

**Comments of the Natural Resources  
Defense Council on EPA's Proposed  
Emission Guidelines for Greenhouse Gas  
Emissions From Existing Electric Utility  
Generating Units; Revisions to Emission  
Guideline Implementing Regulations;  
Revisions to New Source Review Program**

**Docket No. EPA-HQ-OAR-2017-0355**

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The Natural Resources Defense Council (NRDC) submits the following comments on EPA's proposed rule "Emission Guidelines for Greenhouse Gas Emissions From Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program," 83 Fed. Reg. 44,746 (Aug. 31, 2018). NRDC has also submitted joint comments on this proposal with other environmental and public health organizations.

NRDC is a national nonprofit environmental organization representing more than three million members and online activists. NRDC uses law, science, and the support of its members to ensure a safe and healthy environment for all living things. One of NRDC's top priorities is to reduce emissions of the air pollutants that are causing climate change.

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Attachment 1: Comments of the Natural Resources Defense Council on EPA's Proposed Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (Apr. 26, 2018), Docket No. EPA-HQ-OAR-2017-0355-20348

Attachment 2: Comments of the Natural Resources Defense Council on EPA's Advance Notice of Proposed Rulemaking: State Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units (Feb. 26, 2018), Docket No. EPA-HQ-OAR-2017-0545-0358

## I. Introduction

The Clean Power Plan placed the first-ever limits on emissions of dangerous carbon pollution from existing power plants.<sup>1</sup> NRDC has long supported the Clean Power Plan as a critical step toward reducing the threat of climate change to our communities.<sup>2</sup>

We are already experiencing severe effects of climate change across the country, as hurricanes batter our coasts, extreme heat bakes our cities, and wildfires rage through our forests.<sup>3</sup> The recent Special Report by the Intergovernmental Panel on Climate Change underscores the urgency of action to avert the worst climate change risks. Avoiding irreversible, disruptive, and unmanageable climate change impacts will require “deep emissions reductions in all sectors,” including the power sector, within the next decade and through the middle of this century.<sup>4</sup>

Ignoring this reality, the Trump EPA has: proposed an outright repeal of the Clean Power Plan;<sup>5</sup> initiated an Advance Notice of Proposed Rulemaking to consider whether to issue a replacement rule at all;<sup>6</sup> and finally proposed the so-called “Affordable Clean Energy Rule”<sup>7</sup> – a proposal neither affordable nor clean, which EPA itself estimates actually *increase* pollution and end up costing *more* than the Clean Power Plan. Indeed, EPA’s own estimates conclude that the proposal could cause up to 1,630 early deaths per year in 2030.

NRDC strongly opposes the Trump EPA’s ongoing effort to dismantle the Clean Power Plan and replace it with a rule intended to produce only minor reductions in carbon pollution, if any at all.

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<sup>1</sup> EPA, *Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, 80 Fed. Reg. 64,662 (Oct. 23, 2015).

<sup>2</sup> See, e.g., NRDC Comments on Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (Dec. 1, 2014), Docket No. EPA-HQ-OAR-2013-0602-26818; NRDC Comments on Federal Plan Requirements for Greenhouse Gas Emissions from Electric Utility Generating Units (Jan. 21, 2016), Docket No. EPA-HQ-OAR-2015-0199-0863.

<sup>3</sup> U.S. Global Change Research Program, *Climate Science Special Report: Fourth National Climate Assessment* (2017), [https://science2017.globalchange.gov/downloads/CSSR2017\\_FullReport.pdf](https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf); U.S. Global Change Research Program, *Climate Change Impacts in the United States: The Third National Climate Assessment* (2014), <https://nca2014.globalchange.gov/report>.

<sup>4</sup> IPCC, *Special Report on Global Warming of 1.5°C, Summary for Policymakers* at SPM-21 (Oct. 6, 2018), <http://www.ipcc.ch/report/sr15/>.

<sup>5</sup> EPA, *Proposed Rule: Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Source: Electric Utility Generating Units*, 82 Fed. Reg. 48,035 (Oct. 16, 2017) (“Repeal Proposal”).

<sup>6</sup> EPA, *Advance Notice of Proposed Rulemaking: State Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units*, 82 Fed. Reg. 61,507 (Dec. 28, 2017) (“Replacement ANPR”).

<sup>7</sup> EPA, *Proposed Rule: Emission Guidelines for Greenhouse Gas Emissions From Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program*, 83 Fed. Reg. 44,746 (Aug. 31, 2018) (“ACE Proposal”).

NRDC has previously submitted our own public hearing testimony<sup>8</sup> and public comments,<sup>9</sup> and joint comments with a coalition of public health and environmental organizations,<sup>10</sup> detailing the flaws in the Repeal Proposal. We also submitted individual<sup>11</sup> and joint<sup>12</sup> comments providing extensive input on the questions raised in the Replacement ANPR.

In these comments we first describe in Part II why the ACE Proposal fails to meet EPA's Clean Air Act obligation to determine the best system of emission reduction and set the level of emission reduction achievable through that system. In Part III we explain that the ACE Proposal does not justify the repeal and replacement of the Clean Power Plan because it fails to demonstrate that the Clean Power Plan is prohibited by or an unreasonable interpretation of the Clean Air Act – instead, as we show, the Clean Power Plan should be updated based on current data to achieve significant emission reductions. In Part IV we explain that, even under the ACE Proposal's flawed legal interpretation, the proposed heat-rate-improvement-only approach is insufficient to comprise the best system of emission reduction and EPA unreasonably excludes other source-specific emission reduction measures that could achieve greater reductions at reasonable cost. In Part V we describe how EPA fails to consider the power sector-wide effects of the ACE Proposal. Finally, we note that NRDC has submitted additional comments jointly with other public health and environmental organizations.<sup>13</sup>

NRDC urges Administrator Wheeler to withdraw this ACE Proposal and the Repeal Proposal, and instead direct EPA's efforts toward strengthening the Clean Power Plan.

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<sup>8</sup> See, e.g., Testimony of David Doniger on the Proposed Repeal and Replacement of the Clean Power Plan (Oct. 1, 2018), Docket No. EPA-HQ-OAR-2017-0355-22159.

<sup>9</sup> Comments of the Natural Resources Defense Council on EPA's Proposed Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (Apr. 26, 2018), Docket No. EPA-HQ-OAR-2017-0355-20348 (Attachment 1) ("NRDC Repeal Comments").

<sup>10</sup> Joint Comments of Health, Environmental, and Conservation Groups on EPA's Proposed Rule: Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (Apr. 26, 2018), Docket No. EPA-HQ-OAR-2017-0355-20656 ("Joint CPP Repeal Comments").

<sup>11</sup> Comments of the Natural Resources Defense Council on EPA's Advance Notice of Proposed Rulemaking: State Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units (Feb. 26, 2018), Docket No. EPA-HQ-OAR-2017-0545-0358 (Attachment 2) ("NRDC ANPR Comments").

<sup>12</sup> Joint Comments of Environmental and Public Health Organizations on Advance Notice of Proposed Rulemaking Regarding Emission Guidelines for Existing Electric Utility Generating Units (Feb. 26, 2018), Docket No. EPA-HQ-OAR-2017-0545-0298 ("Joint ANPR Comments").

<sup>13</sup> Joint Comments of Environmental and Public Health Organizations on the Best System of Emission Reduction and Other Issues ("Joint Environmental Comments on BSER Issues"); Joint Comments of Environmental and Public Health Organizations on Proposed Revisions to the Section 111(d) Framework Regulations ("Joint Environmental Comments on Framework Regulations"); Comments of Public Health and Environmental Organizations on the Proposed Amendments to the New Source Review Regulations ("Joint Environmental Comments on NSR Issues"); Joint Comments of Environmental and Public Health Organizations on the Regulatory Impact Analysis ("Joint Environmental Comments on RIA Issues"); Comments of Environmental and Public Health Organizations Concerning Climate Science and Climate Change; Comments of Clean Air Task Force and NRDC on Carbon Capture and Sequestration ("Joint CCS Comments"); Joint Comments on the Treatment of Biomass-Based Power Generation. All joint comments will be submitted Oct. 31, 2018 to Docket No. EPA-HQ-OAR-2017-0355.

## **II. EPA must set the level of emission reduction achievable through the “best” system, at reasonable cost.**

Under Clean Air Act section 111(d) and EPA’s longstanding regulations, EPA issues an emission guideline pursuant to which states may submit plans that “establish standards of performance for any existing source.”<sup>14</sup> Such standards of performance must “reflect[] the degree of emission limitation achievable through the application of the best system of emission reduction” that “the Administrator determines has been adequately demonstrated,” considering costs, energy requirements, and other enumerated factors.<sup>15</sup>

The interpretation of “best system of emission reduction” (BSER) advanced in the Repeal Proposal and ACE Proposal is not compelled by the language of the Clean Air Act, nor is it even a reasonable construction that language. Determining the *best* system requires consideration of the full range of emission reduction techniques that are reasonably encompassed in the terms “best system of emission reduction,” including those used in the Clean Power Plan, and the selection of the option that most reduces dangerous carbon pollution at reasonable cost.

