

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 60

[EPA-HQ-OAR-2017-0545; FRL-XXXX-XX-XXX]

RIN 2060-AT67

State Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units

AGENCY: Environmental Protection Agency (EPA).

ACTION: Advance notice of proposed rulemaking.

SUMMARY: An advance notice of proposed rulemaking (ANPRM) is a notice intended to solicit information from the public as the Environmental Protection Agency (EPA) considers proposing a future rule. In this ANPRM, the EPA is considering proposing emission guidelines to limit greenhouse gas (GHG) emissions from existing electric utility generating units (EGUs) and is soliciting information on the proper respective roles of the state and federal governments in that process, as well as information on systems of emission reduction that are applicable at or to an existing EGU, information on compliance measures, and information on state planning requirements under the Clean Air Act (CAA). This ANPRM does not propose any regulatory requirements.

DATES: Comments must be received on or before **[Insert date 60 days after date of publication in the Federal Register]**.

ADDRESSES: *Comments.* Submit your comments, identified by Docket ID No. EPA-HQ-OAR-2017-0545, at <http://www.regulations.gov>. Follow the online instructions for submitting comments. Once submitted, comments cannot be edited or removed from Regulations.gov. The EPA may publish any comment received to its public docket. Do not submit electronically any

information you consider to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Multimedia submissions (audio, video, *etc.*) must be accompanied by a written comment. The written comment is considered the official comment and should include discussion of all points you wish to make. The EPA will generally not consider comments or comment contents located outside of the primary submission (*i.e.*, on the Web, cloud, or other file sharing system).

Comments may also be submitted by mail. Send your comments to: EPA Docket Center, U.S. EPA, Mail Code 28221T, 1200 Pennsylvania Ave. NW, Washington, DC 20460, Attn: Docket No. ID EPA–HQ–OAR–2017–0545.

For additional submission methods, the full EPA public comment policy, information about CBI or multimedia submissions, and general guidance on making effective comments, please visit <https://www.epa.gov/dockets/commenting-epa-dockets>.

Instructions. Direct your comments on the proposed rule to Docket ID No. EPA–HQ–OAR–2017–0545. The EPA’s policy is that all comments received will be included in the public docket and may be made available online at <http://www.regulations.gov>, including any personal information provided, unless the comment includes information claimed to be CBI or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through <http://www.regulations.gov> or email. The <http://www.regulations.gov> Web site is an “anonymous access” system, which means the EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an email comment directly to the EPA without going through <http://www.regulations.gov>, your email address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you

submit an electronic comment, the EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD-ROM you submit. If the EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, the EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses.

Docket. The EPA has established a new docket for this action under Docket ID No. EPA-HQ-OAR-2017-0545. The EPA previously established a docket for the October 23, 2015, Clean Power Plan (CPP) under Docket ID No. EPA-HQ-OAR-2013-0602. All documents in the docket are listed in the <http://www.regulations.gov> index. Although listed in the index, some information is not publicly available, *e.g.*, CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy form. Publicly available docket materials are available either electronically at <http://www.regulations.gov> or in hard copy at the EPA Docket Center (EPA/DC), EPA WJC West Building, Room 3334, 1301 Constitution Ave., NW, Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the EPA Docket Center is (202) 566-1742.

FOR FURTHER INFORMATION CONTACT: Dr. Nick Hutson, Energy Strategies Group, Sector Policies and Programs Division (D243-01), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711; telephone number: (919) 541-2968; email address: hutson.nick@epa.gov.

SUPPLEMENTARY INFORMATION: *Submitting CBI.* Do not submit information that you consider to be CBI electronically through <http://www.regulations.gov> or email. Send or deliver

information identified as CBI to only the following address: OAQPS Document Control Officer (Room C404-02), Environmental Protection Agency, Research Triangle Park, North Carolina 27711; Attn: Docket ID No. EPA-HQ-OAR-2017-0545.

Clearly mark the part or all of the information that you claim to be CBI. For CBI information in a disk or CD-ROM that you mail to the EPA, mark the outside of the disk or CD-ROM as CBI and then identify electronically within the disk or CD-ROM the specific information that is claimed as CBI. In addition to one complete version of the comment that includes information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. If you submit a CD-ROM or disk that does not contain CBI, mark the outside of the disk or CD-ROM clearly that it does not contain CBI. Information marked as CBI will not be disclosed except in accordance with procedures set forth in 40 Code of Federal Regulations (CFR) part 2.

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I. General Information

A. What is the purpose of this ANPRM?

An ANPRM is an action intended to solicit information from the public in order to inform the EPA as the Agency considers proposing a future rule. In light of the proposed repeal of the CPP, 82 FR 48035 (October 16, 2017), this ANPRM focuses on considerations pertinent to a potential new rule establishing emission guidelines for GHG (likely expressed as carbon dioxide (CO₂))¹ emissions from existing EGUs. In this ANPRM, the EPA sets out and requests comment on the roles, responsibilities, and limitations of the federal government, state governments, and regulated entities in developing and implementing such a rule, and the EPA solicits information regarding the appropriate scope of such a rule and associated technologies and approaches.

¹ The air pollutants of interest in this ANPRM are GHGs. However, any emission guidelines in a potential rule likely would be expressed as guidelines to limit emissions of CO₂ as it is the primary GHG emitted from fossil fuel-fired EGUs.

B. Introduction

When an agency considers proposing a new regulation, it should inform the public of the need and statutory authority for its action. In particular, for this ANPRM, the EPA believes it appropriate to inform the public of the reasons why the Agency is considering a future rulemaking addressing greenhouse gas emissions from existing electric utility generating units. The EPA is mindful that its regulatory powers are limited to those delegated to it by Congress. Here, the Clean Air Act—as interpreted by the EPA and the federal courts, in particular the Supreme Court and the Court of Appeals for the District of Columbia Circuit—determines the scope of whatever obligation and authority the EPA may have.

When passing and amending the CAA, Congress sought to address and remedy the dangers posed by air pollution to human beings and the environment. While the text of the CAA does not reflect an explicit intent on the part of Congress to address the potential effects of elevated atmospheric GHG concentrations, the U.S. Supreme Court in *Massachusetts v. EPA*, 549 U.S. 497 (2007), concluded that Congress had drafted the CAA broadly enough so that GHGs constituted air pollutants within the meaning of the CAA. Based on this decision, the EPA subsequently determined that emissions of GHGs from new motor vehicles cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare. This determination required the EPA to regulate GHG emissions from motor vehicles.

Thereafter, the EPA moved to regulate GHG emissions from two types of stationary sources: fossil fuel-fired electric utility steam generating units and fossil fuel-fired stationary combustion turbines (collectively, EGUs). Under CAA section 111(b) the EPA Administrator is required to list a category of stationary sources and adopt regulations establishing standards of performance for that category “if in his judgment [the category of sources] causes, or contributes

significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare.” 42 U.S.C. § 7411(b)(1)(A).

In October 2015, the EPA promulgated standards of performance for new fossil fuel-fired EGUs. 80 FR 64510 (October 23, 2015). The EPA took the position that no new or separate endangerment finding was necessary, explaining that “[u]nder the plain language of CAA section 111(b)(1)(A), an endangerment finding is required only to list a source category,” *id.* at 64529-30, and that such a finding had already been made for the fossil fuel-fired EGU source categories many years before. Further, the EPA stated that “section 111(b)(1)(A) does not provide that an endangerment finding is made as to specific pollutants.” *Id.* at 64530. The EPA continued that “[t]his contrasts with other CAA provisions that do require the EPA to make endangerment findings for each particular pollutant that the EPA regulates under those provisions.” *Id.* (citing CAA sections 202(a)(1), 211(c)(1), and 231(a)(2)(A)).²

Given this understanding of the CAA, the EPA disclaimed explicit reliance on the endangerment finding that it had previously made under CAA section 202(a)(1) with respect to GHG emissions from new motor vehicles for its decision to establish standards of performance for GHG emissions from EGUs. To the contrary, the EPA said, “once a source category is listed” under CAA section 111(b)(1)(A), “the CAA does not specify what pollutants should be the subject of standards from that source category.” 80 FR 64530. Rather, the EPA continued, “the statute, in section 111(b)(1)(B), simply directs the EPA to propose and then promulgate ‘...

