Policy Statement on the Commission's Role Regarding the Environmental Protection Agency's Mercury and Air Toxics Standards," 139 FERC ¶ 61,131, Docket No. PL12-1-000 (May 17, 2012).

[22]NERC, *2013 Long-Term Reliability Assessment*, December 2013 and *2014 Summer Reliability Assessment* (May 2014).

reliability challenges through a technical conference that it convened to obtain information on the effect of recent cold weather events on the RTOs.[23]

Recent and Pending Actions on Regulations May Require Additional Efforts to Monitor Industry's Progress

Recent and pending actions on the four existing regulations, as well as EPA's recently proposed regulations to reduce carbon dioxide emissions from existing generating units, may require additional agency effort to monitor industry's progress in responding to the regulations and any potential impacts on reliability. DOE, EPA, and FERC officials told us that, in light of these changes, their coordination efforts may need to be revisited. Specifically, one EPA official noted that the agencies may need to reexamine their coordination efforts, as appropriate, in light of changing conditions, including newly proposed EPA regulations. In addition, according to FERC officials, since not all the regulations have been finalized, conditions will continue to change, making continued monitoring of potential reliability or resource adequacy challenges important. Furthermore, in April 2014, a FERC Commissioner testified before Congress about concerns and uncertainty related to potential reliability and price impacts associated with environmental regulations.[24] Specifically, the Commissioner expressed concerns about the reliability of data on which generating units are retiring and the resources to replace those retiring generating units and called for a more formal review process including FERC, EPA, and others to analyze the specific details of retiring units, as well as the new units and new transmission that will be needed to manage the transition and ensure reliability of the nation's electricity sector.

RTO officials and other industry stakeholders also told us that recent and pending actions on regulations could have impacts on the industry's ability to reliably deliver electricity. Officials from several RTOs told us that, while widespread reliability concerns are not anticipated, some regions may face reliability challenges including challenges associated with increasing reliance on natural gas. Officials from several RTOs said that their efforts to monitor reliability impacts will include evaluating the

[23]FERC, "Technical Conference on Winter 2013-2014 Operations and Market Performance in RTOs and ISOs," AD14-8-000 (Washington, D.C.: Apr. 1, 2014).

[24]FERC, Commissioner Moeller's Testimony before the Senate Committee on Energy and Natural Resources (Washington, D.C.: Apr. 10, 2014).

recently proposed regulations to reduce carbon dioxide emissions, which may present challenges in the future. In addition, officials from one RTO told us that compliance with new and proposed EPA regulations and an evolving generation portfolio will have significant effects on the industry's ability to reliably deliver electricity. Officials from this RTO reported that their region is forecasting shortfalls in its reserve margin—additional capacity that exceeds the maximum expected demand to provide for potential backup—in some areas. In addition, these RTO officials and industry stakeholders noted that retirement of coal-fueled generating units may lead to increasing reliance on natural gas, as these generating units are replaced with natural gas fueled generating units, which will require construction of new pipeline and storage infrastructure. As a result, according to officials from one RTO, their region has increased coordination with the natural gas industry through a stakeholder forum and a series of gas infrastructure studies. These officials said that, while relying on natural gas to generate electricity has not historically negatively affected reliability, greater reliance on natural gas may require more consideration of potential fuel-related future reliability challenges.

RTO officials and other industry stakeholders also told us recent and pending actions on regulations could have impacts on electricity prices. For example, industry stakeholders told us that the retirements that are occurring or planned are significant and could lead to increased electricity rates in some regions. In addition, as we reported in July 2012, the studies we reviewed estimated that increases in electricity prices could vary across the country, with one study projecting a range of increases from 0.1 percent in the Northwest to an increase of 13.5 percent in parts of the South more dependent on electricity generated from coal. Officials from several RTOs told us that, while they analyze the potential reliability impacts of specific generating units that power companies are considering retiring, they do not analyze the potential market impacts of these retirements on electricity prices or other market factors. In addition, several RTO officials told us they cannot estimate the impacts of these potential retirements on the markets due to the number of factors involved in determining market prices and affecting markets. Based on our discussions with agency officials, FERC, DOE, and EPA are not evaluating the potential impacts of planned retirements or retrofits on electricity prices as part of their monitoring efforts. However, EPA officials told us it uses its power sector modeling tool to analyze the potential impact of new regulations on economic factors including electricity prices and has used the tool to examine the potential impact of the new carbon rule that reflected publicly announced retirements and retrofits at the time of its analysis. According to EPA's analysis for the recently proposed

regulations to reduce carbon dioxide emissions from existing generating units, it projected an increase in the national average retail electricity price between 5.9% and 6.5% in 2020 compared with its base case estimate.[25]

Power Companies Plan to Retire More Generating Capacity and Retrofit Less Generating Capacity Than Initial Estimates

According to our analysis, power companies plan to retire a greater percentage of coal-fueled net summer generating capacity and retrofit less capacity with environmental controls than the estimates we reported in July 2012. Specifically, our analysis indicates that power companies retired or plan to retire about 13 percent of coal-fueled net summer generating capacity (42,192 MW) from 2012 through 2025, which exceeds the estimates of 2 to 12 percent of capacity we reported in 2012. In addition, power companies have planned or completed some type of retrofit on about 70,000 MW of net summer generating capacity to reduce SO_2, NO_x, or particulate matter from 2012 through 2025, which is less than estimates we reported in 2012. In addition to our analysis of publicly announced retirements and retrofits, RTO officials told us that power companies may take additional steps and provided information on generating units that owners may take steps to retire or retrofit; specifically, about 7,000 MW of additional capacity from 46 generating units may be retired from 2012 through 2025, beyond what we identified in our analysis of SNL data.

Power Companies Plan to Retire More Coal-Fueled Generating Capacity Than Estimated in 2012

According to our analysis of SNL data, planned retirements of coal-fueled generating units appear to have increased and are above the high end of the estimates we reported in July 2012. Specifically, power companies retired or plan to retire about 13 percent of coal-fueled net summer generating capacity (42,192 MW from 238 units) from 2012 through

[25]EPA's base case estimate—which serves as the starting point against which policy scenarios are compared—includes a projected national average retail electricity price of 10.4 cents/kilowatt-hour (kWh) in 2020. According to EPA, its base case was updated in August 2013 to reflect planned new power plant construction, retirements, new power plant cost and performance, pollution control costs and performance, emission rate assignments, state rules and enforcement actions, and other economic factors including fuel prices and demand for electricity. The base case is a projection of electricity sector activity that takes into account only those federal and state air emission laws and regulations with provisions either in effect or enacted and clearly delineated at the time the base case was finalized in August 2013.