### **A. EPA’s constrained proposed interpretation of BSER misreads the statute.**

The constrained interpretation of “best system of emission reduction” (BSER) offered in the Repeal Proposal and reiterated in the ACE Proposal – that BSER is “limited to emission reduction measures that can be applied to or at an individual stationary source”<sup>16</sup> – is simply not mandated by the statute. As we have argued in prior comments, EPA’s proposed interpretation is neither compelled by the Clean Air Act nor a permissible or reasonable construction of the statutory language.<sup>17</sup>

A more flexible conception of BSER is consistent with the language of the statute, with the structure and operational characteristics the electric power industry, and with the most efficient and effective solutions to that industry’s contribution to climate-endangering pollution. The relevant terms of sections 111(a)(1) and 111(d) are broad enough to encompass a wide range of measures to reduce emissions from sources, including those employed by the Clean Power Plan. Indeed, Congress declined to enact terms more restrictive than “best system of emission reduction,” and instead intended to provide EPA with discretion to identify strategies for reducing air pollution from existing sources.<sup>18</sup> The 1977 Clean Air Act Amendments revised section 111(d)(1) to require states to adopt “standards of performance” based on the “best system of continuous emission reduction” and to further require consideration of “nonair quality health

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<sup>14</sup> 42 U.S.C. § 7411(d); 40 C.F.R. § 60.22(b)(5).

<sup>15</sup> 42 U.S.C. § 7411(a)(1).

<sup>16</sup> 82 Fed. Reg. at 48,039; 83 Fed. Reg. at 44,748.

<sup>17</sup> NRDC Repeal Comments at 2-20; Joint Repeal Comments at 12-23; NRDC ANPR Comments at 2-7; Joint ANPR Comments at 3-4.

<sup>18</sup> NRDC Repeal Comments at 6-8.

and environmental impact and energy requirements.”<sup>19</sup> In 1990, Congress restored the definition of “standard of performance” to the definition agreed to in the 1970 Amendments – the “best system of emission reduction” that is “adequately demonstrated” – but retained the requirement to consider environmental impacts and energy requirements as added in 1977.<sup>20</sup> Congress retained the definition of “technological system of continuous emission reduction,” which continues to be used for *new* sources under other subsections of section 111, but this narrower definition is not and has not been used to limit the emission reduction measures EPA may consider for *existing* sources.<sup>21</sup>

EPA’s prior regulatory practice reflects the discretion Congress afforded the agency. EPA has in the past employed a variety of strategies – including trading or averaging measures – as part of a system of emission reduction for power plants under section 111 and in other Clean Air Act contexts.<sup>22</sup> Thus there are a variety of legally permissible “systems” of emission reduction available, against which EPA must justify its proposed constrained interpretation.

### **B. EPA must choose the best system and set the required level of emission reduction that reflects its application.**

EPA must consider the range of emission reductions achievable at reasonable cost through the variety of ways to define possible systems of emission reduction. EPA must then choose the *best* system: the most environmentally protective at reasonable cost. Then, EPA must set the level of the standard of performance—a numerical emission rate or quantity—that reflects the degree of emission reduction achievable by the BSER. To meet these requirements, EPA must engage in a factual assessment of the costs of reduction and the magnitude and benefits of possible reductions—including both direct benefits and co-benefits of reducing power plant emissions—under a range of possible definitions of the best system of emission reduction.<sup>23</sup>

In the ACE Proposal, EPA has entirely failed to conduct the necessary analysis to justify its proposed heat-rate-improvement-only BSER. To justify the ACE Proposal BSER as better than

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<sup>19</sup> Clean Air Act Amendments of 1977, Pub. L. No. 95-95 § 109(c), 91 Stat. 685, 699-700. Congress clarified that “standards in the Section 111(d) state plan would be based on the best available means (not necessarily technological) for categories of existing sources to reduce emissions” to distinguish the broader basis for existing source standards from the narrower requirements for new source standards. H.R. Rep. No. 95-294 (May 12, 1977), *reprinted in* 1977 Clean Air Act Legis. Hist. at 2662; Sen. Muskie, S. Consideration of the H.R. Conf. Rep. No. 95-564 (Aug. 4, 1977), *reprinted in* 1977 Clean Air Act Legis. Hist. at 353.

<sup>20</sup> Clean Air Act Amendments of 1990, Pub. L. No. 101-549 § 403, 104 Stat. 2399, 2631.

<sup>21</sup> *See* 42 U.S.C. §§ 7411(a)(7), (h), (j).

<sup>22</sup> *Id.* at 8-10; *see also* Richard L. Revesz et al., *Familiar Territory: A Survey of Legal Precedents for the Clean Power Plan*, 46 *Envtl. L. Rep.* 10,190 (2016), [https://policyintegrity.org/files/publications/Familiar\\_Territory\\_ELR.pdf](https://policyintegrity.org/files/publications/Familiar_Territory_ELR.pdf).

<sup>23</sup> *See Sierra Club v. Costle*, 657 F.2d at 326 (quantity of emission reductions is an important factor in determining “best” system of emissions reduction); *see also Michigan v. EPA*, 135 S. Ct. 2699, 2707 (2015) (“reasonable regulation ordinarily requires paying attention to the advantages *and* the disadvantages of agency decisions”); *Lignite Energy Council v. EPA*, 198 F.3d 930, 933 (D.C. Cir. 1978) (EPA’s balancing of section 111 factors upheld unless costs are “exorbitant”).

the Clean Power Plan’s requires the Administrator to measure and compare the results achievable under two interpretations against the statutory factors enumerated in Section 111 and the core purposes of the Clean Air Act.<sup>24</sup> That comparison must take into account the massive factual record on the dangers posed by power plant pollution, on how the power sector actually functions, and on the benefits and costs of reducing that pollution. And as discussed in Part IV below, the ACE Proposal did not even adequately analyze the emission reductions and control costs that could be achieved within the artificially constrained structure of the proposed BSER, by using other well-demonstrated measures that clearly fit within an “applied to” or “at” approach. EPA’s selection of minimal heat-rate improvements as the “best” system despite the variety of other adequately demonstrated measures that would achieve greater emission reductions at reasonable cost is unlawful and arbitrary.

In addition, the ACE Proposal fails to establish any required standard of performance—the required level of emission reduction that reflects application of the best system. Instead, the ACE Proposal identifies a “list of ‘candidate technologies’ of HRI measures” for the states to consider.<sup>25</sup> As discussed at length in joint comments with other environmental and public health organizations, this violates EPA’s statutory obligation to specify the degree of emission limitation achievable through application of the BSER and cedes EPA’s regulatory authority entirely to the states.<sup>26</sup>

### **III. The flexible approach embodied in the Clean Power Plan remains the *best* system of emission reduction**

Both the ACE Proposal and the Repeal Proposal fail to demonstrate that the language of the Clean Air Act unambiguously precludes the Clean Power Plan or that the Plan represents an impermissible construction of the statute.<sup>27</sup> On the contrary, the Clean Power Plan fits comfortably within the ordinary meaning of “best system of emission reduction” and plainly sets emission limits “for” and “applicable to” each source.<sup>28</sup> The Clean Power Plan BSER is an

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<sup>24</sup> See *Peter Pan Bus Lines*, 471 F.3d at 1354 (“*Chevron* step 2 deference is reserved for those instances when an agency recognizes that the Congress's intent is not plain from the statute’s face. ‘In precisely those kinds of cases, it is incumbent upon the agency not to rest simply on its parsing of the statutory language’ — ‘[i]t must bring its experience and expertise to bear in light of competing interests at stake.’” (quoting *PDK Laboratories, Inc. v. DEA*, 362 F.3d 786, 797-98 (D.C. Cir. 2004))); *General Am. Transp. Corp. v. ICC*, 872 F.2d 1048, 1053 (D.C. Cir. 1989) (review of reasonable statutory construction and arbitrary and capricious review both require determination of whether agency has “rationally considered the factors deemed relevant by the Act.”).

<sup>25</sup> 83 Fed. Reg. at 44,756.

<sup>26</sup> See Joint Environmental Comments on BSER Issues; Joint Environmental Comments on Framework Regulations.

<sup>27</sup> *Chevron, U.S.A. v. Natural Res. Def. Council, Inc.*, 467 U.S. 837, 842-43 (1984) (“If the intent of Congress is clear . . . the court, as well as the agency, must give effect to the unambiguously expressed intent of Congress,” but where the statute is “silent or ambiguous with respect to the specific issue,” courts defer to agency interpretation “based on a permissible construction of the statute.”); see also *Peter Pan Bus Lines, Inc. v. Federal Motor Carrier Safety Admin.*, 471 F.3d 1350, 1354 (D.C. Cir. 2006) (“‘deference to an agency’s interpretation of a statute is not appropriate when the agency wrongly believes that such interpretation is compelled by Congress’”) (quoting *PDK Laboratories, Inc. v. DEA*, 362 F.3d 786, 798 (D.C. Cir. 2004)).

<sup>28</sup> See NRDC Repeal Comments at 4-6.



entirely reasonable exercise of EPA’s authority, employing a flexible market-based system of emission reduction that is well-demonstrated in the power sector to achieve significant emission reductions at low cost.