² In response to commenters who had argued that the EPA was “required to make a new endangerment finding before it may regulate CO₂ from EGUs,” the EPA reiterated its disagreement, but then added that, “even if CAA section 111 required the EPA to make endangerment and cause-or-contribute significantly findings as prerequisites” for its CAA section 111(b) rulemaking, the “information and conclusions” set forth in the preamble accompanying the final rule “should be considered to constitute the requisite endangerment finding.” 80 FR 64530.

standards of performance for new sources within such category,” with the CAA otherwise giving no “specific direction or enumerated criteria . . . concerning what pollutants from a given source category should be the subject of standards.” *Id.* The EPA then pointed out that it had “previously interpreted [CAA section 111(b)(1)(B)] as granting it the discretion to determine which pollutants should be regulated.” *Id.* In the instant case, the EPA went on to explain, the Agency had a “rational basis for concluding that emissions of GHGs from fossil fuel-fired power plants, which are the major U.S. source of GHG air pollution, merit regulation under CAA section 111.” *Id.* While the EPA said that it was not required to make a new or separate endangerment finding, the Agency did point to the endangerment finding it had made in 2009 under CAA section 202(a)(1) as providing the “rational basis” for regulating GHG emissions from EGUs. *Id.*

By regulating GHG emissions from *new* stationary sources under CAA section 111(b), the EPA concluded that, under the regulations that the EPA had previously adopted for implementing CAA section 111(d), it triggered obligations to regulate GHG from existing sources. *See* 40 CFR § 60.22(a). Pursuant to those regulatory obligations, the EPA, simultaneously with the new-source rule, issued regulations pertaining to GHG emissions from *existing* stationary sources. It was under CAA section 111(d), a rarely used provision, that EPA issued its “Clean Power Plan.”³

³ Nothing in this ANPRM should be construed as addressing or modifying the prior findings made under titles I and II of the CAA discussed in the preceding paragraphs with respect to endangerment and the requirements under 111. The ANPRM mentions them merely to explain the genesis of the CPP. Moreover, this ANPRM does not propose any modifications to the GHG regulations on new stationary sources promulgated under CAA section 111(b). The EPA has previously announced that it is undertaking a review of those regulations, and, at the conclusion of that review, if appropriate, “will initiate proceedings to suspend, revise or rescind” those regulations. 82 FR 16330 (April 4, 2017). The EPA is not soliciting comment on those actions in this ANPRM.

After considering the statutory text, context, legislative history, and purpose, and in consideration of the EPA's historical practice under CAA section 111 as reflected in its other existing CAA section 111 regulations and of certain policy concerns, the EPA has proposed to repeal the CPP. 82 FR 48035. At the same time, the EPA continues to consider the possibility of replacing certain aspects of the CPP in coordination with a proposed revision. Therefore, this ANPRM solicits comment on what the EPA should include in a potential new existing-source regulation under CAA section 111(d), including comment on aspects of the States' and the EPA's role in that process, on the Best System of Emission Reduction (BSER) in this context under the statutory interpretation contained in the proposed repeal of the CPP, on what systems of emission reduction may be available and appropriate, and the interaction of a potential new existing-source regulation with the New Source Review (NSR) program and with New Source Performance Standards under CAA section 111(b).

Section 111(d)(1) of the CAA states that the EPA "Administrator shall prescribe regulations which shall establish a procedure . . . under which each State shall submit to the Administrator a plan which (A) establishes standards of performance for any existing source for any air pollutant . . . to which a standard of performance under this section would apply if such existing source were a new source, and (B) provides for the implementation and enforcement of such standards of performance." 42 U.S.C. § 7411(d). CAA section 111(d)(1) also requires the Administrator to "permit the State in applying a standard of performance to any particular source under a plan submitted under this paragraph to take into consideration, among other factors, the remaining useful life of the existing source to which such standard applies." *Id.*

As the plain language of the statute provides, the EPA's authorized role under section 111(d)(1) is to develop a procedure for States to establish standards of performance for existing

sources. “Section 111(d) grants a more significant role to the states in development and implementation of standards of performance than does [section 111(b)].”⁴ Indeed, the Supreme Court has acknowledged the role and authority of states under CAA section 111(d): this provision allows “each State to take the first cut at determining how best to achieve EPA emissions standards within its domain.” *Am. Elec. Power Co. v. Connecticut*, 131 S. Ct. 2527, 2539 (2011). The Court addressed the statutory framework as implemented through regulation, under which the EPA promulgates emission guidelines and the States establish performance standards: “For existing sources, EPA issues emissions guidelines; in compliance with those guidelines and subject to federal oversight, the States then issue performance standards for stationary sources within their jurisdiction, § 7411(d)(1).” *Id.* at 2537-38.

As contemplated by CAA section 111(d)(1), States possess the authority and discretion to establish appropriate standards of performance for existing sources. CAA section 111(a)(1) defines “standard of performance” as “a standard of emissions of air pollutants which reflects” what is colloquially referred to as the “Best System of Emission Reduction” or “BSER”—*i.e.*, “the degree of emission limitation achievable through the application of the *best system of emission reduction* which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.” 42 U.S.C. § 7411(a)(1) (emphasis added).

The EPA’s principal task under CAA section 111(d)(1), as implemented by the EPA’s regulations, is to publish a guideline document for use by the States, with that guideline document containing, among other things, an “emission guideline” that reflects the BSER, as

⁴ Jonas Monast, Tim Profeta, Brooks Rainey Pearson, and John Doyle, *Regulating Greenhouse Gas Emissions from Existing Sources: Section 111(d) and State Equivalency*, 42 ENVTL. L., 10206, (2012).

determined by the Agency, for the category of existing sources being regulated. *See* 40 CFR § 60.22(b) (“Guideline documents published under this section will provide information for the development of State plans, such as: . . . (5) An emission guideline that reflects the application of the best system of emission reduction (considering the cost of such reduction) that has been adequately demonstrated.”). In undertaking this task, the EPA is to specify “different emission guidelines . . . for different sizes, types, and classes of . . . facilities when costs of control, physical limitations, geographical location, or similar factors make subcategorization appropriate.” 40 CFR § 60.22(b)(5).

In short, under the EPA’s regulations implementing CAA section 111(d), the guideline document serves to “provide information for the development of state plans.” 40 CFR § 60.22(b), with the “emission guideline,” reflecting BSER as determined by the EPA, being the principal piece of information States use to develop their plans—plans which, under the statute, “establish[] standards of performance for . . . existing source[s].” 42 U.S.C. § 7411(d)(1).

Because the Clean Air Act cannot necessarily be applied to GHGs in the same manner as other pollutants, *Utility Air Regulatory Group*, 134 S. Ct. 2427, 2455 (2014) (Alito, J., concurring in part and dissenting in part), it is fortuitous that the regulations implementing CAA section 111(d) recognize that States possess considerable flexibility in developing their plans in response to the emission guideline(s) established by the EPA.⁵ 40 CFR § 60.24(c) specifies that the “emission standards” adopted by States “shall be no less stringent than the corresponding emission guideline(s)” published by the EPA. That is to say, in those circumstances where the

⁵ Subpart B of 40 CFR part 60 sets forth the procedures and requirements for States’ submittal of, and the EPA’s action on, state plans for control of designated pollutants from designated facilities under section 111(d) of the CAA (we refer to these as the “implementing regulations”).

Agency, in an exercise of discretion, chooses to make its emission guideline binding,⁶ state-adopted standards may not be less stringent than the federal emission guidelines. However, the implementing regulations also provide that, where the EPA has *not* exercised its discretion to make its emission guideline binding, States “may provide for the application of *less stringent* emissions standards,” where a State makes certain demonstrations. 40 CFR § 60.24(f) (emphasis added).⁷ Those demonstrations include a case-by-case determination that a less stringent standard is “significantly more reasonable” due to such considerations as cost of control, a physical limitation of installing necessary control equipment, and other factors specific to the facility. 40 CFR § 60.24(f).

Additionally, while CAA section 111(d)(1) clearly authorizes States to develop state plans that establish performance standards and provides States with certain discretion in determining appropriate standards, CAA section 111(d)(2) provides the EPA specifically a role with respect to such state plans. This provision requires the EPA to prescribe a plan for a State “in cases where the State fails to submit a satisfactory plan.” The EPA therefore is charged with determining whether state plans developed and submitted under section 111(d)(1) are satisfactory,” and 40 CFR § 60.27 accordingly provides timing and procedural requirements for the EPA to make such a determination. Just as guideline documents may provide information for States in developing plans that establish standards of performance, they may also provide information for EPA, particularly where EPA makes an emission guideline binding as described above, to consider when reviewing and taking action on a submitted state plan, as 40 CFR

⁶ The implementing regulations authorize the EPA to make its emission guideline binding on the States only where the EPA has specifically determined that the pollutant that is the target of regulation “may cause or contribute to endangerment of public health.” 40 CFR § 60.24(c).

⁷ States are, as a general matter, free to adopt *more* stringent standards than federal standards under CAA title I. *See* 42 U.S.C. § 7416.