2025.[26] When we reported in July 2012, projections suggested that 2 to 12 percent of coal-fueled capacity may be retired.[27] Based on our analysis of SNL data, power companies retired 100 coal-fueled units from January 2012 to May 2014 with a total of 14,887 MW net summer generating capacity. In addition, based on our analysis of SNL data, power companies have reported plans to retire an additional 138 coal-fueled units with a total of 27,306 MW of net summer generating capacity from June 2014 through 2025. Another recent review also identified higher projected retirements of coal-fueled capacity than estimates we reported in July 2012. Specifically, in April 2014, EIA projected that retirements from 2012 through 2020 could reach approximately 50,000 MW or about 16 percent of net summer generating capacity available at the end of 2012.[28]

Consistent with the reasons we had reported for retirements in 2012, some stakeholders we interviewed said that some of these projected retirements may have occurred without the environmental regulations. Specifically, these stakeholders noted that several industry trends may be contributing to the retirement of coal-fueled generating units, including

[26]Information on planned retirements reflects publicly reported plans for units with a net summer capacity greater than 25 MW as identified by SNL as of May 30, 2014. In total, we identified 1,080 coal-fueled electric generating units greater than 25 MW with a total net summer capacity of 319,246 MW that were operating as of January 1, 2012. The generating units we identified in SNL's database as coal-fueled generating units include units where coal is reported as the primary or secondary fuel. In addition, generating units listed as either "Out of Service" or "Mothballed" were treated as operating for the purposes of this analysis, which included about 4,200 MW of net summer generating capacity including 2,100 MW that did not have a listed retirement date. As plans may change, actual future retirements may differ from these plans. In addition, some units may be in the process of determining whether to retire, but they have not made a public announcement. Furthermore, in our review of planned retirements for existing generating units, we have identified only some services that are likely provided by these generating units. In particular, we were able to identify the net summer generating capacity, but we have not identified other services, such as ancillary services, that are important to the reliability of the electricity system. According to RTO officials, they analyze the potential reliability impacts of specific generating units that power companies are considering retiring.

[27]GAO-12-635. In addition, in October 2012 (GAO-13-72), we reported that data we examined indicated that 10 percent (30,447 MW from 174 coal-fueled units) of net summer generating capacity in service in 2011 were planned for retirement by 2020 in response to regulations and other factors.

[28]EIA, *Annual Energy Outlook 2014* (April 2014). These figures represent data produced in EIA's 2014 "Reference Case." EIA typically conducts several analyses that include variations in influential factors such as fuel prices.

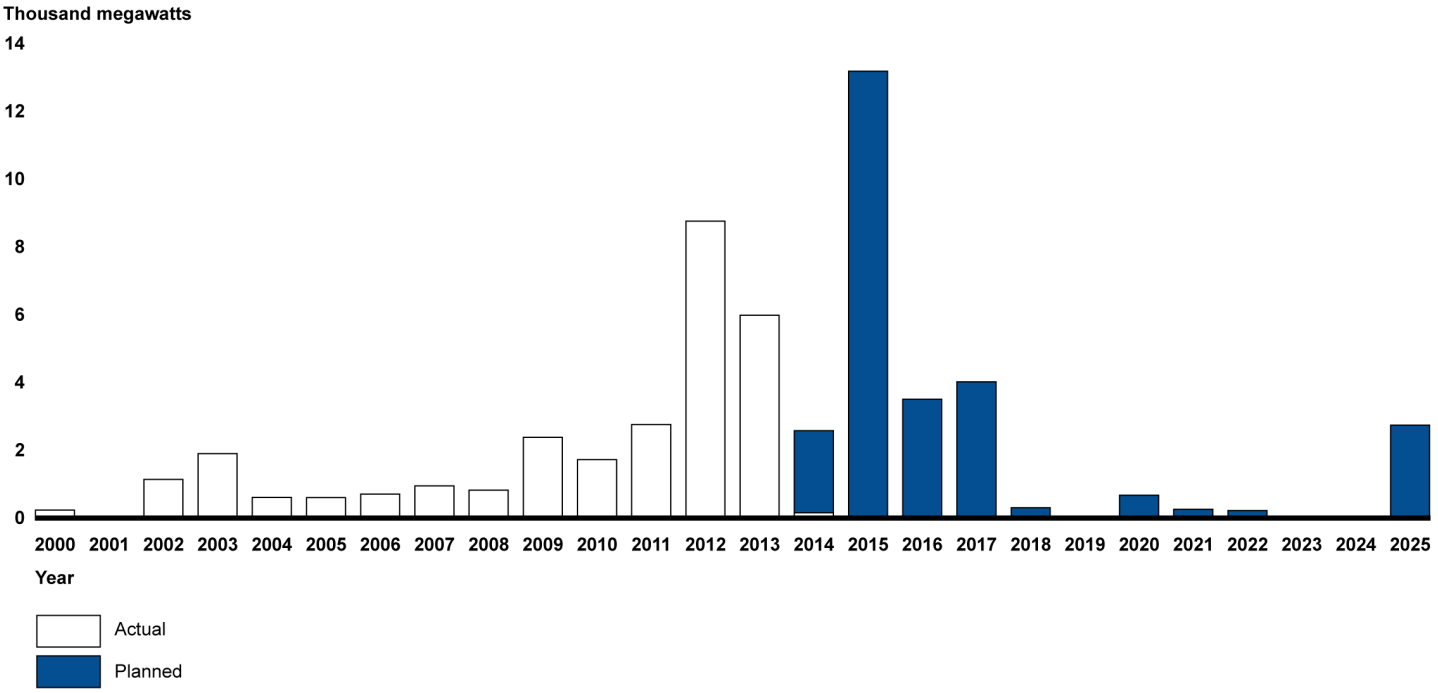
relatively low natural gas prices, increasing prices for coal, and low expected growth in demand for electricity. In addition, in June 2012, we reported that operators of some coal-fueled generating units had entered into agreements with EPA to retire or retrofit units to settle EPA enforcement actions.[29] However, we also reported in July 2012 that, according to some stakeholders, the new environmental regulations may accelerate retirements because power companies may not want to invest in retrofitting units with environmental controls for those units they expect to retire soon for other reasons.[30]

About three-quarters of the retirements we identified in our analysis of SNL data are expected to occur by the end of 2015, corresponding to the initial April 2015 MATS compliance deadline (see fig. 1). This level of retirements is significantly more retirements than have occurred in the past; for example, according to our analysis, between 2000 and 2011, 150 coal-fueled units with a total net summer generating capacity of 13,786 MW have been retired.