**A. EPA has not established that the Clean Power Plan is based on a prohibited construction of the Clean Air Act.**

The Clean Power Plan fits comfortably within the ordinary meaning of “best system of emission reduction” and plainly sets emission limits “for,” “at,” and “applicable to” each source. The Clean Power Plan’s “chief regulatory requirement” consists of two national emission performance rates—one for fossil steam plants (primarily coal units) and one for combined cycle natural gas plants—expressed in pounds of CO<sub>2</sub> emissions per megawatt-hour of generation, and phased in gradually between 2022 and 2030.<sup>29</sup> These emission limits reflect EPA’s determination of the carbon dioxide emission reductions achievable applying the best system of emission reduction, taking into account cost and the other factors enumerated in Clean Air Act section 111(a)(1). As set forth in 40 C.F.R. § 60.5790(c), each affected source may meet its applicable emissions performance rate (1) by reducing its actual emission rate, (2) by reducing its “adjusted” emission rate through the use of emission rate credits, or (3) by a combination of these measures.<sup>30</sup>

The Clean Power Plan provides that credits may be created by increasing electric generation from specified low- and zero-emitting resources.<sup>31</sup> As the rulemaking record thoroughly demonstrated, electric generating resources are interconnected through the electric grid and are managed to balance electricity supply and demand in real time.<sup>32</sup> When generation from one source increases, generation from another necessarily declines. Specifically, when low- and zero-emitting generation resources ramp up, generation from the set of affected sources as a whole necessarily declines, and this necessarily reduces CO<sub>2</sub> emissions in predictable, quantifiable amounts. The Rule establishes specific formulas, supported by the record, for how many credits are created by increasing generation from low- and zero-emitting resources.<sup>33</sup>

EPA determined that each affected source can meet its applicable emission rate by improving its heat rate, by applying credits derived from increased low- or zero-emitting generation, or by a combination of the two.<sup>34</sup> Fully consistent with Section 111(a)(1), EPA determined that these measures constituted a “system of emission reduction” – indeed, the “*best* system of emission reduction” – for existing coal- and gas-fired electricity generation sources. And with enormous record support, EPA determined that the emission rates specified for coal- and gas-fired

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<sup>29</sup> 80 Fed. Reg. at 64,811-12.

<sup>30</sup> 40 C.F.R. § 60.5790(c); 80 Fed. Reg. at 64,949.

<sup>31</sup> *See, e.g.*, 80 Fed. Reg. at 64,709.

<sup>32</sup> *See, e.g.*, 80 Fed. Reg. at 64,691-93; 64,725-26; 64,728-29.

<sup>33</sup> 80 Fed. Reg. at 64,904-07.

<sup>34</sup> 80 Fed. Reg. at 64,667.

generating units are achievable by application of this best system of emission reduction, taking into account cost and the other relevant factors enumerated in Section 111(a)(1).

**B. The definition of BSER adopted in the Clean Power Plan is a reasonable exercise of EPA’s section 111(d) authority.**

The definition of BSER adopted in the Clean Power Plan is an entirely reasonable exercise of EPA’s section 111(d) authority, and the Clean Power Plan BSER reflects the most common-sense approach to reducing carbon pollution from existing power plants.

To define the “best system of emission reduction” in the CPP, EPA took account of the unique characteristics of CO<sub>2</sub> pollution and the electric power industry.<sup>35</sup> Because CO<sub>2</sub> mixes evenly in the atmosphere, a ton of emission reductions from any plant provides equal climate benefit.<sup>36</sup> Power plants—both those that emit CO<sub>2</sub> and those that do not—are part of an interconnected electric grid and are jointly operated to supply exactly the amount of electricity demanded at any given time.<sup>37</sup> To meet a given level of electricity demand, increased generation by one plant necessarily causes decreased generation by other plants. Power companies and grid operators routinely shift generation among facilities to meet demand subject to economic and environmental constraints.<sup>38</sup>

Based on these characteristics, EPA concluded that the CO<sub>2</sub>-emitting electric generating units covered by the CPP can achieve meaningful and cost-effective emission reductions through a combination of emission-reducing actions taken at the units themselves and use of credits for emission-reducing actions taken across the electric grid. All of these actions (which EPA called “building blocks”) were already in widespread use in the power sector: improving coal unit efficiency (heat rate) (building block 1); increasing generation by existing lower-emitting units (natural gas combined cycle plants) (building block 2); and increasing generation by new zero-emitting units (e.g., wind turbines and solar plants) (building block 3).<sup>39</sup> Because power plants are interconnected and the amount of electricity produced in any hour is determined by market demand, expanding generation by lower- or zero-emitting facilities cuts emissions from higher-emitting regulated units by reducing their generation.<sup>40</sup>

EPA determined that affected coal- and gas-fired units could achieve their respective applicable performance rate by improving thermal efficiency (building block 1) and using “emission rate credits” from expanded lower-emitting or new zero-emitting generation (building blocks 2 and 3)

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<sup>35</sup> 80 Fed. Reg. at 64,723-24, 64,733-35.

<sup>36</sup> *Id.* at 64,725-26.

<sup>37</sup> *Id.* at 64,691-93.

<sup>38</sup> *Id.* at 64,728-29. *See also Fed. Energy Regulatory Comm’n v. Elec. Power Supply Ass’n*, 136 S. Ct. 760, 768 (2016) (“[E]lectricity flows...through an interconnected grid of near nationwide scope.”).

<sup>39</sup> 80 Fed. Reg. at 64,745.

<sup>40</sup> *Id.* at 64,677-78.

to reduce their “adjusted CO<sub>2</sub> emission rate” to the limit.<sup>41</sup> EPA explained that each unit has multiple ways to acquire emission rate credits: by shifting generation within a company’s portfolio, building eligible facilities, contracting for credits from another company, or purchasing credits in a trading market.<sup>42</sup> The cost advantages of a system-based approach are demonstrated through several pairs of Integrated Planning Model runs NRDC conducted, which show that a system-based approach costs as much as seventy percent less than a comparable source-specific approach.<sup>43</sup>

The CPP is fully in line with effective and lower-cost regulatory approaches EPA has employed for decades in the power industry and other sectors. For example, EPA has repeatedly used such programs to curb power plants’ interstate pollution that worsens downwind violations of public health standards. The Cross-State Air Pollution Rule established state-wide budgets for power plants’ sulfur dioxide and nitrogen oxides emissions, based in part on “increased dispatch of lower-emitting generation.”<sup>44</sup> The Supreme Court found this a “permissible, workable, and equitable interpretation” of section 110(a)(2)(D)(i).<sup>45</sup>

Likewise, EPA established limitations for power plant nitrogen oxides emissions based on a region-wide emissions trading program, and accounted for changes in dispatch.<sup>46</sup> Similarly, EPA’s Regional Haze Rule allowed states to replace source-specific emission standards with trading programs, “[i]n recognition of the control and cost efficiencies that can be achieved through trading programs.”<sup>47</sup>

### **C. The Clean Power Plan should be updated based on current data.**

Any replacement for the Clean Power Plan must account for the rapidly declining costs of emission reduction credits obtained from lower-emitting sources of energy and the accompanying market shifts that have occurred in recent years.

The Clean Power Plan established that the BSER was based on the strategies that states and industry already use to reduce carbon pollution in the power sector.<sup>48</sup> Applying that BSER, EPA set achievable emission reduction targets that the industry is already well on its way to

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<sup>41</sup> *Id.* at 64,811-12; 40 C.F.R. § 60.5790(c).

<sup>42</sup> 80 Fed. Reg. at 64,752; EPA, *Legal Memorandum Accompanying Clean Power Plan for Certain Issues* at 137-48 (hereinafter “CPP Legal Memo”).

<sup>43</sup> One pair of runs is discussed in Part IV.B.3. of this comment. A second pair of runs is discussed in the Joint Comments of CATF and NRDC on CCS at Part VI(b)(ii).

<sup>44</sup> 76 Fed. Reg. 48,208, 48,252 (Aug. 8, 2011).

<sup>45</sup> *EPA v. EME Homer City*, 134 S. Ct. 1584, 1610 (2014).