§ 60.27(c) references the ability of the EPA to find a state plan as “unsatisfactory because the requirements of (the implementing regulations) have not been met.”⁸

Through this ANPRM, the EPA solicits information on multiple aspects of a potential rule that would establish emission guidelines for States to establish performance standards for GHG emissions from existing EGUs. To facilitate effective and efficient provision and review of comments, we here identify main areas in which we are soliciting comment and request that commenters include the corresponding numeric identifier(s) when providing comments. We emphasize that we are not limiting comment to these identified areas, but that we are identifying these to provide a framework and consistent approach for commenters. In the following discussion, we solicit comment on (1) the roles and responsibilities of the States and the EPA in regulating existing EGUs for GHGs. As discussed below, we are particularly interested in comment on (1a) the suitability of provisions of the EPA’s regulations that set forth the procedures and requirements for States’ submittals of, and the EPA’s action on, state plans for controlling emissions under CAA section 111, as applied in this context of regulating existing EGUs for GHG and on (1b) the extent of involvement and roles of the EPA in developing emission guidelines, including, but not limited to, providing sample state plan text, determining the BSER, considering existing or nascent duplicative state programs, and reviewing state plan submittals; the roles of the States in this endeavor, including determining the scope of most appropriate emissions standards, *e.g.*, setting unit-by-unit or broader-based standards; and joint considerations, such as the form of the emission standard, *i.e.*, rate- or mass-based, and compliance flexibilities, such as emissions averaging and trading.

⁸ *See also* 40 FR at 53343 (“If there is to be substantive review, there must be criteria for the review, and EPA believes it is desirable (if not legally required) that the criteria be made known in advance to the States, to industry, and to the general public. The emission guidelines, each of which will be subjected to public comment before final adoption, will serve this function.”).

We further solicit comment on (2) application, in the specific context of limiting GHG emissions from existing EGUs, of reading CAA section 111(a)(1) as limited to emission measures that can be applied to or at a stationary source, at the source-specific level. Note that the solicitation in this ANPRM is application- and context-specific; comments on interpreting CAA section 111(a)(1) as generally applied to CAA section 111(d) should be submitted to the docket on the CPP repeal proposal. *See* 82 FR 48035.

Under this source-specific reading of CAA section 111(a)(1), we solicit comment on (3) how to best define the BSER and develop GHG emission guidelines for existing EGUs, specifically with respect to (3a) identifying the BSER that can be implemented at the level of an affected source, including aspects related to efficiency (heat rate) improvement technologies and practices as well as other systems of emission reduction; (3b) considering whether GHG emission guidelines for existing EGUs should include presumptively approvable limits; and (3c) aspects relating to use of carbon capture and storage (CCS) as a compliance option to reduce GHG emissions. With respect to applicability of a potential rule, we solicit comment on (3d) criteria for determining affected sources and on (3e) potential subcategories and any effects on an appropriate corresponding BSER and standards.

Additionally, we solicit comment on (4) potential interactions of a possible rule limiting GHG emissions from existing EGUs with existing statutory and regulatory programs, such as New Source Review (NSR) applicability and permitting criteria and processes and impacts on state plans of New Source Performance Standards (NSPS) coverage of existing sources that undergo reconstruction or modification sufficient to trigger regulation as a new source in that federal program.

We again emphasize that we list these main areas in which we are soliciting comment only to provide a conceptual and organizational structure for providing comments and not to limit comment; we encourage provision of (5) any other comment that may assist the Agency in considering setting emission guidelines to limit GHG emissions from existing EGUs.

C. Where can I get a copy of this document?

In addition to being available in the docket, an electronic copy of this ANPRM will also be available on the Internet. Following signature by the EPA Administrator, a copy of this ANPRM will be posted at the following address: <https://www.epa.gov/Energy-Independence>. Following publication in the **Federal Register**, the EPA will post the **Federal Register** version of the ANPRM and key technical documents at this same Web site.

II. Background

In accordance with Executive Order 13783, 82 FR 16093 (March 31, 2017), the EPA has reviewed the CPP and issued a notice of proposed repeal on October 16, 2017, 82 FR 48035. As discussed in that notice, the EPA proposes a change in the legal interpretation underlying the CPP to an interpretation that is consistent with the text, context, structure, purpose, and legislative history of the CAA, as well as with the Agency's historical understanding and exercise of its statutory authority. If the proposed interpretation were to be finalized, the CPP would be repealed. 82 FR 48038-39. The EPA also explains in that proposal that the Agency is considering the scope of its legal authority to issue a potential new rule and, in this ANPRM, is soliciting information on systems of emission reduction that are in accord with the legal interpretation discussed in the CPP repeal proposal and information on potential compliance measures and state planning requirements.

III. The Statutory and Regulatory Framework under CAA Section 111(d)

A. Introduction

As discussed above, the EPA's authorized role under CAA section 111(d) is to establish a procedure under which States submit plans establishing standards of performance for existing sources, reflecting the application of the best system of emission reduction (BSER) that the EPA has determined is adequately demonstrated for the source category. Under the statute and the EPA's implementing regulations, the States have authority and discretion to establish less stringent standards where appropriate.

This ANPRM solicits comment, as specified below, on certain aspects of the proper implementation of this statutory and regulatory framework with respect to GHG emissions from existing EGUs. This ANPRM further solicits comment both on the proper application in this context of the interpretation of CAA section 111 contained in the proposed repeal of the CPP—under which a BSER is limited to measures that apply to and at individual sources, on the source-specific level—and on the EPA's proper role and responsibilities under CAA section 111 as applied to GHG emissions from existing EGUs.

B. States' Role and Responsibilities under CAA Section 111(d)

1. Designing State Plans

The implementing regulations at subpart B of 40 CFR part 60 set forth the procedures and requirements for States' submittal of, and the EPA's action on, state plans for control of designated pollutants from designated facilities under CAA section 111(d). A summary of the implementing regulations and a discussion of the basic concepts underlying them appear in the preamble published in connection with its promulgation (40 FR 53340, November 17, 1975). In brief, the implementing regulations provide that after a standard of performance applicable to emissions of a designated pollutant from new sources is promulgated, the Administrator will publish a draft guideline document containing information pertinent to the control of the same

pollutant from designated (*i.e.*, existing) facilities. The Administrator will also publish a notice of availability of the draft guideline document, and invite comments on its contents. After publication of a final guideline document for the pollutant in question, the States will have 9 months to develop and submit plans for control of that pollutant from designated facilities. Within 4 months after the date for submission of plans, the Administrator will approve or disapprove each plan (or portion thereof). If a state plan (or portion thereof) is disapproved, the Administrator will promulgate a federal plan (or portion thereof) within 6 months after the date for plan submission. These and related provisions of the implementing regulations were patterned after section 110 of the CAA and 40 CFR part 51 (concerning adoption and submittal of state implementation plans (SIPs) under CAA section 110).

As discussed in the preamble to the implementing regulations, those regulations provide certain flexibilities available to States in establishing state plans. For example, as provided in 40 CFR § 60.24, States may consider certain factors such as cost and other limitations in setting emission standards or compliance schedules. After the implementing regulations were first promulgated, CAA section 111(d) was amended to authorize States “to take into consideration, among other factors, the remaining useful life” of existing sources when applying standards to such sources. Pub. L. 95-95, § 109(b), 91 Stat. 685, 699 (August 7, 1977). The EPA solicits comment on the proper application of this provision to a potential new rule addressing GHG emissions from existing EGUs, and whether any change to that provision—or to other provisions of the implementing regulations, particularly those establishing the time frames for States to submit their plans to the EPA, for the EPA to act on those plans, and for the EPA to develop its own plan or plans in the absence of an approvable state submission, as well as criteria for approval of state plans—is warranted in the context of such a potential new rulemaking. The

EPA further solicits comment on which mechanisms, if any, presently available under CAA section 110 for SIPs may also be appropriate for the EPA to adopt and utilize in the context of state plans submitted under CAA section 111(d) (*e.g.*, conditional approvals). The EPA also solicits comment on whether any other changes to the implementing regulations are appropriate.

2. Application of Standards to Sources

Historically, the EPA has provided States with guidance on the preparation of state plans (for example, by providing model rules or sample rule language). While providing this text provides States with a clear direction in creating their state plans, the EPA understands that it may also be perceived as sending a signal of limiting flexibility and limiting the consideration of other factors that are unique to each State and situation. The EPA is soliciting comment on whether it would be beneficial to States for the EPA to provide sample state plan text as part of the development of emission guidelines.

Each State has its own unique circumstances to consider when regulating air pollution emissions from the power industry within that State. A prime example is the remaining useful life (RUL) of the State's fleet of EGUs. A State may take into account the RUL of sources within its fleet, such as how much longer an EGU will operate and how viable it is to invest in upgrades that can be applied at or to the source, when establishing emission standards as part of its state plan. These are source-specific considerations and play a role in a State evaluating the future of a fleet. The EPA solicits comment on the role of a State in setting unit-by-unit or broader emission standards for EGUs within its borders, including potential advantages of such an approach (*e.g.*, it provides flexibility to tailor standards that take into account the characteristics specific to each boiler or turbine) and potential challenges (*e.g.*, the impact that varying requirements could have on emissions and dispatch in such an interconnected system). The EPA also solicits comment on

an approach where the EPA determines what systems may constitute BSER without defining presumptive emission limits and then allows the States to set unit-by-unit or broader emission standards based on the identified BSER while considering the unique circumstances of the State and the EGU. The EPA requests more information on the burden that it would create for States to determine unit-by-unit emission standards for each EGU, for determining what the remaining useful life of a given source is and how that should impact the level of the standard and on what role subcategorization can play in the emission standard setting process.