[29]GAO, *Air Pollution: EPA Needs Better Information on New Source Review Permits*, GAO-12-590 (Washington, D.C.: June 22, 2012). We reported that, since 1999, EPA's enforcement of New Source Review—a permitting process that applies to (1) units built after August 7, 1977, and (2) existing units that undertake a major modification—among certain coal-fired electricity generating units resulted in settlements with owners of such units. These settlements have resulted in the installation of emissions controls, unit retirements, agreements to fund environmentally beneficial projects, and tens of millions of dollars in civil penalties. In total, we reported that EPA reached 22 settlements covering 263 units, which would require affected unit owners to, among other things, install around $12.8 billion in emissions controls.

[30]GAO-12-635.

Figure 1: Net Summer Generating Capacity of Actual and Planned Retirements of Coal-Fueled Electricity Generating Units, 2000-2025



Source: GAO analysis of SNL Financial data. | GAO-14-672

Note: Data on generating unit capacity refers to units with over 25 megawatts of net summer generating capacity—a generating unit's capacity to produce electricity during the summer when electricity demand for many electricity systems and losses in efficiency are generally the highest.

According to our analysis of SNL data, the units that power companies have retired or plan to retire are generally older, smaller, and more polluting, and this is generally consistent with what we reported in October 2012.[31] In addition, we found that many of the units that companies have retired or plan to retire are those that are not used extensively and are geographically concentrated, with some exceptions. Specifically, we found the following:

- **Older.** Generating units that power companies have retired or plan to retire are generally older. The fleet of operating coal-fueled units was built over many decades, with most of the capacity currently in service

[31] GAO-13-72.

built in the 1970s and 1980s. In particular, from 2012 through 2025, power companies retired or plan to retire about 80 percent of net summer generating capacity from units that were placed in service prior to 1970 (33,419 MW from 213 of the 238 units). However, SNL data indicate that power companies retired or plan to retire some newer generating units, including one generating unit placed into service in 2008.

- **Smaller.** Generating units that power companies have retired or plan to retire are generally smaller. Smaller generating units are generally less fuel efficient than larger units and can be more expensive to retrofit, maintain, and operate on a per-MW basis. In particular, smaller units—those less that 300 MW—comprise about 63 percent of the net summer generating capacity that power companies retired or plan to retire from 2012 through 2025 (26,659 MW from 208 of the 238 units). However, some larger generating units are also planned for retirement. In particular, according to our analysis, power companies retired 4 generating units with a net summer generating capacity of over 300 MW from 1990 to 2012, and they retired or plan to retire about 30 such generating units from 2012 through 2025.
- **More polluting.** Generating units that power companies retired or plan to retire over the next 3 years emit air pollutants such as SO_2 and NO_x at generally higher rates than the remaining fleet. According to our analysis, units that were retired or are planned for retirement from 2014 through 2017 emitted on average almost three times as much SO_2 per unit of fuel used at the generating unit in 2013 as units that are not planned for retirement.[32] Similarly, units that were retired or are planned for retirement from 2014 through 2017 emitted on average about 41 percent more NO_x per unit of fuel used at the generating unit in 2013 than units not planned for retirement.[33]
- **Not used extensively.** Most generating units that power companies have retired or plan to retire have not been extensively used in recent

[32]If a power company was to retrofit a generating unit to achieve compliance with MATS this would need to occur no later than April 2017; the compliance deadline is April 2015, but extensions are possible through April 2017.

[33]This analysis considered average generating unit emissions of SO_2 and NO_x (reported as pounds per million British thermal units (Btu) of fuel used at the generating unit), fuel efficiency (reported as the "heat rate" as BTUs per kWh of output) and generation data from 2013. Data for generating units that were already retired prior to 2013 were not available. In addition, generating units that did not operate and therefore lacked data for either emissions, heat rate, or generation for all 3 years were also excluded from this analysis.