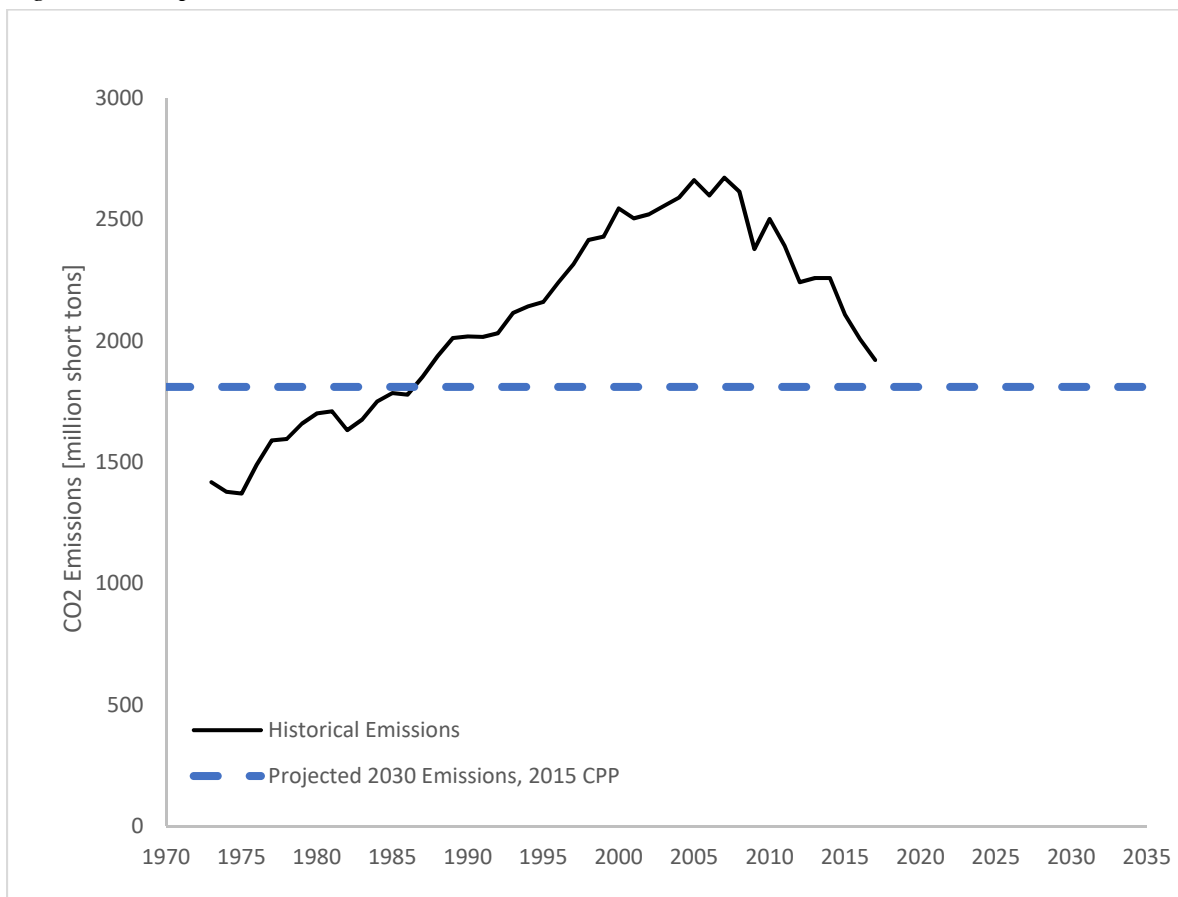
<sup>46</sup> *See* CPP Legal Memo 96, 106-08; 63 Fed. Reg. 57,356, 57,362 (Oct. 27, 1998).

<sup>47</sup> 64 Fed. Reg. 35,714, 35,739 (July 1, 1999); *see also Util. Air Regulatory Grp. v. EPA*, 471 F.3d 1333, 1336 (D.C. Cir. 2006) (affirming this approach).

<sup>48</sup> 80 Fed. Reg. at 64,727.

reaching.<sup>49</sup> The U.S. Energy Information Administration (EIA) estimates that 2017 CO<sub>2</sub> emissions in the electricity sector were 27 percent lower than 2005 levels, meaning that the power sector is already within striking distance of the 2030 Clean Power Plan goals.<sup>50</sup> The Clean Power Plan would gradually phase in the emissions limits between 2022 and 2030, and was projected to result in emissions cuts of roughly 32 percent below 2005 levels by 2030, which translates to 19 percent below 2012 levels. Since 2012 – the baseline year used to set the emissions targets – power sector carbon emissions have already fallen by 14 percent. In other words, the power sector has already achieved more than 72 percent of the cuts required by 2030 in just the past five years.

Figure 1. U.S. power sector carbon dioxide emission trends



<sup>49</sup> See e.g., EPA, *Basis for Denial of Petitions to Reconsider and Petitions to Stay the Clean Power Plan*, Appendix 1: State Progress and Trends (Jan. 11, 2017) (finding that numerous states are on track to meet their CPP obligations).

<sup>50</sup> EIA, *Monthly Energy Review*, (March 2018), <https://www.eia.gov/totalenergy/data/monthly/>; power sector carbon emissions are presented in Table 12.6, [https://www.eia.gov/totalenergy/data/monthly/pdf/sec12\\_9.pdf](https://www.eia.gov/totalenergy/data/monthly/pdf/sec12_9.pdf).

Meanwhile, the costs of compliance with the Clean Power Plan have continued to decline as the prices of lower- and zero-emitting generation have continued to drop.<sup>51</sup> The continued shift from coal to natural gas-fired generation has accelerated, and EPA’s natural gas price assumptions underlying Building Block 2 have proven to be quite conservative. Over the last several years since the Clean Power Plan was developed, natural gas prices have fallen well below forecasted levels and spawned a range of new gas price projections that are far below previous expectations.<sup>52</sup>

The costs of wind and solar technologies have also fallen dramatically in recent years, outpacing EPA’s expectations.<sup>53</sup> In many places, these zero emissions resources are out-competing fossil fuel-based electricity generation. According to the investment firm Lazard, the cost of generating power from new wind and solar projects has declined by 67 percent and 86 percent, respectively, since 2009.<sup>54</sup> In the past two years alone, according to the same analysis, the cost of wind and solar power has fallen by 17 percent and 22 percent, respectively. Even as emissions have declined, the potential to achieve cost-effective emissions reductions by shifting generation to lower-emitting sources continues to grow.

*1. CPP building blocks should be updated based on current data.*

As EPA demonstrated in the Clean Power Plan, there are a wide range of well-established means of reducing carbon pollution already in use by the electric generating industry.<sup>55</sup> Using these very approaches, the power sector has reduced its carbon pollution by 27 percent since 2005.<sup>56</sup> Ongoing progress in the power sector means that the costs of these emission reduction approaches have declined considerably even in the few years since EPA finalized the rule. EPA itself notes in the Repeal Proposal RIA that more recent modeling efforts “indicate that the CPP would have had a more modest impact at lower cost than projected at the time the CPP was finalized.”<sup>57</sup> The BSER in the proposed ACE Rule is both legally and factually unsound as it

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<sup>51</sup> *Id.* at Appendix 2 – Power Sector Trends (finding “new information and data show that the CPP goals will be less impactful on the generation mix of the industry and considerably less costly to implement *than previously thought.*”)

<sup>52</sup> EIA, *Annual Energy Outlook*, Natural Gas Supply, Disposition, and Prices (2018), <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=13-AEO2018&region=0-0&cases=ref2018~aeo2017no&start=2016&end=2050&f=A&linechart=~aeo2017no-d120816a.31-13-AEO2018~ref2018-d121317a.31-13-AEO2018&ctype=linechart&sourcekey=0>.

<sup>53</sup> In its power sector modeling in the final CPP Regulatory Impact Analysis, EPA relied on cost projections developed by the National Renewable Energy Laboratory, as published in its Annual Technology Baseline. NREL updates its cost projections each year; their levelized cost projections for 2030 for wind and solar have fallen by 26% and 47%, respectively, since the time of EPA’s analysis.

<sup>54</sup> Lazard, *Lazard’s Levelized Cost of Energy Analysis – Version 11.0*, (Nov. 2017), <https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf>.

<sup>55</sup> *See, e.g.*, 80 Fed. Reg. at 64,725, 64,785, 64,803-04.

<sup>56</sup> EIA, *Monthly Energy Review*, (March 2018), <https://www.eia.gov/totalenergy/data/monthly/>; power sector carbon emissions are presented in Table 12.6, [https://www.eia.gov/totalenergy/data/monthly/pdf/sec12\\_9.pdf](https://www.eia.gov/totalenergy/data/monthly/pdf/sec12_9.pdf).

<sup>57</sup> Repeal Proposal RIA at 80.

ignores both the measures commonly relied on in the power sector and the reductions that are achievable in practice.

Even as emissions have declined, the potential to achieve cost-effective emissions reductions by shifting to lower-emitting sources continues to grow. Instead of the ACE Rule proposal, EPA should have updated the calculations used to derive the CPP targets building on the progress that the electricity sector has made since the 2015 CPP finalization. We estimate that by applying the same building blocks and methodology with the latest available data to a baseline year of 2016, the Clean Power Plan would could be strengthened considerably and the and the emissions targets could be set at 50 percent below a 2016 baseline, equivalent to 60 percent below 2005 levels. The ACE Rule fails to meet the Clean Air Act’s mandate because it falls far short of achieving emissions reductions of this magnitude. See Appendix D for details and a guide to the calculations for the updated CPP targets.