The process that the State of North Carolina used in the development of its draft rule,⁹ in response to the CPP, may provide a useful example of a process a State could go through to determine unit-level emission standards based on technology that can be applied at or to a source.¹⁰ In that draft rule, North Carolina developed a menu of potential heat rate improvements. The State then examined these potential opportunities on a unit-by-unit basis, determined that some units had opportunities for cost-effective improvements and developed unit-specific emission standards consistent with those rates. North Carolina determined that other units did not have such opportunities (for reasons including that a given heat rate improvement opportunity was not applicable to a particular unit, that it had already been applied, or that the unit was scheduled to retire soon (*i.e.*, RUL)).

Another example of a unit-by-unit heat rate improvement analysis can be found in the final CAA section 111(b) GHG standards of performance for modified fossil fuel-fired steam generating EGUs (80 FR 64510, October 23, 2015). There, the EPA determined that the BSER for existing steam generating EGUs that trigger the modification provisions is the affected

⁹ <https://files.nc.gov/ncdeq/Air%20Quality/rules/hearing/111dRules.pdf>.

¹⁰ The EPA is not otherwise endorsing nor judging whether this draft plan was or is adequate to meet any previous or future CAA section 111(d) emission guidelines.

EGU's own best potential performance as determined by that source's historical performance. Relying on this BSER, the EPA finalized an emission standard that is based on a unit-specific emission limitation consistent with each modified unit's best 1-year historical performance and can be met through a combination of best operating practices and equipment upgrades. *See* 80 FR 64658. The EPA seeks comment on this approach to evaluate unit-specific heat rate improvement opportunities. We also seek comment on potential limitations to this approach, such as the potential for degradation of heat rate over time and the effects of changing operating conditions (*e.g.*, changing from stable baseload operations to variable load-following operations or vice-versa).

The EPA is aware that some States have already developed, or are in the process of developing, programs to limit GHG emissions from EGUs. The EPA requests comment on how these programs could interact with, or perhaps, satisfy, a potential rule under CAA section 111(d) to regulate GHG emissions from existing EGUs.

a. Rate-based and Mass-based Compliance Options and Other Potential Compliance Flexibilities

The Agency's existing CAA section 111 rules (both new-source rules under 111(b) and existing-source rules under 111(d)) are all based on emission rate standards (*e.g.*, mass of pollutant per unit of heat input or production). The potential opportunities for improvements in a unit's GHG performance seem similarly amenable to emission rate standards. The EPA requests comment on whether emission guidelines for GHG emission rate standards is all that it or the States should consider in a potential future rulemaking or whether the use of mass-based emission standards should also be considered.

In addition to the form of the emission standard, the EPA solicits comment on what factors the EPA should consider when reviewing State plans, as well as additional compliance flexibilities States should be able to employ in developing state plans. Should States be able to develop plans that allow emissions averaging? If so, should averaging be limited to units within a single facility, to units within a State, to units within an operating company, or beyond the State or company? If averaging is not limited between units in different States or between units owned by the same company, are any special requirements needed to facilitate such trading? Should mass-based trading be considered? If so, how should rate-based compliance instruments intended to meet unit-specific emission rates be translated into mass-based compliance instruments? Should rate-based trading programs be able to interact with mass-based trading programs? What considerations should States and the EPA take into account when determining appropriate implementing and enforcing measures for emission standards? The EPA requests information and feedback on all of these questions and on what limitations, if any, apply to States as they set standards.

C. The EPA's Interpretation of CAA Section 111(a)(1)

In the CPP repeal proposal, the EPA explained that the Administrator proposes to return to the traditional reading of CAA section 111(a)(1) as being limited to emission reduction measures that can be *applied to or at* a stationary source, at the source-specific level. Under this reading, such measures must be based on a physical or operational change to a building, structure, facility, or installation at that source, rather than measures that the source's owner or operator *can implement on behalf of* the source at another location. The EPA is not soliciting comment through this ANPRM on this proposed interpretation; rather, comments on interpreting CAA section 111(a)(1) should be submitted on the CPP repeal proposal. Here, the EPA is

requesting comment on how the program should be implemented assuming adoption of that proposed interpretation.

D. The EPA's Role and Responsibilities under CAA Section 111(d)

The EPA has certain responsibilities to fulfill and certain authority to act when issuing a rule under CAA section 111(d). Specifically, the EPA is required to prescribe regulations establishing a procedure under which States submit plans that establish standards of performance for existing sources and that provide for the implementation and enforcement of such standards. The EPA's regulations implementing CAA section 111(d) created a process by which the EPA issues "emission guidelines" reflecting the Administrator's judgment on the degree of control attainable with the BSER that has been adequately demonstrated for existing sources in relevant source categories. *See generally* 40 FR 53340 (November 17, 1975). The EPA has set emission guidelines consistent with this approach for five source categories under CAA section 111(d).¹¹

These earlier emission guidelines shared a number of common features or elements:

- A description of the BSER that has been adequately demonstrated based on controls or actions that could be implemented at the level of the individual source;
- A consideration of the degree of emission limitation achievable, taking into account costs and energy and environmental impacts from the application of the BSER;
- A compliance schedule;
- A level or degree of emission reductions achievable with application of the BSER;
- Rule language implementing the emission guideline; and
- Other information to facilitate the development of state plans.

¹¹ These categories are: Phosphate Fertilizer Plants, *see* 42 FR 12022 (March 1, 1977); Sulfuric Acid Plants, *see* 42 FR 55796 (October 18, 1977); Kraft Pulp Mills, *see* 44 FR 29828 (May 22, 1979); Primary Aluminum Plants, *see* 45 FR 26294 (April 17, 1980); and Municipal Solid Waste Landfills, *see* 61 FR 9905 (March 12, 1996). (Note that the Agency also finalized CAA section 111(d) emission guidelines for municipal waste combustors, *see* 56 FR 5514 (February 11, 1991); however, those rules were subsequently withdrawn and superseded by requirements under CAA section 129, *see* 60 FR 65387 (December 19, 1995)).

Once the EPA issues an emission guideline, States develop CAA section 111(d) plans establishing standards of performance for the covered sources within their borders and providing procedures for the implementation and enforcement of such standards similar to the process used for SIPs for National Ambient Air Quality Standards under CAA section 110. In accordance with CAA section 111(d)(1), state plans may—when applying a standard of performance to a particular source—“take into consideration, among other factors, the remaining useful life” of an existing source to which such standard applies. 42 U.S.C. § 7411(d)(1). The state plans are submitted to the EPA for review and approval or disapproval through notice-and-comment rulemaking. In cases where a State fails to submit a “satisfactory” plan, the EPA has authority to prescribe a plan for that State. Where a State fails to enforce an EPA-approved plan, the EPA has the authority to enforce the provisions of such a plan.

The EPA is taking comment on how best to define the BSER and to develop emission guidelines for EGUs for emissions of GHG. Specifically, we are requesting comment on the following three subjects:

- (1) Identifying the BSER that can be implemented at the level of an affected source (section IV below discusses what such a BSER might look like in more detail).
- (2) Whether emission guidelines for EGUs for emissions of GHG should include presumptively approvable limits.
- (3) How much discretion States have to depart from the EPA’s emission guidelines.

As discussed in the proposed repeal of the CPP, there have been significant changes in the power sector since the CPP was finalized. We take comment on how these changes should be factored into any analysis that the EPA does regarding determination of a BSER that can be *applied to or at* an individual source, at the source-specific level. In particular, the EPA is

interested in comment on how the EPA should consider the impact on the benefits and costs of any potential new rule from state programs to reduce GHG emissions from existing EGUs that are not federally mandated.

1. BSER

The EPA's traditional approach to establishing the BSER focused on technological or operational measures that can be applied to or at a single source. The Agency is now requesting comment on *how* to take an approach to regulating GHG from existing EGUs in line with its prior practice under CAA section 111(d) whereby it would consider only measures that can be applied at or to individual sources to develop the BSER and emission guidelines.¹² The types of measures that may be considered are discussed in more detail below in section IV.

2. Presumptively Approvable Limits

As discussed in section IV of this document, with regard to coal-fired EGUs, the potential for emission reductions at the unit-level or source-level may vary widely from unit to unit. Consequently, broadly applicable, presumptively approvable emission limitations (even at a subcategorized level) may not be appropriate for GHG emissions from EGUs. Therefore, in this ANPRM, the EPA is taking comment on an approach where the Agency defines BSER or otherwise provides emission guidelines without providing a presumptively approvable emission limitation.

IV. Available Systems of GHG Emission Reduction

The EPA has examined technologies and strategies that could potentially be applied at or to existing EGUs to reduce emissions of GHG. The Agency primarily focused on opportunities

¹² As noted above, the EPA is not soliciting comment through this ANPRM on that proposed interpretation. Rather, comments on how the EPA should interpret CAA section 111(a)(1) should be submitted to the docket for the CPP repeal proposal.

for heat rate (or efficiency) improvements at fossil fuel-fired steam generating EGUs to be a part of the BSER.