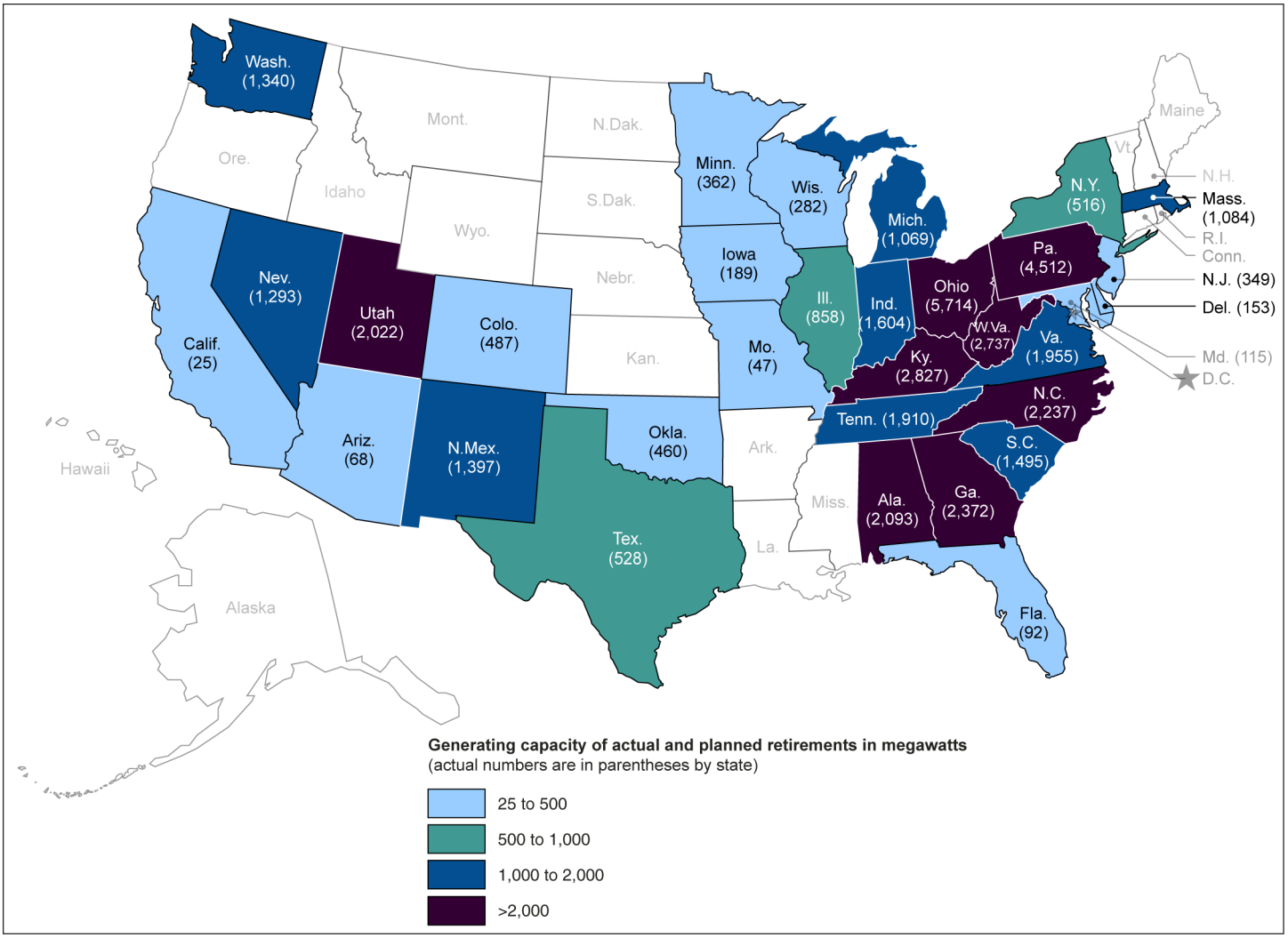
years, but other units were used more often.[34] Specifically, according to our analysis, from 2012 through 2025, power companies retired or plan to retire units that comprise about 70 percent of the net summer generating capacity (30,000 MW from 186 of the 238 units) that operated the equivalent of less than half of the hours they were available over the past few years.[35] However, data also indicate that about 13 of the 238 units that companies retired or plan to retire—which represent about 4,200 MW of net summer generating capacity—operated the equivalent of 70 percent or more of the hours they were available over the past few years.

- **Geographically concentrated.** Generating units that power companies have retired or plan to retire are concentrated in certain states (see fig. 2). Specifically, about 38 percent of the net summer generating capacity that power companies retired or plan to retire from 2012 through 2025 is located in four states—Ohio (14 percent), Pennsylvania (11 percent), Kentucky (7 percent), and West Virginia (6 percent). In particular, figure 2 shows how completed or planned retirements from 2012 through 2025 are distributed nationwide and how these are concentrated in certain areas.

[34]As noted elsewhere, this analysis only evaluated the generating output and did not evaluate other services that these units may have provided.

[35]These data reflect analysis of generating unit data on total generation (reported as "capacity factor") from 2011 through 2013. Capacity factor is a measure of how often an electric generator runs for a specific period of time. It indicates how much electricity a generator actually produces relative to the maximum it could produce at continuous full power operation during the same period. Out of the 238 units that power companies retired or plan to retire from 2012 through 2025, we did not have generation data for all 3 years for 7 units, and these units were excluded from this analysis.

Figure 2: Net Summer Generating Capacity of Actual and Planned Retirements of Coal-Fueled Electricity Generating Units by State, 2012-2025



Sources: GAO analysis of SNL Financial data; Map Resources (map). | GAO-14-672

Note: Data on generating unit capacity refers to units with over 25 megawatts of net summer generating capacity—a generating unit's capacity to produce electricity during the summer when electricity demand for many electricity systems and losses in efficiency are generally the highest.

Power Companies Plan to Retrofit Less Coal-fueled Generating Capacity Than Estimated in 2012

According to our analysis of SNL data, completed or planned retrofits of coal-fueled generating units include less capacity than estimates we reported in July 2012.[36] These retrofits include the use of a wide range of the technologies we reported at that time. As noted in our July 2012 report, operators of generating units were expected to rely on the combined installation of several technologies to comply with the regulations. These technologies include: (1) fabric filters or electrostatic precipitators to control particulate matter; (2) flue gas desulfurization units—also known as scrubbers—or dry sorbent injection units to control SO_2 and acid gas emissions; (3) selective catalytic reduction or selective noncatalytic reduction units to control NO_x; and (4) activated carbon injection units to reduce mercury emissions. Appendix I includes a description of these controls, how they operate, and their potential capacity to remove pollutants.

Our analysis of SNL data indicates that companies have identified specific units to retrofit, but the total net summer generating capacity with planned or completed retrofits from 2012 through 2025 is lower than the estimates we reported on in July 2012.[37] Most of the retrofits—about 91 percent—have occurred since 2012 or are planned for completion by the end of 2017. Specifically, according to our analysis of SNL data, power companies have planned or completed some type of retrofit on about 70,000 MW (from 153 generating units) of net summer generating capacity from 2012 through 2025.[38] More specifically, about 37,500 MW of these planned or completed retrofits involve technologies typically used to reduce emissions of NO_x, and about 41,000 MW involve technologies typically used to reduce emissions of SO_2. Data we reviewed also indicate

[36]As noted elsewhere in this report, the data we examined may change as companies make decisions about specific generating units.

[37]As noted previously, MATS has a specific and near-term deadline for compliance, but the other regulations have been either in active litigation or have undetermined regulatory compliance periods. As such, our analysis has focused on identifying steps that operators have taken to address air emissions. The data available to us provided details on installations, and planned installations, of equipment to reduce SO_2, NO_x, and particulate matter. The data did not provide details on planned installations of equipment installed specifically to reduce mercury. As noted in our 2012 reports, generating unit operators identified the use of SO_2 reduction equipment, namely scrubbers, used in conjunction with particulate controls, such as fabric filters, as a broad approach to reduce mercury.

[38]Some generating units are expecting to install more than one of these controls. As a result, total net summer generating capacity installing an environmental retrofit does not equal the sum of net summer generating capacity installing each type of retrofit.

that power companies have either installed or expect to install a scrubber—generally intended to reduce SO_2—on about 34,000 MW of net summer generating capacity from 2012 through 2025, an effort that we reported in July 2012 has typically been costly and can take some time to complete. In addition, about 20,000 MW have completed or planned to complete a retrofit to reduce particulates, including about 17,000 MW with completed or planned installations of fabric filters known as "baghouses."