Figure 2. Comparison of Updated CPP and Proposed ACE Rule Emissions

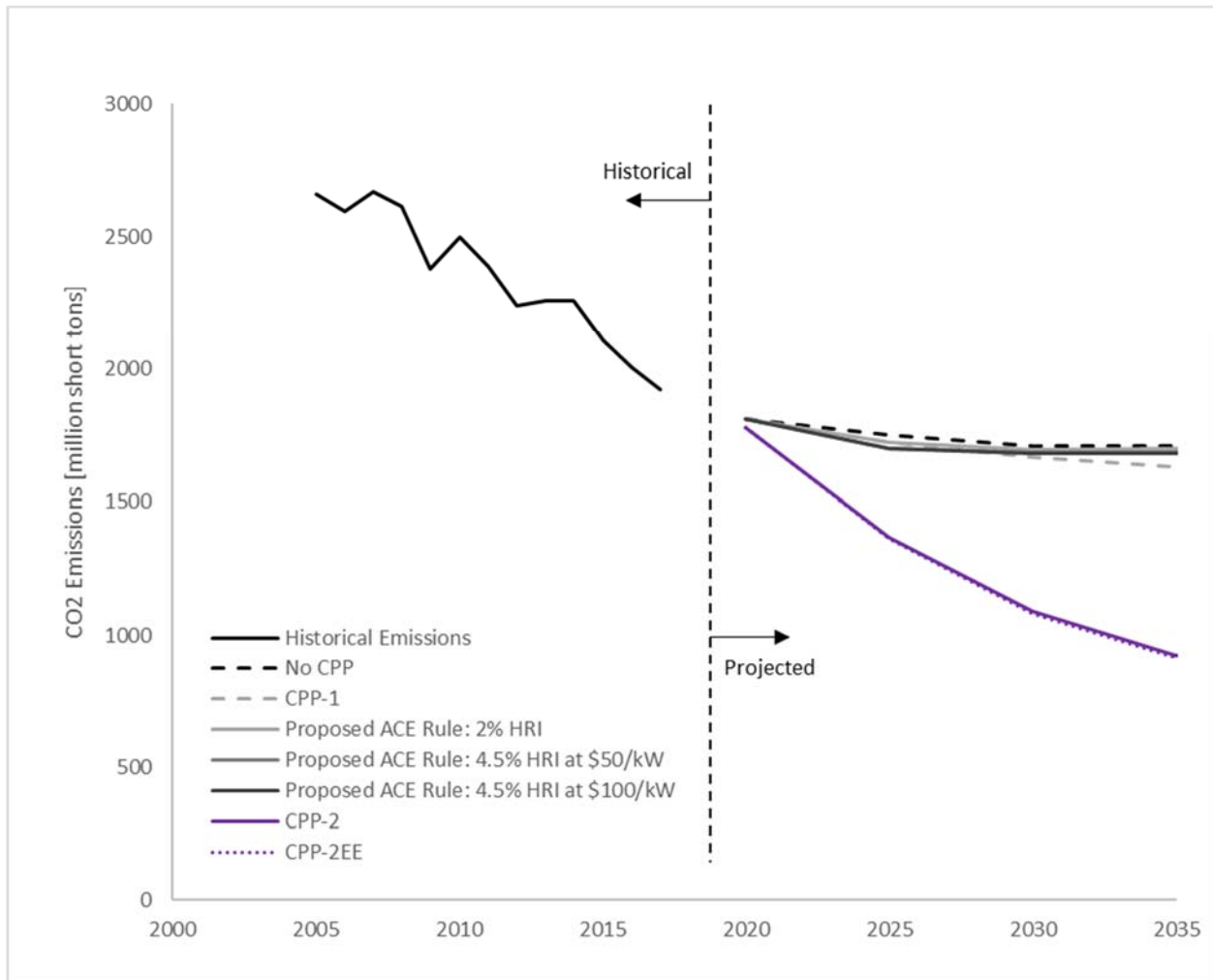


Table 1. Modeled Emissions Reductions of 2015 CPP Targets (CPP-1) and Updated CPP Targets (CPP-2EE)

		CO2 Target (short tons)	% Below 2005	% Below 2016
2025	CPP-1	1,878,255,598	29%	12%
	CPP-2	1,332,585,703	50%	37%
2030	CPP-1	1,709,291,321	36%	20%
	CPP-2	1,071,337,528	60%	50%
2035	CPP-1	1,555,526,747	42%	27%
	CPP-2	910,520,503	66%	57%

2. *NRDC Analysis in IPM Demonstrates that a Program Based on Updated CPP Targets Achieves Strong Emissions Reductions and is Highly Cost-Effective*

NRDC conducted analysis using the Integrated Planning Model (IPM®) to evaluate the economic and environmental outcomes in the electricity sector of a program based on the updated CPP targets described in the previous section. We found that such a program would deliver emissions reductions of 56 percent below 2016 levels, or 65 percent below 2005 levels. This level of emissions reductions in the electricity sector is important because it would position the United States closer to meeting its long-term decarbonization goals and contribute to averting the worst impacts of climate change. Moreover, these emissions reductions are achievable at a reasonable annual cost of \$6.2 billion in 2030 with smart planning and investment in clean and cost-effective resources.<sup>58</sup>

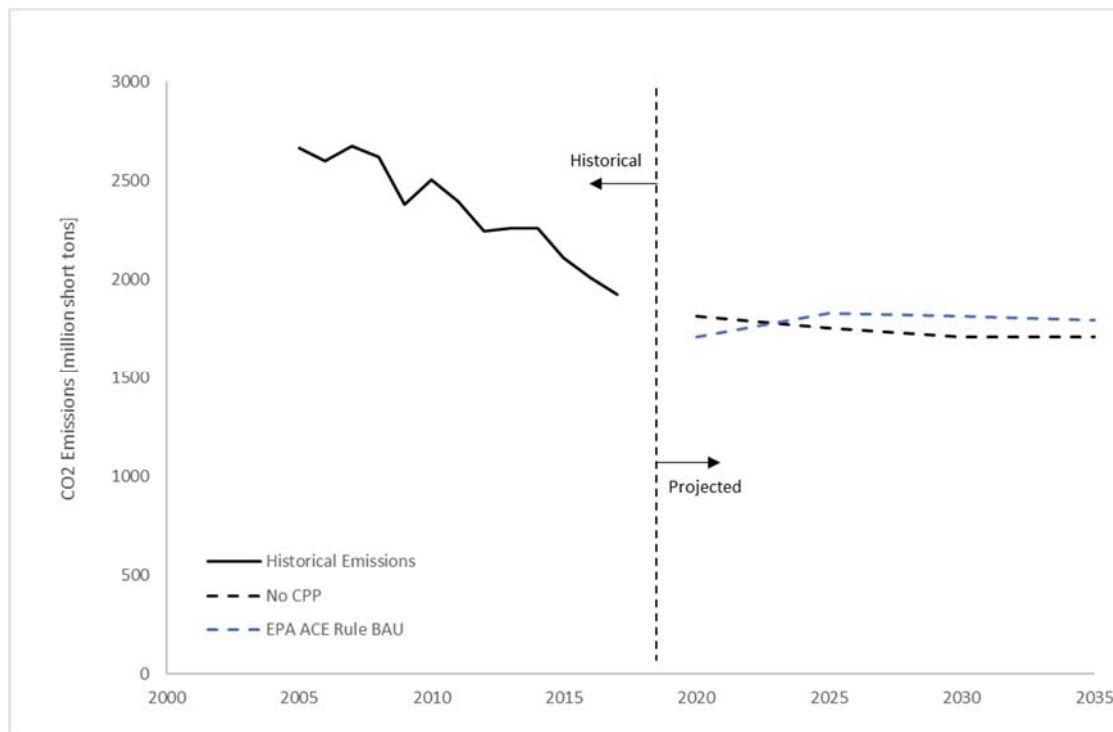
NRDC formulated its analysis based on electricity demand and fuel price assumptions taken from the EIA’s 2018 Annual Energy Outlook (AEO), with fossil technology costs taken from EPA IPM v6 and renewable technology costs taken from National Renewable Energy Laboratory (NREL’s) Annual Technology Baseline (ATB) 2018. See Appendix B for a summary of the assumptions for these scenarios.

Business-as-Usual Scenario

NRDC’s Business-as-Usual (BAU) case represents a baseline case that accounts for all current federal, state and regional energy policies, except for the Clean Power Plan. Electricity sector CO<sub>2</sub> emissions in the BAU case are projected to continue the steadily declining trajectory, reaching 1.710 billion short tons, equivalent to 36 percent below 2005 levels in 2030.

<sup>58</sup> Annie Gilleo, *New data, same results – Saving energy is still cheaper than making energy*, American Council for an Energy-Efficient Economy (Dec. 1, 2017), <https://aceee.org/blog/2017/12/new-data-same-results-saving-energy>.

Figure 3. Projected Emissions in NRDC BAU and EPA ACE Rule BAU



Market dynamics driving this emissions forecast include: low and further declining costs of renewable projects along with improving renewable technology, declining costs of technologies like battery storage that enable additional renewable capacity on the electricity grid, competitive gas prices, and state policies supporting investment in clean energy resources. The BAU case also projects a growing role for battery storage in the sector, with 8.4 GW of 4-hour battery storage projected to be a part of the power capacity mix in 2025, expanding to 25.3 GW in 2030. These storage additions bolster the economics for solar power in particular.

Solar generation in the BAU is projected to reach 297.6 terawatt-hours (TWh) in 2030, making up 7 percent of the generation mix. To compare, solar generation totaled 53 TWh in 2017, accounting for 1.3 percent of the generation mix.<sup>59</sup> Solar capacity also expands commensurately, with 105.7 GW of new solar added to the system by 2030. That is in addition to 45.2 GW of solar capacity in 2020. In the BAU case, solar capacity and generation grow by nearly 2.5 times between 2020-2030.

Wind generation in the BAU follows a similar pattern of expansion. In 2017, wind generation totaled 254 TWh, or 6.3 percent of the electricity generation mix.<sup>60</sup> In the NRDC BAU scenario, wind generation reaches 490 TWh in 2030, composed of 364.6 TWh of generation from existing

<sup>59</sup> EIA, *What is U.S. electricity generation by energy source?* (Oct. 29, 2018), <https://www.eia.gov/tools/faqs/faq.php?id=427&t=3>.