A. Heat Rate Improvements for Boilers

1. Heat Rate Improvement

Heat rate is a measure of efficiency for fossil fuel-fired EGUs. An EGU's heat rate is the amount of energy input, measured in British thermal units (Btu), required to generate one kilowatt hour (kWh) of electricity. The more efficiently an EGU operates, the lower its heat rate will be. As a result, an EGU with a lower heat rate will consume less fuel per kWh generated and emit lower amounts of GHG and other air pollutants per kWh generated as compared to a less efficient unit. An EGU's heat rate can be affected by a variety of design characteristics, site-specific factors, and operating conditions, including:

- Thermodynamic cycle of the boiler;
- Boiler and steam turbine size and design;
- Cooling system type;
- Auxiliary equipment, including pollution controls;
- Operations and maintenance;
- Fuel quality; and
- Ambient conditions.

The EPA has previously assessed the potential heat rate improvements of existing coal-fired EGUs by conducting statistical analyses using historical gross heat rate data from 2002 to 2012 for 884 coal-fired EGUs that reported both heat input and gross electricity output to the Agency in 2012.¹³ The Agency grouped the EGUs by regional interconnections—Western, Texas, and Eastern—and analyzed potential heat rate improvements within each interconnection. The results of the statistical analyses indicated that there may be significant potential for heat

¹³ Greenhouse Gas Mitigation Measures Technical Support Document (TSD), Docket ID: EPA-HQ-OAR-2013-0602-36859.

rate improvement – both regionally and nationally. However, these results represent fleet-wide average heat rate improvement. The EPA did not conduct analyses to identify heat rate improvement opportunities at the unit level, and the Agency recognizes that the fleet of U.S. fossil fuel-fired EGUs is varied in terms of size, age, fuel type, fuel usage (e.g. baseload, cycling, etc.) boiler type, *etc.* The EPA solicits comment on this statistical approach and its applicability in identifying heat rate improvement opportunities at the unit level. The EPA also is aware that many coal-fired EGUs now often operate under load following and cycling conditions. The EPA solicits comment on how best to evaluate unit level heat rate improvement opportunities while properly accounting for the effects of changes in the historical operation of such units. The EPA also invites comment on how heat rate is impacted when EGUs operate outside their design conditions and what options are available to remedy the efficiency losses these units may incur when responding to variable load demands. The EPA also requests comment on whether there are any data that the Agency should consider collecting either for the purpose of proposing emission guidelines or that could ultimately be helpful to States in developing state plans.

There are several technologies and equipment upgrades – as well as good operating and maintenance practices – that EGU owners or operators may utilize to reduce an EGU's heat rate, in particular for utility boilers. Table 1 lists some technology and equipment upgrades that owners or operators of EGUs may be able to deploy to improve heat rate. Table 2 lists some good practices that have the potential to reduce an EGU's heat rate. (Note, these lists of technologies and practices, along with their respective potential heat rate improvements, were drawn from studies listed below in Table 3.)

The EPA is seeking comment on all technologies and practices that may be implemented to improve heat rate – including, but not limited to, those listed in Tables 1 and 2. Specifically,

the Agency is interested in the availability and applicability of technologies and best operating and maintenance practices for the U.S. fossil fuel-fired EGU fleet. We are also soliciting comment on potential heat rate improvements from technologies and practices; on likely costs of deploying these technologies and the good operating and maintenance practices, including applicable planning, capital, and operating and maintenance costs; on owner and operator experiences deploying these technologies and employing these operating and maintenance practices; on barriers to or from deploying these technologies and operating and maintenance practices; and on any other technologies or operating and maintenance practices that may exist for improving heat rate, but are not reflected on these lists. The EPA solicits comments on any differences in cost or effectiveness in technologies that are due to impacts of regional or geographical considerations (*e.g.*, regional labor or materials costs).

The EPA also requests comment on the merits of differentiating between gross and net heat rate. This may be particularly important when considering the effects of part load operations (*i.e.*, *net* heat rate would include inefficiencies of the air quality control system at a part load whereas *gross* heat rate would not). The EPA explicitly requests comment on how the technologies and operating practices are potentially affected by the operation of the EGU (*e.g.*, at part load or in cycling operations).

Table 1 – Example Equipment Upgrades and Technology to Improve Heat Rates at Utility Boilers

Equipment upgrade(s)	Potential heat rate improvement
Replace materials handling motors and drives with more efficient motors and / or variable frequency drives to reduce ancillary energy consumption.	Negligible
Improve coal pulverizers to produce more finely ground coal to improve combustion efficiency.	0.52 – 2.6%
Use waste heat to dry low-grade coal and improve combustion efficiency.	N/A
Automate boiler drains to manage make-up water intake.	N/A
Improve boiler, furnace, ductwork, and pipe insulation to reduce heat loss.	N/A

Upgrade economizer to increase heat recovery.	50-100 Btu/kWh
Install a neural network and advanced sensors and controls to optimize plant station operation.	0-150 Btu/kWh
Install intelligent sootblowers to enhance furnace efficiency.	30-150 Btu/kWh
Improve seals on regenerative air pre-heaters to reduce air in-leakage and increase heat recovery.	10-40 Btu/kWh
Install sorbent injection system to reduce flue gas sulfuric acid content and allow increased energy recovery at the air heater.	50-120 Btu/kWh
Upgrade steam turbine internals to improve efficiency and replace worn seals to reduce steam leakage.	100-300 Btu/kWh; 1.5 – 5.5%
Retube the condenser to restore efficiency or expand condenser surface area to improve efficiency.	3-70 Btu/kWh; 1.0 – 3.5%
Replace feedwater pump seals to reduce water loss.	N/A
Install solar systems to pre-heat feedwater to improve efficiency.	N/A
Increase feedwater heating surface to improve efficiency.	N/A
Overhaul or upgrade boiler feedwater pumps to improve efficiency.	25-50 Btu/kWh
Replace centrifugal induced draft (ID) fans with axial ID fans.	10-50 Btu/kWh
Replace ID fan motors with variable frequency drives.	10-150 Btu/kWh
Upgrade flue-gas desulfurization components (<i>e.g.</i> , co-current spray tower quencher, turning vanes, variable frequency drives) to reduce pressure drop, improve flow distribution, and reduce ancillary energy consumption.	0-50 Btu/kWh
Upgrade the electrostatic precipitator energy system (<i>e.g.</i> , high voltage transformer/rectifier sets) to improve particulate matter capture and reduce energy consumption.	0-5 Btu/kWh
Replace older motors with more efficient motors to reduce ancillary energy consumption.	0-21 Btu/kWh
Refurbish and/or upgrade cooling tower packing material to improve cycle efficiency.	0-70 Btu/kWh
Install condenser tube cleaning system to reduce scaling, improve heat transfer and restore efficiency.	N/A

N/A = The potential heat rate improvement is unknown.

Table 2 – Example Good Practices to Improve Heat Rates at Utility Boilers

Good practice(s)	Potential heat rate improvement
Reduce excess air to improve combustion efficiency.	N/A
Optimize primary air temperature to improve combustion efficiency.	N/A
Measure and control primary and secondary air flow rates to improve combustion efficiency.	N/A
Tune individual burners (balance air/fuel ratio) to improve combustion efficiency.	N/A

Conduct more frequent condenser cleanings to maintain cycle performance.	30-70 Btu/kWh
Monitor condenser performance to track efficiency/performance.	N/A
Use secondary air for ammonia vaporization and dilution to reduce ancillary energy consumption.	0-5 Btu/kWh
Careful monitoring of the water treatment system for optimal feedwater quality and cooling water performance to reduce scale build-up and corrosion plus maintain efficiency.	N/A
Conduct maintenance of cooling towers (<i>e.g.</i> , replace missing/damaged planks) to restore cooling tower efficiency.	N/A
Chemical clean scale build-up on feedwater heaters to improve heat transfer.	N/A
Repair steam and water leaks (<i>e.g.</i> , replace valves and steam traps) to reduce makeup water consumption.	N/A
Repair boiler, furnace, ductwork, and air heater cracks to reduce air in-leakage and auxiliary energy consumption.	N/A
Clean air pre-heater to improve heat transfer.	N/A
Adopt sliding pressure operation to reduce turbine throttling losses.	N/A
Reduce attemperator activation to reduce heat input.	N/A
Clean turbine blades to remove deposits and improve turbine efficiency.	N/A
Maintain instrument calibration to ensure valid operating data.	N/A
Perform on-site appraisals to identify areas for improved heat rate performance.	N/A
Adopt training program for operating and maintenance staff on heat rate improvements.	N/A
Adopt incentive program to reward actions to improve heat rate.	N/A
Implement heat rate analytics to identify real-time heat rate deviations.	N/A
Plant lighting upgrades to reduce ancillary energy consumption.	N/A
Use predictive maintenance to avoid outages and de-rate events.	N/A

N/A = The potential heat rate improvement is unknown.