By comparison, in July 2012, we reported that several studies forecasted the steps generating unit owners would take to retrofit units.[39] In particular, EPA estimated that, in response to MATS, companies would retrofit 102,000 MW of generating capacity with fabric filters and 83,000 MW with new scrubbers or scrubber upgrades.[40] In addition, a study by NERC, which collectively examined early versions of all four regulations in 2011, estimated that 576 units that account for about 234,371 MW of capacity would be retrofitted by the end of 2015.[41]

We identified two key characteristics of the units that power companies have retrofitted or plan to retrofit as follows:

- **Larger.** Most of the net summer generating capacity that have completed or plan to complete a retrofit—about 68 percent—is at larger units with capacity greater than 500 MW.
- **Geographically concentrated.** A large share of the net summer generating capacity that has completed or plan to complete a retrofit—about 36 percent—is composed of generating units located in four states: Illinois, Indiana, Kansas, and Texas. In addition, some states have completed or plan to complete more retrofits than others. In particular, seven states (Kansas, Louisiana, New Hampshire, New Mexico, Oregon, South Dakota, and Washington) have completed or plan to retrofit more than half of the net summer generating capacity located in that state.

[39]GAO-12-635.

[40]EPA projected that MATS would lead to the installation of fabric filters on 102,000 MW of capacity; upgraded electrostatic precipitators on 34,000 MW; new dry sorbent injection units on 44,000 MW; new scrubbers on 20,000 MW (and scrubber upgrades on 63,000 MW); and activated carbon injection units on 99,000 MW by 2015. EPA also projected that CSAPR will lead to retrofitted dry sorbent injection units on 3,000 MW and scrubbers on 5,900 MW by 2014.

[41]NERC, *2011 Long-Term Reliability Assessment* (November 2011).

Additional Generating Units May Take Steps to Retire or Retrofit Units According to Information Provided by RTOs

Based on information provided by RTOs, power companies may be considering retiring or retrofitting some additional generating units. In particular, RTO officials provided information on additional generating capacity that power companies have either announced plans to retire or retrofit, or are in the process of considering for a retirement or retrofit.[42] In particular, RTOs identified about 46 coal-fueled generating units that account for about 7,000 MW of additional generating capacity that may be retired from 2012 through 2025, beyond what we identified in our analysis of SNL data. In addition, RTOs identified a total of 260 units that account for about 108,000 MW of generating capacity that have completed or may undertake a retrofit from 2012 through 2025, which may include the capacity identified in our analysis.

Concluding Observations

The electricity sector is in the midst of a significant transition as power companies face decisions on the future of coal-fueled electricity generating units in light of new regulations and changes in the market, such as recent low prices for natural gas, and even though compliance deadlines for three of the regulations remain uncertain, power companies have already identified retirements beyond the range of estimates we reported in 2012. Reliable electricity remains critically important to U.S. homes and businesses and is itself reliant upon the availability of sufficient generating capacity. DOE, EPA, and FERC have taken initial steps to implement our recommendation to establish a joint process to monitor industry's progress in responding to the four EPA regulations and other factors. However, stakeholders, including a FERC Commissioner, continue to express concerns about reliability and electricity prices. Furthermore, proposed regulations focused on reducing emissions of carbon dioxide from the electricity sector, when finalized, may pose additional challenges for coal-fueled generating units. The initial coordination efforts now under way across the three agencies are an

[42]Nonpublic information on individual generating units was not provided by the RTOs; any nonpublic information related to retirements and retrofits was provided by the RTOs in aggregate. Because the data provided by the RTOs was more limited than what was available from SNL, we did not include it in our analysis above, and these retirements are in addition to the 42,192 MW of retirements reported above. However, because RTOs reported aggregated data on retrofits, and not generating unit-level data, the amounts of capacity planned for retrofits may overlap with the generating units in our analysis of SNL data. In addition, the RTOs reported the capacity figures to us in a variety of ways, some using net summer generating capacity, and others providing another measure such as nameplate capacity or did not specify. In this summary, we have aggregated the capacity figures RTOs reported to us.

important tool for understanding and monitoring the potential effects of EPA regulations and other factors on the electricity sector. However, consistent with our recommendation in 2012, careful monitoring and coordination by the federal agencies incorporating the views of other stakeholders such as RTOs will be even more important over the next several years as key regulations are finalized and implemented.

Agency Comments and Our Evaluation

We are not making new recommendations in this report. We provided a draft of this report to DOE, EPA, and FERC, for review and comment. In written comments from DOE, EPA, and FERC, reproduced in appendixes II, III, and IV respectively, the three agencies generally concurred with our analysis. The agencies stated that they will continue to monitor the progress of industry implementation of the regulations and coordinate with one another to address potential reliability challenges. Specifically, DOE stated that these coordination efforts have primarily focused on MATS and may be revisited as they work with industry to monitor compliance with other EPA regulations. EPA stated that it will monitor compliance with all of the rules, as appropriate, to ensure that reliability is not put at risk. FERC stated that it is working with industry to explore reliability issues stemming from new and pending environmental rules for the power sector, and that it will continue to monitor industry's progress implementing these rules and will coordinate with DOE, EPA, and industry. We continue to believe it is important that these agencies jointly monitor industry's progress in responding to the EPA regulations and fully document these steps as we recommended in 2012.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to the appropriate congressional committees, the Secretary of Energy, the Administrator of the EPA, the Chairman of FERC, and other interested parties. In addition, the report will be available at no charge on the GAO website at http://www.gao.gov.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or ruscof@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on

the last page of this report. GAO staff members who made major contributions to this report are listed in appendix V.