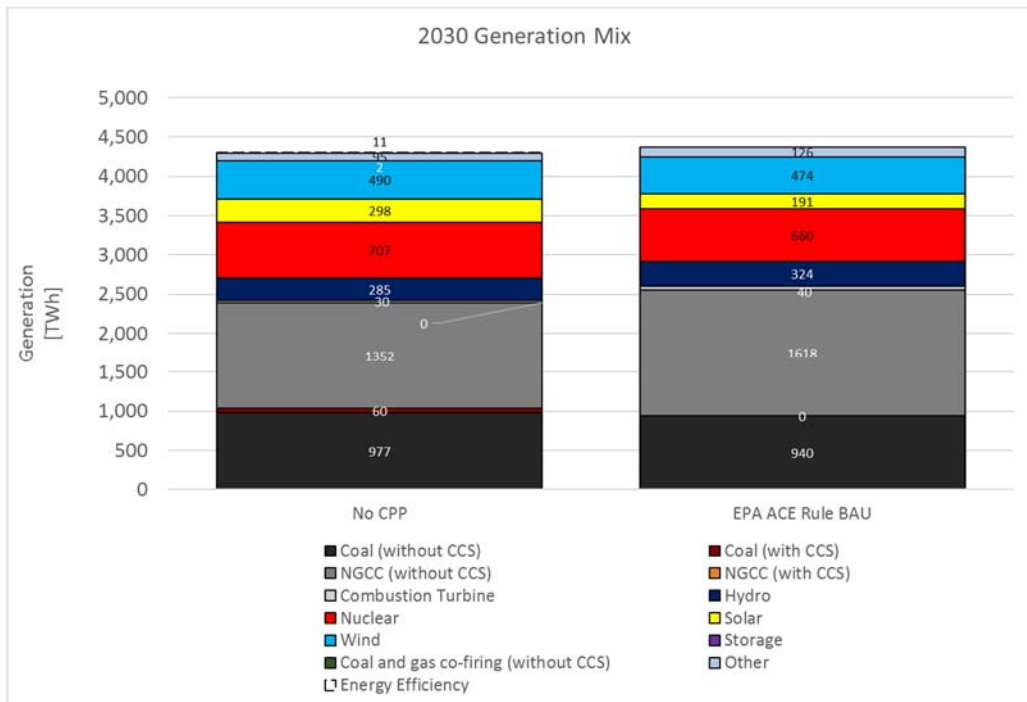
<sup>60</sup> *Id.*



wind installations (including announced projects), 101.0 TWh from new wind projects, and 24.7 TWh from mandated offshore wind projects. Altogether, wind generation makes up more than 11 percent of the generation mix in 2030, and in total, wind and solar generation account for close to one-fifth of the 2030 generation mix. Projected renewable generation growth in NRDC’s BAU case outpaces the EPA ACE Rule BAU forecast. Total renewable generation reaches 788 TWh in 2030 in NRDC’s BAU, compared with 699 TWh in the EPA ACE Rule BAU.

Gas combined cycle generation in 2030 in NRDC’s BAU totals 1,352 TWh, exceeding the gas combined cycle generation of 1,618 TWh in the EPA ACE Rule BAU by 16 percent. Generation from nuclear facilities and coal units tends to remain in the generation mix in the NRDC BAU compared with the EPA ACE Rule BAU. Nuclear generation in the NRDC BAU totals 706.7 TWh, and nuclear capacity totals 91 GW in 2030. Nuclear generation in the EPA ACE Rule BAU totals 660 TWh, and nuclear capacity totals 84 GW in 2030. The NRDC BAU projects 977.3 TWh of coal generation (without CCS), and 160.2 GW of coal capacity in 2030. The EPA BAU projects 936 TWh of coal generation (without CCS), and 182 GW of coal capacity in 2030. See Figure 4 and Figure 5, illustrating these comparisons.

Figure 4. 2030 Projected Generation Mix in NRDC BAU and EPA ACE Rule BAU

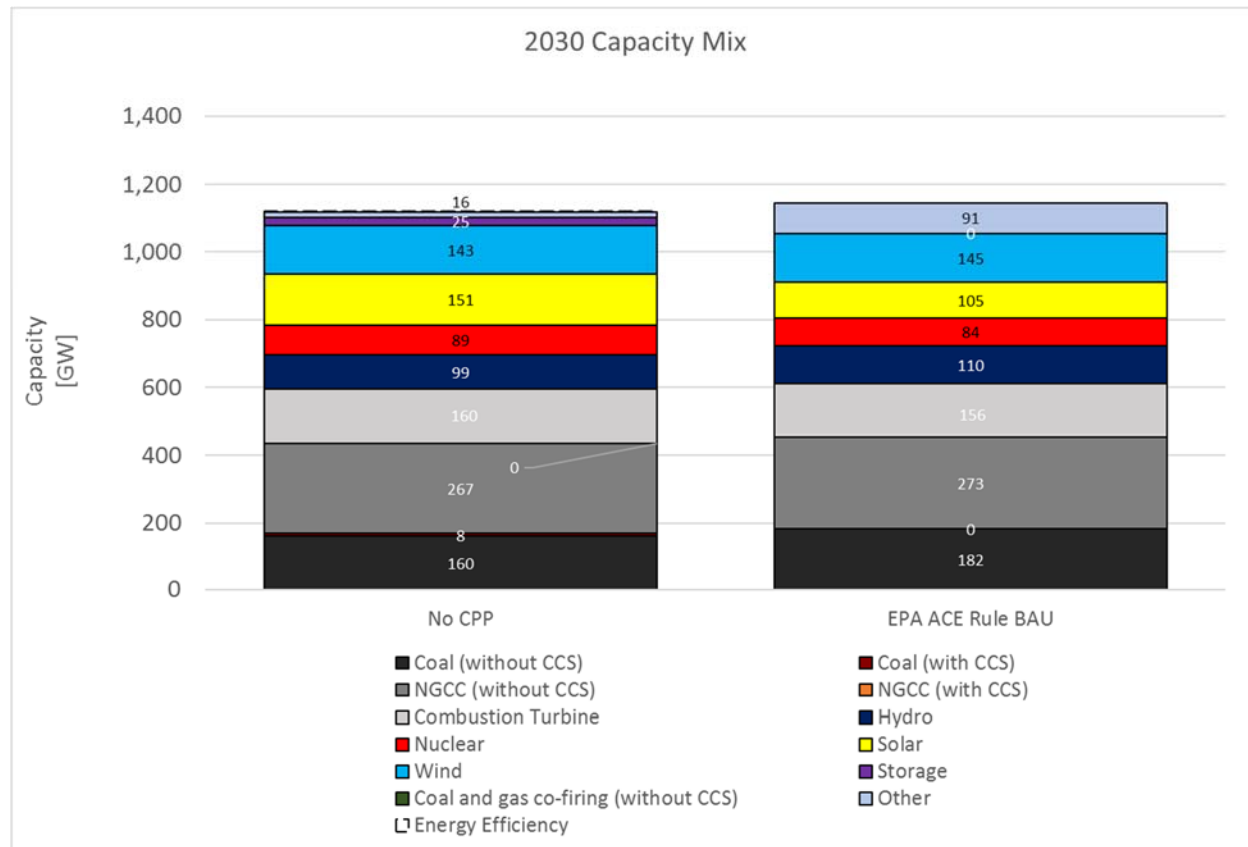


Note: Other includes oil/gas steam, biomass, geothermal, other renewable and other non-renewable generation.

NRDC’s BAU case differs from the EPA’s BAU with no CPP in the ACE Rule Regulatory Impact Analysis (RIA) in several key ways. NRDC projects minimal additional gas combined cycle capacity additions, with 1.0 GW added in 2030. By contrast, EPA’s BAU with no CPP projects 9 GW of new gas combined cycle capacity in 2030. Total gas capacity in 2030 in NRDC’s BAU is 267 GW, compared with 273 GW in the EPA ACE Rule BAU. Additionally,

the BAU projects 8.2 GW of retrofitted coal CCS capacity in 2025, contributing 60.0 TWh to the generation mix (making up 1.4 percent) and driven in large part by the 45Q federal tax credit for carbon dioxide sequestration.<sup>61</sup>

Figure 5. 2030 Capacity Projections in NRDC BAU and EPA ACE Rule BAU



Note: Other includes oil/gas steam, biomass, geothermal, other renewable and other non-renewable generation.

See Appendix B for an overview of the assumptions underlying the NRDC BAU case.

### Business-as-Usual with 2015 CPP (CPP1 E+N)

NRDC also examined a BAU scenario that included an assumption representing the 2015 final CPP targets (2015 CPP BAU). The 2015 CPP in this analysis was modeled as a mass limit covering existing and new coal and gas facilities, expressed as a tonnage cap in 2025, 2030 and 2035. The methodology to derive these limits was based on the finalized 2015 CPP targets. The 2015 CPP is represented as a tonnage limit including both existing and new fossil units for consistency with the guidance in the final CPP that emissions leakage to new gas sources must be addressed in implementation. By contrast, the EPA BAU with CPP from the ACE Rule RIA assumed tonnage limits as finalized by EPA in 2015 applying only to existing units. NRDC views this run as an inadequate representation of the CPP program because it excluded a