The technologies and operating and maintenance practices listed above may not be available or appropriate for all types of EGUs; and some owners or operators may have already deployed some of the technologies and/or employed some of the best operating and maintenance practices at their fossil fuel-fired EGUs. In addition, some of the technologies and operating and maintenance practices listed above might be alternatives to other actions on the list and, therefore, mutually exclusive of other technologies and practices.

Government agencies and laboratories, industry research organizations, engineering firms, equipment suppliers, and environmental organizations have conducted studies examining

the potential for improving heat rate in the U.S. EGU fleet or a subset of the fleet. Table 3 provides a list of some reports, case studies, and analyses about heat rate improvement opportunities in the U.S. The EPA is seeking comment on the appropriateness of the studies for informing our understanding of potential heat rate improvement opportunities. The EPA is also seeking information on any additional publicly available studies that identify heat rate improvement measures or demonstrate actual or potential heat rate improvements at fossil fuel-fired EGUs, including the appropriateness of the studies for establishing heat rate improvement goals.

Table 3 – Heat Rate Improvement Reports, Case Studies, and Analyses

Heat rate improvement report organization/publication (author, if known) – title – year [URL]
ABB Power Generation – Energy Efficient Design of Auxiliary Systems in Fossil-Fuel Power Plants [https://library.e.abb.com/public/5e627b842a63d389c1257b2f002c7e77/Energy%20Efficiency%20for%20Power%20Plant%20Auxiliaries-V2_0.pdf]
Alstom Engineering (Sutton) – CO ₂ Reduction Through Energy Efficiency in Coal-Fired Boilers – 2011 [http://www.mcilvaineconomy.com/Universal_Power/Subscriber/PowerDescriptionLinks/Jim%20Sutton%20-%20Alstom%20-%202013-31-2011.pdf]
Congressional Research Service (Campbell) – Increasing the Efficiency of Existing Coal-fired Power Plants (R43343) – 2013 [https://fas.org/sgp/crs/misc/R43343.pdf]
EIA – Analysis of Heat Rate Improvement Potential at Coal-Fired Power Plants – 2015 [https://www.eia.gov/analysis/studies/powerplants/heatrate/pdf/heatrate.pdf]
EPA – Greenhouse Gas Mitigation Measures – 2015 [https://www.regulations.gov/document?D=EPA-HQ-OAR-2013-0602-37114]
EPRI – Range of Applicability of Heat Rate Improvements – 2014 [https://www.epri.com/#/pages/product/000000003002003457]
European Commission – Integrated Pollution Prevention and Control Reference Document on Best Available Techniques for Large Combustion Plants – 2006 [http://eippcb.jrc.ec.europa.eu/reference/BREF/lcp_bref_0706.pdf]
GE – Comments of the General Electric Company – 2014 [https://www.regulations.gov/document?D=EPA-HQ-OAR-2013-0602-22971]
IEA (Reid) – Retrofitting Lignite Plants to Improve Efficiency and Performance (CCC/264) – 2016 [http://bookshop.iea-coal.org/reports/ccc-264/83861]
IEA (Henderson) – Upgrading and Efficiency Improvement in Coal-fired Power Plants (CCC/221) – 2013 [http://bookshop.iea-coal.org/reports/ccc-221/83186]

Lehigh University – Reducing Heat Rates of Coal-fired Power Plants – 2009 [http://www.lehigh.edu/~inenr/leu/leu_61.pdf]
NETL – Opportunities to Improve the Efficiency of Existing Coal-fired Power Plants – 2009 [http://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Publications/OpportImproveEfficExistCFPP-ReportFinal.pdf]
NETL – Improving the Thermal Efficiency of Coal-Fired Power Plants in the United States – 2010 [http://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Publications/ThermalEfficCoalFiredPowerPlants-TechWorkshopRpt.pdf]
NETL – Improving the Efficiency of Coal-Fired Power Plants for Near Term Greenhouse Gas Emissions Reductions (DOE/NETL-2010/1411) – 2010 [http://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Publications/DOE-NETL-2010-1411-ImpEfficCFPPGHGRdctns-0410.pdf]
NETL – Options for Improving the Efficiency of Existing Coal-Fired Power Plants (DOE/NETL-2013/1611) – 2014 [https://www.netl.doe.gov/energy-analyses/temp/FY14_OptionsforImprovingtheEfficiencyofExistingCoalFiredPowerPlants_040114.pdf]
National Petroleum Council – Electric Generation Efficiency – 2007 [http://www.npc.org/Study_Topic_Papers/4-DTG-ElectricEfficiency.pdf]
NRDC – Closing the Power Plant Carbon Pollution Loophole: Smart Ways the Clean Air Act Can Clean Up America’s Biggest Climate Polluters (12-11-A) – 2013 [https://www.nrdc.org/sites/default/files/pollution-standards-report.pdf]
Power Engineering International (Cox) – Dry Sorbent Injection for SO _x Emissions Control – 2017 [http://www.powerengineeringint.com/articles/print/volume-25/issue-6/features/dry-sorbent-injection-for-sox-emissions-control.html]
Power Mag (Korellis) – Coal-Fired Power Plant Heat Rate Improvement Options, Parts 1 & 2 – 2014 [http://www.powermag.com/coal-fired-power-plant-heat-rate-improvement-options-part-1/] [http://www.powermag.com/coal-fired-power-plant-heat-rate-improvement-options-part-2/]
Power Mag (Peltier) – Steam Turbine Upgrading: Low-hanging Fruit – 2006 [http://www.powermag.com/steam-turbine-upgrading-low-hanging-fruit/]
Resources for the Future (Lin <i>et al</i>) – Regulating Greenhouse Gases from Coal Power Plants Under the Clean Air Act (RFF-DP-13-05) – 2014 [http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-13-05.pdf]
S&L – Coal-fired Power Plant Heat Rate Reductions (SL-009597) – 2009 [https://www.regulations.gov/document?D=EPA-HQ-OAR-2013-0602-36895]
S&L – Coal Fired Power Plant Heat Rate Reduction – NRECA (SL-012541) - 2014 [https://www.regulations.gov/document?D=EPA-HQ-OAR-2013-0602-22767_Supp_33]
Sierra Club (Buckheit & Spiegel) – Sierra Club 52 Unit Study – 2014 [http://content.sierraclub.org/environmentallaw/sites/content.sierraclub.org.environmentallaw/files/Appendix%201%20-%20Rate%20v%20Load%20Summary.pdf]
Storm Technologies – Applying the Fundamentals for Best Heat Rate Performance of Pulverized Coal Fueled Boilers – 2009 [http://www.stormeng.com/pdf/EPRI2009HeatRateConference%20FINAL.pdf]

It has been noted that unit-level heat rate improvements, with the resulting reductions in variable operating costs at those improved EGUs, could lead to increases in utilization of those EGUs as compared to other generating options. *See generally* 80 FR 64745. This so-called “rebound effect” could result in smaller overall reductions in GHG emissions (depending on the GHG emission rates of the displaced generating capacity). The EPA solicits comments on this potential “rebound effect,” on whether the EPA should consider it in a potential future rulemaking, and on any available measures that the Agency can take to minimize any potential effect.

2. Measuring Heat Rate at Fossil Fuel-Fired EGUs

Accurately monitoring changes in heat rate is vital for assessing the degree of heat rate improvement at fossil fuel-fired EGUs. Most coal-fired EGUs already continuously monitor heat input and gross electric output and report the information to the EPA under 40 CFR part 75. To calculate heat input, coal-fired EGUs monitor the CO₂ concentration and stack volumetric flow rates. Part 75 classifies hourly CO₂ concentration and stack volumetric flow rates measurements as valid, if the continuous emissions monitoring systems’ (CEMS’) relative accuracies are within plus or minus 10 percent when compared to federal reference methods.

In 1999, the EPA introduced new federal reference methods to address angular stack flow (Methods 2F and 2G) and the effect of the stack walls on gas flow (Method 2H). In general, these alternative measurement methods reduce or eliminate the over-estimation of stack gas volumetric flow that results from the use of Method 2 when specific flow conditions (*e.g.*, angular flow) are present in the stack. Generally, the alternative methods lead to lower flow rates, and, as a result, lower heat input. After the introduction of these new methods, many coal-fired EGUs adopted the alternative methods to measure flow and calculate mass emissions.

However, coal-fired EGUs are not required to use the alternative measurement methods, and they may change methods when conducting a Relative Accuracy Test Audit (RATA).

The EPA is seeking comment on the level of uncertainty of measurement of flue gas CO₂ concentration and stack volumetric flow rate; options to reduce the uncertainty associated with CEMS at coal-fired EGUs and fuel flow monitors (40 CFR part 75, appendix D) and 40 CFR part 75, appendix G, equation G-4 at natural gas- and oil-fired EGUs; options for eliminating or revising 40 CFR part 75, appendix G, equation G-1 at natural gas- and oil-fired EGUs; and alternative approaches to accurately measure heat rate at fossil fuel-fired EGUs.