Sincerely yours,

Frank Rusco
Director, Natural Resources and Environment

Appendix I: Air Pollution Control Equipment Used at Coal-Fueled Electricity Generating Units

Summary of Air Pollution Control Equipment Used at Coal-Fueled Electricity Generating Units (as reported in GAO-12-635)

Primary pollutant targeted	Equipment name	How it works	Removal efficiency
Particulate matter[a]	Electrostatic precipitator	An induced electrical charge removes particles from flue gas.	99.5%
	Fabric filter (commonly referred to as a "baghouse")	Flue gas passes through tightly woven fabric filter "bags" that filter out the particulates.	99.9%
Sulfur dioxide (SO_2)and other acid gases[b]	Flue gas desulfurization unit (commonly referred to as a "scrubber")	Wet flue gas desulfurization units inject a liquid sorbent slurry, such as a limestone slurry, into the flue gas to form a wet solid that can be disposed of or sold. Dry flue gas desulfurization units inject a dry sorbent, such as lime, into the flue gas to form a solid byproduct that is collected.	Wet scrubbers – 99% removal of SO_2 Dry scrubbers – 95% removal of SO_2
	Dry sorbent injection unit	An alkaline powdered material is injected into the flue gas (postcombustion) to react with the SO_2 and other acid gases. The resulting product is then collected through a particulate matter control device.	50% with an electrostatic precipitator, 75% with a fabric filter[c]
Nitrogen oxides (NO_x)	Combustion control technologies, such as low-NO_x burners[d]	Coal combustion conditions are adjusted so less NO_x is formed.	45% reduction in the formation of NO_x
	Postcombustion controls, such as Selective Catalytic Reduction (SCR) and Selective Noncatalytic Reduction (SNCR) units	For SCR, ammonia is injected into flue gas to react with NO_x to form nitrogen (N_2) and water and uses a catalyst to enhance the reaction. For SNCR, ammonia or urea is injected into flue gas to react with NO_x as well, but does not use a catalyst.	SCRs – 95% removal of NO_x SNCRs –75% removal of NO_x
Mercury[e]	Activated carbon injection units	Powdered activated carbon sorbent is injected into flue gas, binds with mercury, and is collected in particulate matter control device.	At least 90% with a fabric filter

Sources: GAO summary of reports by EPA, Energy Information Administration, National Academies, Electric Power Research Institute, and industry documents.

Note: Removal efficiency figures refer to the highest capacity to remove listed pollutants. Units may not always achieve these removal rates.

[a]The MATS regulation specifically places limits on "filterable" particulate matter.

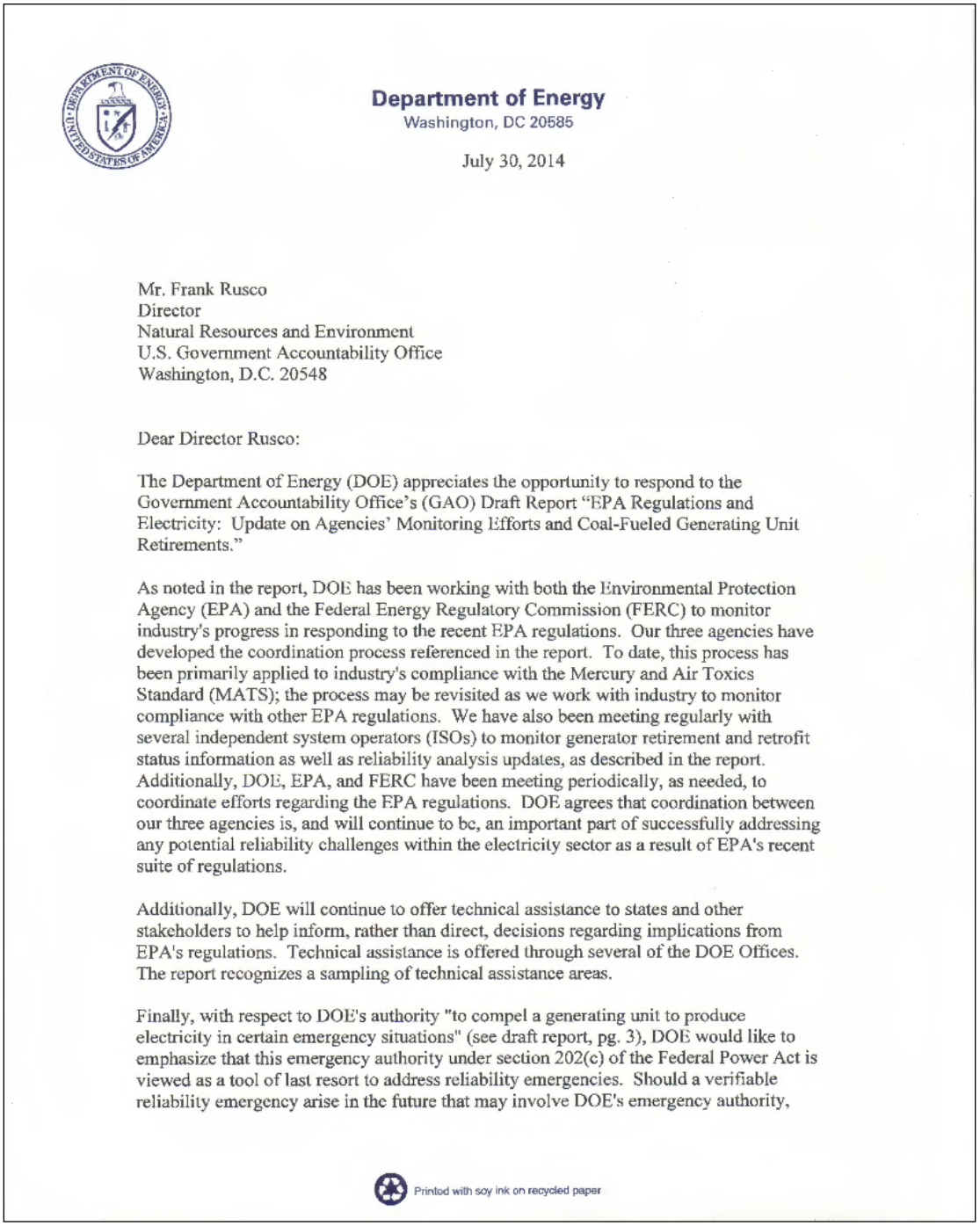
[b]Another approach to reducing SO_2, mercury, and acid gas emissions from generating units is to switch from using coals with high content of these substances to coals with lower contents, or to blend coals.

[c]The removal efficiency rates presented are for SO_2. Removal efficiency rates may be higher for other acid gases.

[d]Low-NO_x burners may also be used in conjunction with postcombustion controls for NO_x.

[e]Mercury can be removed through various controls. For example, wet scrubbers also remove mercury if it is in a soluble form, and particulate matter control equipment can remove mercury that is bound to the ash.

Appendix II: Comments from the Department of Energy



Department of Energy
Washington, DC 20585

July 30, 2014

Mr. Frank Rusco
Director
Natural Resources and Environment
U.S. Government Accountability Office
Washington, D.C. 20548

Dear Director Rusco:

The Department of Energy (DOE) appreciates the opportunity to respond to the Government Accountability Office's (GAO) Draft Report "EPA Regulations and Electricity: Update on Agencies' Monitoring Efforts and Coal-Fueled Generating Unit Retirements."