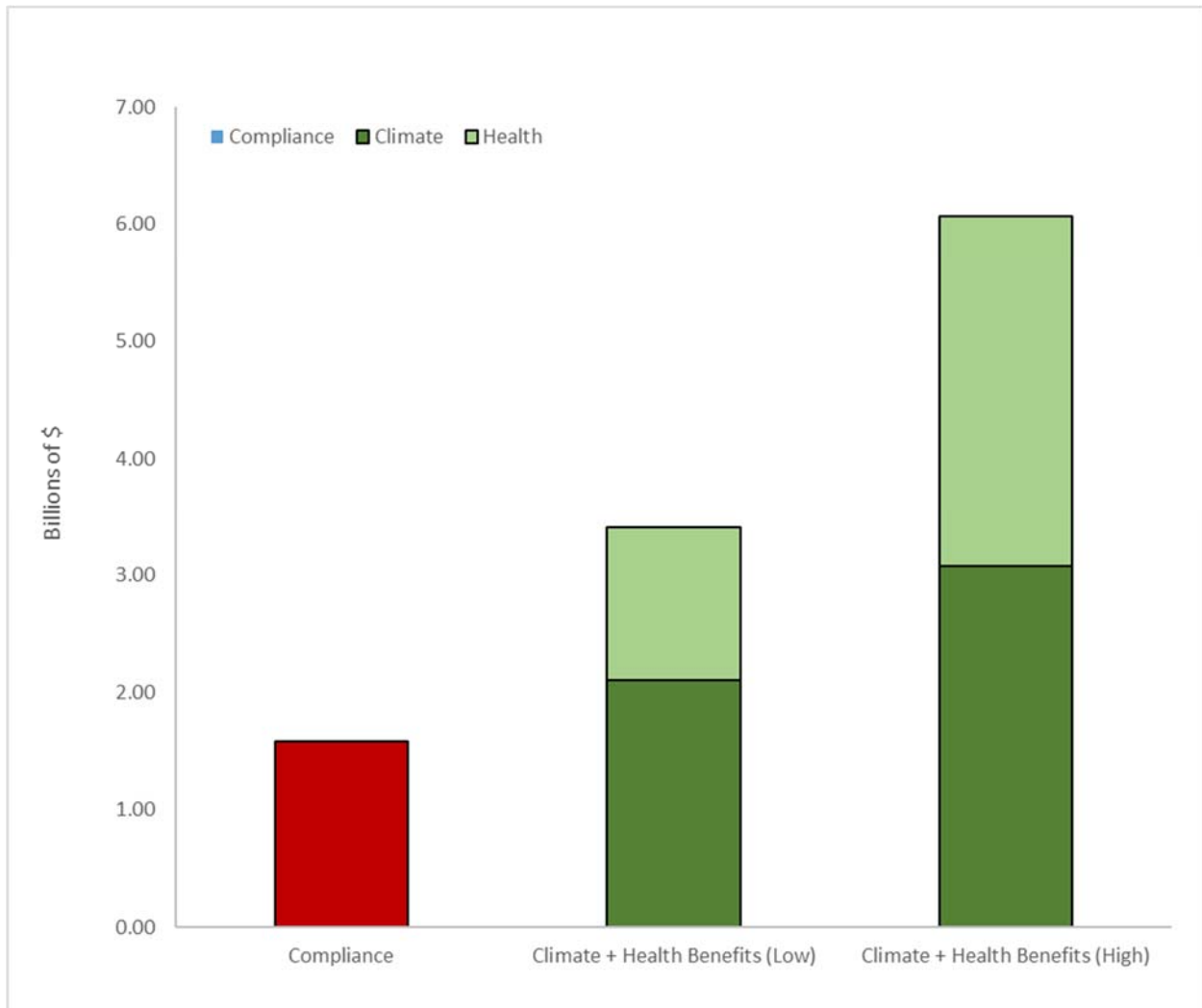
<sup>61</sup> See Joint CCS Comments for a detailed discussion of the implications of CCS modeling assumptions.

mechanism to address emissions leakage to new gas sources, for which the 2015 CPP required implementation controls. Please see Appendix E for additional details.

Electricity sector CO<sub>2</sub> emissions in NRDC's 2015 CPP BAU decline to under 1.7 billion short tons in 2030, or 37 percent below 2005 levels. Accounting for the emissions reductions progress in NRDC's BAU case, the 2015 CPP mass-based targets would drive an additional 1 percent in emissions reductions in 2030. The required changes in the 2015 CPP BAU case are minimal as a consequence of the decline in power sector carbon emissions since the CPP was finalized. Emissions reductions from the BAU in the 2015 CPP BAU are driven primarily by a shift from existing fossil generation without CCS to generation from new gas and coal units retrofitted with CCS installations. Total annualized system compliance costs in 2030 in the NRDC 2015 CPP BAU total \$1.6 billion.

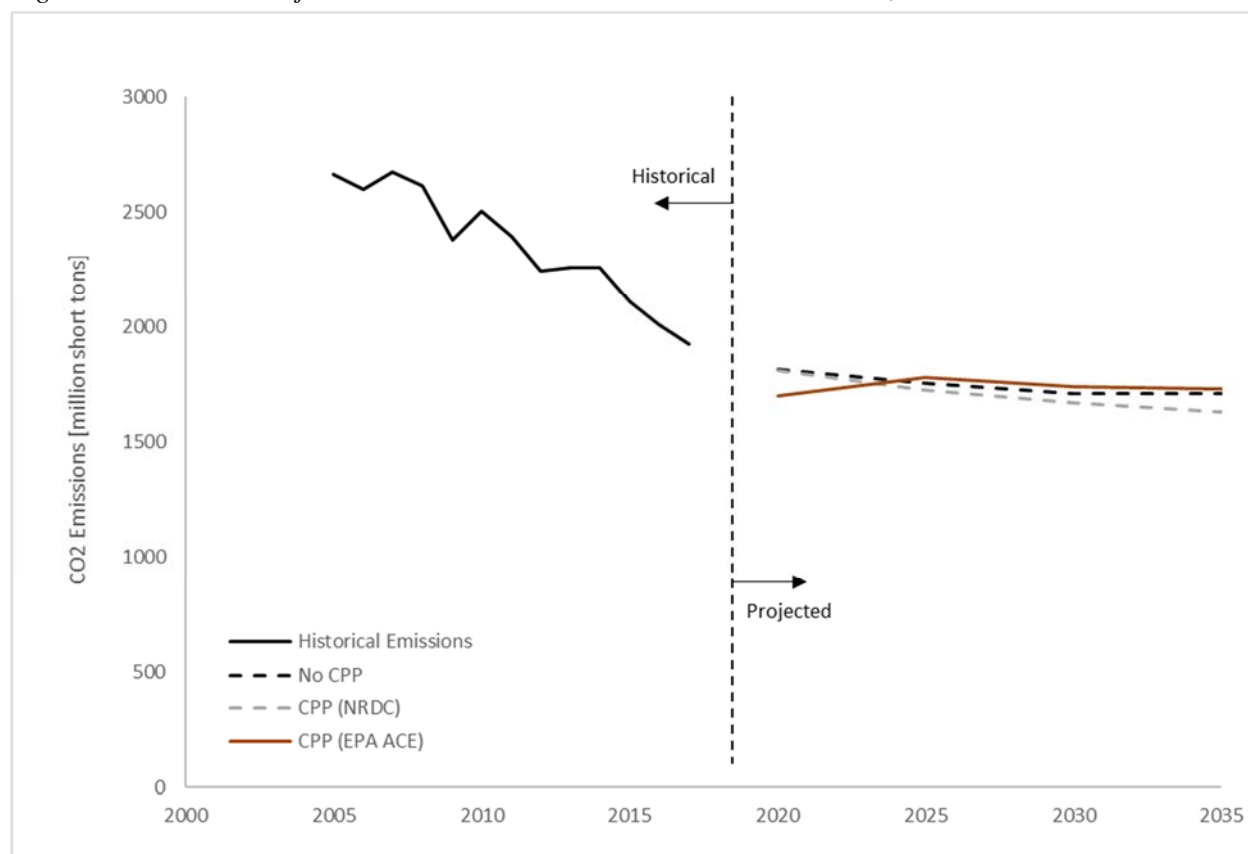
Estimated total climate and health and benefits of the 2015 CPP BAU scenario in 2030 are \$3-6 billion, or about twice to 4 times the compliance costs.

Figure 6. 2030 NRDC 2015 CPP BAU (CPP-1): Compliance Costs, Climate and Health Benefits



EPA also included in its ACE Rule RIA a BAU w/CPP run. The total emissions forecast of the EPA’s BAU w/CPP is higher than the NRDC total emissions forecast. In both cases, BAU trends approach the CPP target, indicating that the power industry can easily meet the goals of the CPP. In fact, this indicates that the power sector could achieve greater emissions reductions than required by the 2015 CPP for a similar level of compliance costs. Any revision to the CPP must reflect the potential for the power sector to achieve more ambitious carbon pollution reductions in order to meet the Clean Air Act’s objective of protecting the public health and the environment.

Figure 7. Emissions Projections in NRDC BAU and 2015 CPP BAU Cases, and EPA ACE Rule BAU



Comparisons throughout the remainder of this section will consider the NRDC BAU as the primary point of reference.

#### Updated CPP Targets (CPP2, CPP2-EE)

The 2015 CPP compliance targets were developed using the latest available electricity sector performance data at the time the standards were finalized. The emissions reduction requirements were designed to reinforce the shift away from high-polluting energy sources to lower- and non-emitting generation that was already underway. Since then, these trends have further accelerated.

Investments in wind, solar, and energy efficiency continue to displace higher-emitting resources due to a combination of favorable economics, state and local policies, and even company-specific targets and goals.

In any proposed replacement to the CPP, EPA should have taken into account the emissions progress in the sector since 2015. Adopting the same calculation steps used to derive the 2015 CPP targets, updating the baseline year from 2012 to 2016 and updating the underlying data to reflect the latest available projections for renewable and gas generation, the standard could produce an emissions outcome in 2030 of 1.071 billion short tons. This is the equivalent of 60 percent below 2005 levels, or 50% below 2016 levels. Please see Appendix D for further details and example calculations for the updated CPP targets in 2025, 2030, and 2035.