The EPA also requests comment on the need for and utility of direct heat input monitoring as EGUs generally do not monitor heat input directly, but instead calculate it from CEMS data.

B. Heat Rate Improvements at Natural Gas-fired Combustion Turbines

The EPA has also considered opportunities for emission reductions at natural gas-fired stationary combustion turbines as a part of the BSER – at both simple cycle turbines and combined cycle turbines – and previously determined that the available emission reductions would likely be too expensive or would likely provide only small overall reductions. In the development of the CAA section 111(b) standards of performance for new, modified, and reconstructed EGUs, several commenters provided information on various options that may be available to improve the efficiency of existing natural gas-fired stationary combustion turbines. *See* 80 FR 64620. Commenters – including turbine manufacturers – described specific technology upgrades for the compressor, combustor, and gas turbine components that operators of existing combustion turbines may deploy. These state-of-the-art gas path upgrades, software upgrades, and combustor upgrades can reduce GHG emissions by a significant amount. In

addition, one turbine manufacturer stated that existing combustion turbines can achieve the largest efficiency improvements by upgrading existing compressors with more advanced compressor technologies, potentially improving the combustion turbine's efficiency by an additional margin. *See* 80 FR 64620.

In addition to upgrades to the combustion turbine, the operator of a natural gas combined cycle (NGCC) unit will have the opportunity to improve the efficiency of the heat recovery steam generator and steam cycle using retrofit technologies that may reduce the GHG emissions by 1.5 to 3 percent. These include (1) steam path upgrades that can minimize aerodynamic and steam leakage losses; (2) replacement of the existing high pressure turbine stages with state-of-the-art stages capable of extracting more energy from the same steam supply; and (3) replacement of low-pressure turbine stages with larger diameter components that extract additional energy and that reduce velocities, wear, and corrosion.

The EPA seeks comment on the broad availability and applicability of any heat rate (efficiency) improvements for natural gas combustion turbine EGUs including, but not limited to, those discussed in this ANPRM. We also seek comment on the Agency's previous determination that the available GHG emission reduction opportunities would likely provide only small overall GHG reductions as compared to those from heat rate improvements at existing coal-fired EGUs. *See* 80 FR 64756.

C. Other Available Systems of GHG Emission Reduction

1. Broad Solicitation of Information on Other Available Systems of GHG Emission Reduction

The EPA is interested in obtaining information on any other systems of GHG emission reductions that may be available for consideration as the BSER for existing fossil fuel-fired EGUs. The EPA is also interested in obtaining information on available systems of emission

reduction that may not meet the criteria for consideration as the BSER (because, for example, they may not be broadly applicable), but are emission reduction options that may be considered as compliance options for individual units.

The Agency solicits information on any system of emission reduction that commenters believe to be available and applicable for reducing emissions of GHG from existing fossil fuel-fired steam-generating EGUs (*e.g.*, utility boilers and integrated gasification combined cycle (IGCC) units) and/or combustion turbines (*e.g.*, NGCC units). The Agency seeks information on all aspects of the systems of emission reduction – including the availability, applicability, technical feasibility, and the cost of any such systems of emission reduction. The EPA also seeks information on any limitations to the application of systems of emission reduction. In particular, the Agency is interested in whether there are geographic limitations to the applicability of suggested emission reduction systems. The Agency also notes that the current fleet of existing EGUs is quite diverse in terms of generating technology, size, location, age, fuel usage, and configuration. The EPA is interested in obtaining information on any limitations on the use of emission reduction systems that are due to the diverse nature of the existing fleet of EGUs. For example, are any potential emission reduction systems limited by geographic location? Are any potential systems of emission reduction limited to use with only certain fossil fuels or certain coal types?

2. Carbon Capture and Storage (CCS)¹⁴

The EPA has previously determined that CCS (or partial CCS) should not be a part of the BSER for existing fossil fuel-fired EGUs because it was significantly more expensive than

¹⁴ CCS is sometimes referred to as Carbon Capture and Sequestration. It is also sometimes referred to as CCUS or Carbon Capture Utilization and Storage (or Sequestration), where the captured CO₂ is utilized in some useful way (for example in enhanced oil recovery) before ultimate storage. In this document, we consider these terms to be interchangeable.

alternative options for reducing emissions. *See* 80 FR 64756. The EPA continues to believe that neither CCS nor partial CCS are technologies that can be considered as the BSER for existing fossil fuel-fired EGUs. However, if there is any new information regarding the availability, applicability, or technical feasibility of CCS technologies, commenters are encouraged to provide that information to the EPA.

The Agency recognizes that some companies may be interested in using CCS technology as a compliance option – especially when they are able to use the captured CO₂ in enhanced oil recovery operations (*e.g.*, the W. A. Parish Plant in Texas). The EPA solicits information on how potentially affected EGUs may utilize retrofit CCS technology as a compliance option to reduce CO₂ emissions and whether those EGUs should be allowed to participate in any intrastate or interstate trading program. The Agency also seeks information on the appropriate level of monitoring, recordkeeping, and reporting that should be required for sequestered CO₂ in such cases. In the final new source performance standards issued under CAA section 111(b), the EPA requires new fossil fuel-fired EGUs to limit CO₂ emissions and identifies partial CCS as one of the compliance options. In that final rule, any new affected EGU that uses CCS to meet the applicable CO₂ emission limit must report in accordance with 40 CFR part 98, subpart PP (Suppliers of Carbon Dioxide), and the captured CO₂ must be injected at a facility or facilities that reports in accordance with 40 CFR part 98, subpart RR (Geologic Sequestration of Carbon Dioxide). *See* 80 FR 64654 and 40 CFR 60.5555(f). Together, these requirements ensure that the amount of captured and sequestered CO₂ will be tracked as appropriate at project and national levels and that the status of the CO₂ in its geologic storage site will be monitored, including air-side monitoring and reporting. The EPA solicits comment on this approach and other alternatives

that may be used when utilizing CCS as a compliance option for meeting emission reduction requirements in a state plan.

D. EGU Source Categories and Subcategories

1. Applicability Criteria

The EPA has specified that an affected EGU is any existing fossil fuel-fired electric utility steam generating unit (*i.e.*, utility boiler or IGCC unit) or stationary combustion turbine that meets specific criteria. An affected EGU (either steam generating or stationary combustion turbine) must serve a generator capable of selling more than 25 megawatts to a utility power distribution system and have a base load heat input rating greater than 250 million Btu per hour. An affected stationary combustion turbine EGU must meet the definition of a combined cycle (*i.e.*, NGCC) or combined heat and power combustion turbine. The EPA has also specifically exempted certain EGUs from applicability, including simple cycle turbines, certain non-fossil units, and certain combined heat and power units. *See* 80 FR 64716. The EPA solicits comment on applicability criteria in a potential new rule and whether the Agency should retain the criteria and exemptions previously set forth.

2. Subcategories

CAA section 111 requires the EPA first to list source categories that may reasonably be expected to endanger public health or welfare and then to regulate new sources within each of those source categories. CAA section 111(d)(1) is silent on whether the EPA may establish subcategories for existing sources, but the EPA has interpreted this provision to authorize the EPA to exercise discretion as to whether and, if so, how to subcategorize existing sources subject to CAA section 111(d). Further, the implementing regulations under CAA section 111(d) provide that the Administrator will specify different emission guidelines or compliance times or both “for

different sizes, types, and classes of designated facilities when costs of the control, physical limitations, geographical location, or similar factors make subcategorization appropriate.”¹⁵

In previous rulemakings, the EPA has promulgated presumptive EGU-related emission standards for subcategories of sources. For example, the EPA has issued separate NSPS for sulfur dioxide (SO₂) and nitrogen oxide (NO_x) emissions from EGUs that utilize coal refuse as a subcategory of steam generating EGUs that utilize coal or other fossil fuel. *See* 77 FR 9423. The EPA has also promulgated separate standards of performance that distinguish between stationary combustion turbines that operate to serve intermediate and baseload power demand as opposed to those that operate to serve peak power demand. The EPA has also issued separate standards based on coal-type. For example, in the Mercury and Air Toxics Standards (MATS), promulgated under CAA section 112(d)(1),¹⁶ the Agency issued separate mercury emission standards for coal-fired EGUs that use lignite versus those that use non-lignite coal. The Agency, also in the MATS rule, promulgated separate emission standards for IGCC EGUs as compared to the standards issued for utility boilers. *See* 77 FR 9487. The Agency solicits comment on whether potentially affected EGU sources (*e.g.*, steam generating EGUs, stationary combustion turbines) should be grouped into categories and subcategories for purposes of identifying the BSER. Commenters are requested to provide justification for such subcategorization. For example, are emissions and emission reduction opportunities distinct for EGUs of different sizes, classes, or types – or for EGUs utilizing different types or qualities of fossil fuels? The EPA requests comment on subcategorization based on operation or utilization of the EGU – *i.e.*, based

¹⁵ 40 CFR 60.22(b)(5).