As noted in the report, DOE has been working with both the Environmental Protection Agency (EPA) and the Federal Energy Regulatory Commission (FERC) to monitor industry's progress in responding to the recent EPA regulations. Our three agencies have developed the coordination process referenced in the report. To date, this process has been primarily applied to industry's compliance with the Mercury and Air Toxics Standard (MATS); the process may be revisited as we work with industry to monitor compliance with other EPA regulations. We have also been meeting regularly with several independent system operators (ISOs) to monitor generator retirement and retrofit status information as well as reliability analysis updates, as described in the report. Additionally, DOE, EPA, and FERC have been meeting periodically, as needed, to coordinate efforts regarding the EPA regulations. DOE agrees that coordination between our three agencies is, and will continue to be, an important part of successfully addressing any potential reliability challenges within the electricity sector as a result of EPA's recent suite of regulations.

Additionally, DOE will continue to offer technical assistance to states and other stakeholders to help inform, rather than direct, decisions regarding implications from EPA's regulations. Technical assistance is offered through several of the DOE Offices. The report recognizes a sampling of technical assistance areas.

Finally, with respect to DOE's authority "to compel a generating unit to produce electricity in certain emergency situations" (see draft report, pg. 3), DOE would like to emphasize that this emergency authority under section 202(c) of the Federal Power Act is viewed as a tool of last resort to address reliability emergencies. Should a verifiable reliability emergency arise in the future that may involve DOE's emergency authority,

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DOE will continue to coordinate with other agencies, as appropriate, to help ensure that the emergency can be resolved in accordance with other applicable statutes and regulations.

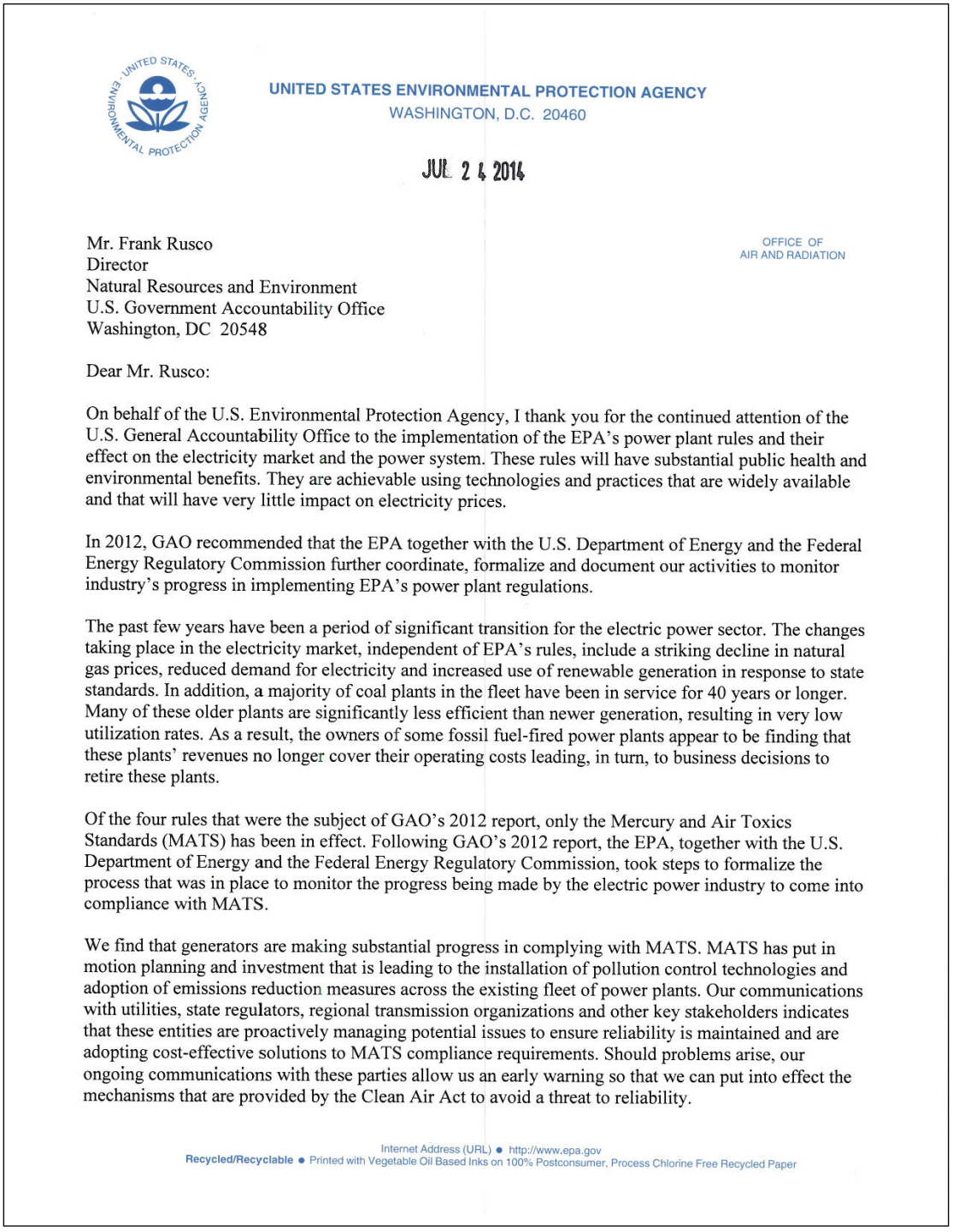
Thank you again for the opportunity to provide comment on the draft report. We look forward to receiving your final report.

Sincerely,

Patricia A. Hoffman

Patricia A. Hoffman
Assistant Secretary
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy

Appendix III: Comments from the Environmental Protection Agency



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 24 2014

OFFICE OF
AIR AND RADIATION

Mr. Frank Rusco
Director
Natural Resources and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Rusco:

On behalf of the U.S. Environmental Protection Agency, I thank you for the continued attention of the U.S. General Accountability Office to the implementation of the EPA's power plant rules and their effect on the electricity market and the power system. These rules will have substantial public health and environmental benefits. They are achievable using technologies and practices that are widely available and that will have very little impact on electricity prices.