¹⁶ CAA section 112(d)(1) provides that “The Administrator may distinguish among classes, types, and sizes of sources within a category or subcategory in establishing such standards”

on whether the EGU (whether a utility boiler, an IGCC unit, or a stationary combustion turbine) is operated to serve baseload, intermediate, or peak power demand.

V. Potential Interactions with Other Regulatory Programs

A. New Source Review (NSR)

The NSR program is a preconstruction permitting program that requires stationary sources of air pollution to obtain permits prior to beginning construction. The NSR program applies both to new construction and to modifications of existing sources. New construction and modifications that emit air pollutants over certain thresholds are subject to major NSR requirements, while smaller emitting sources and modifications may be subject to minor NSR requirements.¹⁷ Major NSR permits for sources in attainment areas and for other pollutants regulated under the major source program are referred to as prevention of significant deterioration (PSD) permits, while major NSR permits for sources emitting nonattainment pollutants and located in nonattainment areas are referred to as nonattainment NSR (NNSR) permits.

Since emission guidelines that are established pursuant to CAA section 111(d) apply to units at existing sources, the interaction between CAA section 111(d) and the NSR program primarily centers around the treatment of modifications of existing sources. Generally, a major stationary source triggers major NSR permitting requirements when it undertakes a physical or operational change that would result in (1) a significant emission increase at the emissions unit, and (2) a significant net emissions increase at the source (*i.e.*, a source-wide “netting” analysis that considers emission increases and decreases occurring at the source during a

¹⁷ Major sources and certain other sources are also required by the CAA to obtain title V operating permits. While title V permits generally do not establish new emissions limits, they consolidate requirements under the CAA into a comprehensive air permit.

contemporaneous period). *See, e.g.*, 40 CFR 52.21(b)(2)(i). NSR regulations define what emissions rate on an annual tonnage basis constitutes “significant” for NSR pollutants. *See, e.g.*, 40 CFR 52.21(b)(23).¹⁸ For example, an increase in emissions is “significant” for NO_x when it is at least 40 tons per year. To calculate the emissions increase from a project, the “projected actual emissions” (PAE) are compared to the “baseline actual emissions” (BAE). For EGUs, the PAE is the maximum annual rate (tons per year) that the modified unit is projected to emit a pollutant in any one of the 5 years (or 10 years if the design capacity increases) after the project, excluding any increase in emissions that (1) is unrelated to the project, and (2) could have been accommodated during the baseline period (commonly referred to as the “demand growth exclusion”). The BAE for an EGU is the average annual rate of actual emissions during any 2-year period within the last 5 years.

If a physical or operational change triggers the requirements of the major NSR program, the source must obtain a permit prior to making the change. The pollutant(s) at issue and the air quality designation of the area where the facility is located or proposed to be built determine the specific permitting requirements. The CAA requires sources to meet emission limits based on Best Available Control Technology (BACT) for PSD permits and Lowest Achievable Emissions Rate (LAER) for NNSR permits. CAA sections 165(a)(4), 173(a)(2). These technology

¹⁸ In the case of GHGs, EPA regulations currently do not have a “significant” emissions rate. Under existing regulations, a major source would trigger PSD permitting requirements for GHG if it undergoes a modification that results in a significant increase in the emissions of a pollutant other than GHGs and a GHG emissions increase of 75,000 tons per year of carbon dioxide equivalent (CO₂e) as well as a GHG emissions increase (*i.e.*, anything above zero) on a mass basis. In proposing a significant emissions rate for GHG, the EPA has proposed to remove the mass-based component of the NSR emissions test for GHG. *See* 81 FR 68110 (October 3, 2016). Furthermore, in *URG v. EPA*, 134 S. Ct. 2427 (June 23, 2014), the U.S. Supreme Court held that an increase in GHG emissions alone cannot by law trigger the NSR requirements of the PSD program under section 165 of the CAA. Thus, unlike other NSR pollutants, a modification that increases only GHG emissions above the applicable level will not trigger the requirement to obtain a PSD permit.

requirements for major NSR permits are not predetermined by a rule or state plan, but are case-specific decisions made by the permitting agency. Other requirements to obtain a major NSR permit vary depending on whether it is a PSD or NNSR permit and a State or a federal permit action.

New sources and modifications that do not require a major NSR permit generally require a minor NSR permit prior to construction. Minor NSR permits are almost exclusively issued by state and local air agencies, and since the CAA is less prescriptive regarding requirements for these permits, agencies have more flexibility to design their own programs.

The EPA's regulations offer flexible permitting approaches that enable sources undergoing modifications to avoid triggering major NSR. In the case of Plantwide Applicability Limits (PALs), a source that plans to make modifications to its emission units can avoid major NSR requirements as long as it obtains a PAL permit and operates within the source-wide emissions cap of the PAL. *See, e.g.*, 40 CFR 52.21(aa). In addition, sources can take enforceable limits on hours of operation in order to avoid triggering major NSR requirements that would otherwise apply to the source. Specifically, a source may voluntarily obtain a synthetic minor source limitation – *i.e.*, a legally and practicably enforceable restriction that has the effect of limiting emissions below the relevant major source level – to avoid triggering major NSR requirements.

Over the years, some stakeholders have expressed concerns that NSR regulations do not adequately allow for some sources to undertake changes to improve their operational efficiency without being “penalized” by having to get a major NSR permit. In the context of EGUs, stakeholders have asserted that heat rate improvement projects could result in greater unit availability and increase in dispatching, which under the NSR program might translate into

projected increases in emissions that trigger major NSR permitting. Stakeholders have raised similar concerns regarding modifying an EGU facility to enable co-firing of natural gas or other lower-emitting fuels.

The EPA received a number of similarly focused comments following proposal of the CPP. Specifically, commenters contended that, if an air agency, as part of its plan to comply with emission guidelines established pursuant to CAA section 111(d), requires a source to make modifications (*e.g.*, heat rate improvement projects), it could potentially trigger major NSR requirements. Commenters added that the EPA has previously taken enforcement action against sources making such modifications without getting a major NSR permit.

Since this ANPRM solicits input on a possible rule that is based on actions that could be implemented at the level of an individual source, we are again inviting comment from interested stakeholders on the topic of how the NSR program overlays with emission guidelines established under CAA section 111(d). We are interested in actions that can be taken to harmonize and streamline the NSR applicability and/or the NSR permitting process with a potential new rule.

We invite comment on the following questions:

1. Under what scenarios would EGUs be potentially subject to the requirements of the NSR program as a result of making physical or operational changes that are part of a strategy for regulating existing sources under CAA section 111(d)? Do the scenarios differ depending on site specific factors, such as the size or class of EGU, how the EGU operates (*e.g.*, baseload, intermediate, load following), fuel(s) the EGU burns, or the EGU's existing level of pollution control? If so, please explain the differences.
2. What rule or policy changes or flexibilities can the EPA provide as part of the NSR program that would enable EGUs to implement projects required under a CAA section 111(d) plan and not trigger major NSR permitting while maintaining environmental protections?
3. What actions can sources take – *e.g.*, through the minor NSR program, agreeing to a PAL – when making heat rate improvements or co-firing with a lower emitting fuel that would allow them to continue to serve the demand of the grid while not having excessive permitting requirements?

4. What approaches could be used in crafting CAA section 111(d) plans so as to reduce the number of existing sources that will be subject to NSR permitting? Do compliance measures, such as inter- and intra-state trading systems, rate-based or mass-based standards, or generation shifting to lower- or zero-emitting units, offer favorable solutions for air agencies and sources with regard to NSR permitting?
5. What other approaches would minimize the impact of the NSR program on the implementation of a performance standard for EGU sources under CAA section 111(d)?

B. New Source Performance Standards (NSPS)

The EPA solicits comment on whether there are any potential interactions between a state-based program under CAA section 111(d) covering existing fossil fuel-fired EGUs and a federal program under CAA section 111(b) covering newly constructed, reconstructed, and modified fossil fuel-fired EGUs. In particular, the EPA requests information on how an existing EGU covered under a CAA section 111(d) state plan might affect the state plan (or an interstate trading program) if the EGU undergoes a reconstruction or modification (as defined under CAA 111(b)).

VI. Statutory and Executive Order Reviews

Under Executive Order 12866, titled Regulatory Planning and Review (58 FR 51735, October 4, 1993), this is a “significant regulatory action.” Accordingly, the EPA submitted this action to the Office of Management and Budget (OMB) for review under Executive Order 12866

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and any changes made in response to OMB recommendations have been documented in the docket for this action. Because this action does not propose or impose any requirements, and instead seeks comments and suggestions for the Agency to consider in possibly developing a subsequent proposed rule, the various statutes and Executive Orders that normally apply to rulemaking do not apply in this case. Should the EPA subsequently determine to pursue a rulemaking, the EPA will address the statutes and Executive Orders as applicable to that rulemaking.

Dated:

E. Scott Pruitt,
Administrator.