In 2012, GAO recommended that the EPA together with the U.S. Department of Energy and the Federal Energy Regulatory Commission further coordinate, formalize and document our activities to monitor industry's progress in implementing EPA's power plant regulations.

The past few years have been a period of significant transition for the electric power sector. The changes taking place in the electricity market, independent of EPA's rules, include a striking decline in natural gas prices, reduced demand for electricity and increased use of renewable generation in response to state standards. In addition, a majority of coal plants in the fleet have been in service for 40 years or longer. Many of these older plants are significantly less efficient than newer generation, resulting in very low utilization rates. As a result, the owners of some fossil fuel-fired power plants appear to be finding that these plants' revenues no longer cover their operating costs leading, in turn, to business decisions to retire these plants.

Of the four rules that were the subject of GAO's 2012 report, only the Mercury and Air Toxics Standards (MATS) has been in effect. Following GAO's 2012 report, the EPA, together with the U.S. Department of Energy and the Federal Energy Regulatory Commission, took steps to formalize the process that was in place to monitor the progress being made by the electric power industry to come into compliance with MATS.

We find that generators are making substantial progress in complying with MATS. MATS has put in motion planning and investment that is leading to the installation of pollution control technologies and adoption of emissions reduction measures across the existing fleet of power plants. Our communications with utilities, state regulators, regional transmission organizations and other key stakeholders indicates that these entities are proactively managing potential issues to ensure reliability is maintained and are adopting cost-effective solutions to MATS compliance requirements. Should problems arise, our ongoing communications with these parties allow us an early warning so that we can put into effect the mechanisms that are provided by the Clean Air Act to avoid a threat to reliability.

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When the EPA promulgated MATS, the agency made clear several flexibilities beyond those in the rule itself that would help to assure that MATS Implementation would proceed without compromising the stability or reliability of the electric power grid. These include offering alternative forms for many of the emissions standards and allowing averaging among units at a plant rather than requiring that each unit meet the standards. The Clean Air Act allows permitting authorities (usually state environmental agencies) to grant an additional year for compliance when it is needed. The EPA reached out to state permitting authorities to assure that an additional year would be broadly available. To date, managers at over 100 generating units have asked for the additional year. In almost all cases those requests have been granted.

In addition, the EPA provided a clear pathway for units that are shown to be critical for electric reliability to obtain a schedule to achieve compliance within up to an additional year beyond the four years mentioned above. This pathway is set forth in a policy memorandum from EPA's Office of Enforcement and Compliance Assurance.[1] So far there have been no formal requests for this flexibility, but we are monitoring the potential need.

The other power sector rules that GAO considered in the 2012 report do not require as extensive an investment in as limited a timeframe as MATS required. The EPA has recently finalized the regulation on cooling water under section 316(b) of the Clean Water Act. The Cross State Air Pollution Rule is still in litigation and the Coal Combustion Residuals Rule is scheduled to become final in December. In addition the EPA has proposed a rule to limit carbon pollution from existing power plants. This rule has much flexibility in both the timing and the measures that can be used for compliance. Indeed, each state can tailor the requirements it imposes on electric generating units to suit the operational needs of its power sector. Therefore it is unlikely that there will be the same level of concern about reliability as there initially was for MATS. However, I assure you that the EPA will monitor compliance with all of these rules, as appropriate, to assure that reliability is not put at risk.

Thank you once again for your attention to this matter.

Sincerely,

Janet G. McCabe
Acting Assistant Administrator

[1] EPA Memorandum December 16, 2011. "The Environmental Protection Agency's Enforcement Response Policy For Use of Clean Air Act Section 113(a) Administrative Orders in Relation To Electric Reliability and the Mercury and Air Toxics Standard" http://www.epa.gov/compliance/resources/policies/civil/erp/mats-erp.pdf

Appendix IV: Comments from the Federal Energy Regulatory Commission

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426

July 16, 2014

OFFICE OF THE CHAIRMAN

Mr. Frank Rusco
Director
Natural Resources and Environment
United States Government Accountability Office
441 G Street, NW
Washington, D.C. 20548

Dear Mr. Rusco:

Thank you for your July 2, 2014, electronic transmission of the draft report, *EPA Regulations and Electricity: Update on Agencies' Monitoring Efforts and Coal-Fueled Generating Unit Retirements*. I appreciate the opportunity to comment on this draft report. I agree with the draft report's observation that "reliable electricity remains critically important to U.S. homes and businesses and is itself reliant upon the availability of sufficient generating capacity."

The draft report concludes that the Federal Energy Regulatory Commission (Commission), the Department of Energy (DOE) and the Environmental Protection Agency (EPA) have taken steps to implement your recommendations to establish a joint process to monitor industry's progress in responding to four proposed or finalized EPA regulations affecting coal-fueled generating units. The draft report specifically highlights that the three agencies hold regular monthly meetings with key stakeholders that play a role in the maintenance of the reliability of the electric power system and the implementation of relevant EPA regulations, and that the Commission monitors information from several sources and has held a technical conference to obtain information on this topic. I would also like to note that the Commission and the National Association of Regulatory Utility Commissioners (NARUC) are working together to explore reliability issues stemming from new and pending environmental rules for the power sector. The FERC/ NARUC Forum on Reliability and the Environment held six meetings in plenary session at NARUC conferences. FERC and state commissioners, senior EPA officials, and industry members participated in each meeting to discuss efforts to comply with new EPA regulations (MATS, cooling water, combustion waste disposal, and 111(d)) while sustaining reliability. This effort is ongoing under the auspices of the NARUC Electricity Committee.

The draft report also concludes that continued careful monitoring and coordination by the federal agencies, incorporating the view of other stakeholders such as the RTOs, will be even more important over the next several years as the EPA regulations are implemented. I look forward to continuing to monitor the progress of industry in implementing these rules and discussing these issues with the EPA, DOE, the North American Electric Reliability Corporation, utilities, NARUC, Independent System Operators and Regional Transmission Organizations, industry, and other stakeholders.

Thank you again for the opportunity to comment on your draft report.

Sincerely,

Cheryl A. LaFleur
Acting Chairman

Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

Frank Rusco, (202) 512-3841 or ruscof@gao.gov

Staff Acknowledgments

In addition to the individual named above, Jon Ludwigson (Assistant Director), Janice Ceperich, Margaret Childs, Philip Farah, Quindi Franco, Cindy Gilbert, Richard Johnson, Armetha Liles, and Alison O'Neill made key contributions to this report.