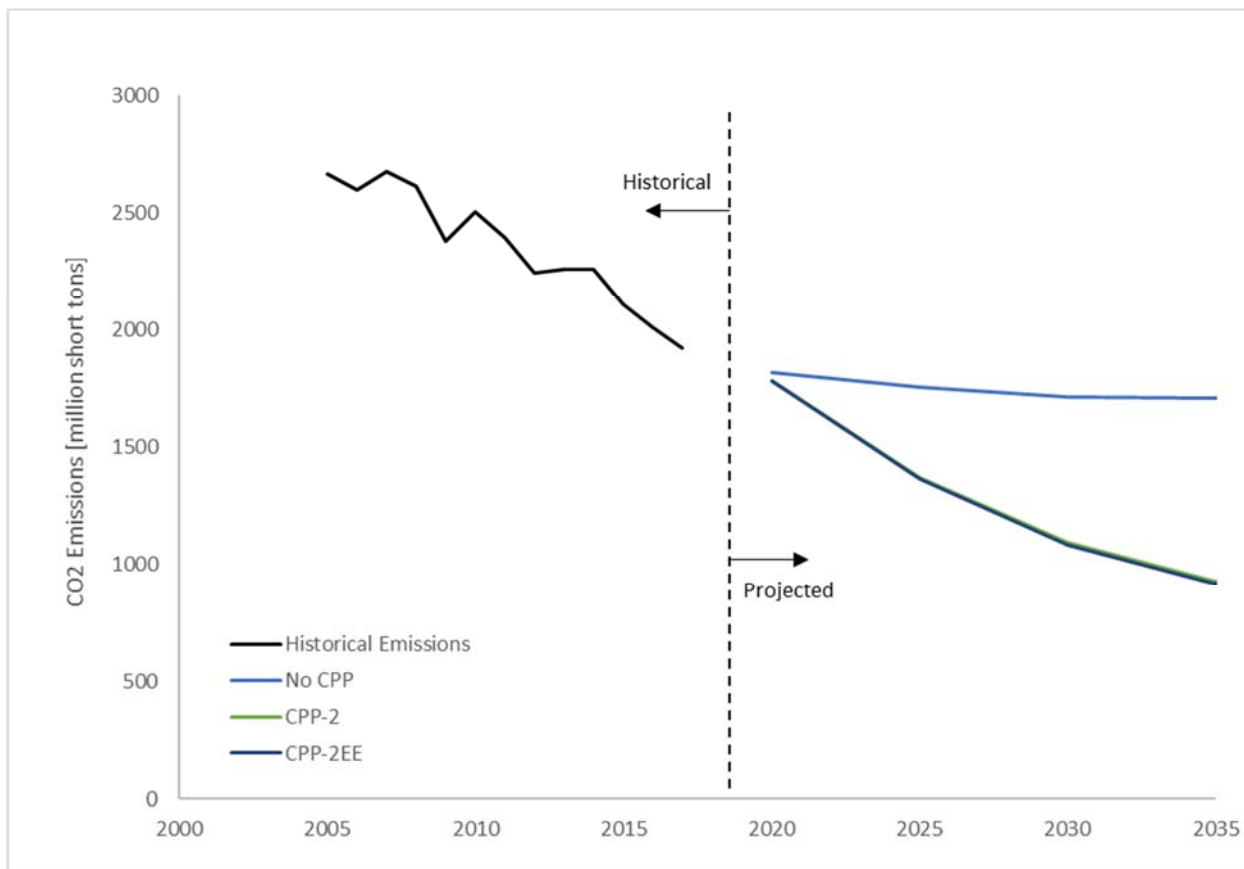
NRDC examined various power sector approaches to compliance with the updated CPP targets, examining a case assuming that a mass limit accounting for new gas generation is applied to existing and new sources together, as well as a case that examines the impact of investing in cost-effective energy efficiency programs as part of the compliance strategy. The former case is referred to in this discussion as CPP-2, while the latter case, with the addition of cost-effective energy efficiency as a compliance strategy, is referred to as CPP-2EE.

The national mass limits assumed in this analysis to represent the updated CPP targets in CPP-2 and CPP-2EE, were:

- 2025: 1,198,601,630 short tons
- 2030: 940,001,917 short tons
- 2035: 780,571,566 short tons

In both CPP-2 and CPP-2EE, these limits applied to all existing and new fossil units, with the exception of the existing fossil units in California. In these scenarios, existing fossil units were exempt from the national mass limit because they were assumed to comply with the state carbon pricing program. New sources in California were subject to the national tonnage limit. In addition, both CPP-2 and CPP-2EE assume full national allowance trading for compliance. See Appendix F for further detail.

Figure 8. CO2 Emissions Projections in NRDC Updated CPP Cases (CPP-2, CPP-2EE)



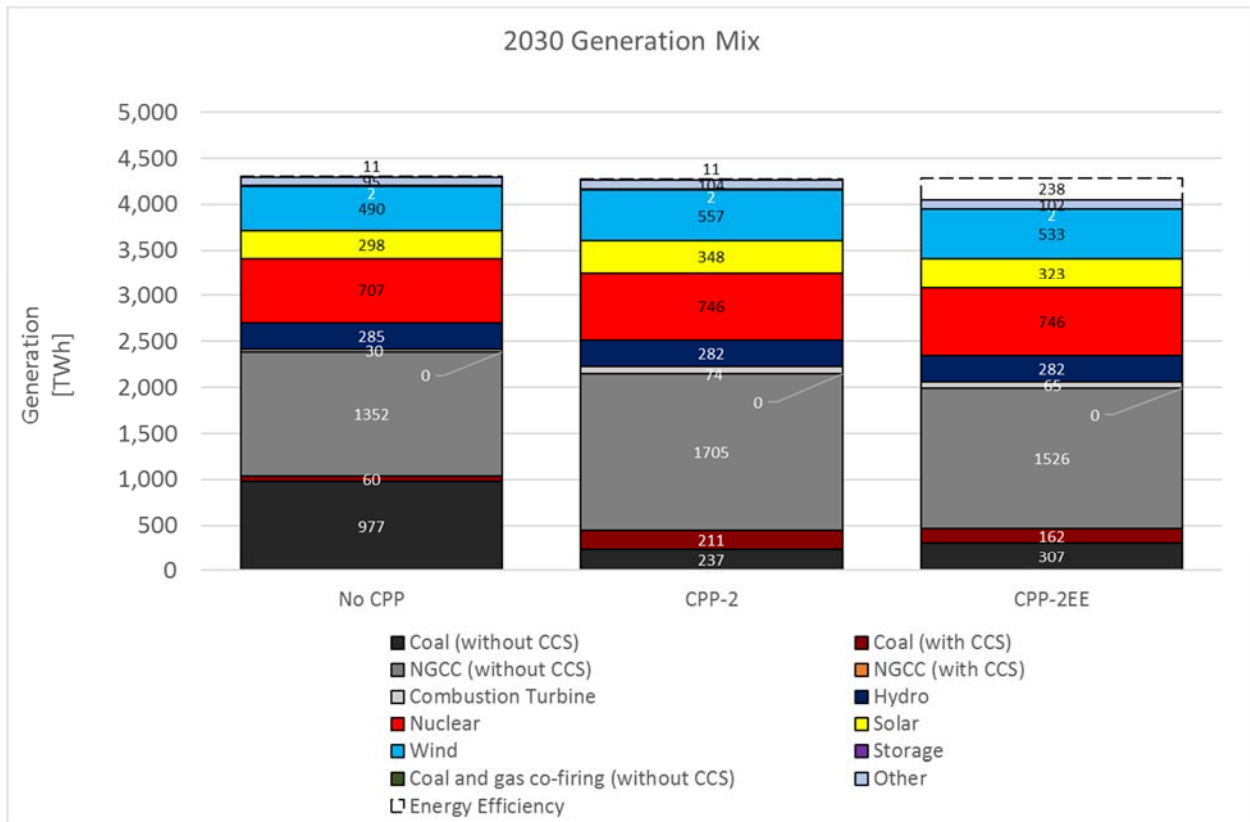
CO<sub>2</sub> emissions in the CPP-2 case total 1.090 billion tons in 2030. This is a reduction of 620 million short tons or 36 percent from the BAU emissions in 2030 of 1.710 billion short tons, and equivalent to 59 percent below 2005 levels or 49 percent below 2016 levels. The CO<sub>2</sub> emissions outcome in CPP-2EE is similar, with 1.079 billion tons of CO<sub>2</sub> emitted in 2030. This is expected, as both scenarios assume the same tonnage emissions limits applying to the same electricity sector emissions sources.

In CPP-2, the emissions declines are driven primarily by adding zero-emitting capacity including new wind and solar projects, and coal carbon capture and sequestration (CCS) retrofits, along with new gas units in the 2030 model period. Shifts in the generation mix reflect this additional capacity. Solar generation totals 348 TWh in 2030 in the CPP-2 case, increasing 17 percent over total solar generation in the BAU of 298 TWh. Similarly, total onshore wind generation from existing projects and economic new projects grows by 14 percent, reaching 532 TWh in 2030 in the CPP-2 case and making up 12.4 percent of total generation, compared with 466 TWh in the BAU (10.7 percent of total BAU generation). Combined cycle generation in the CPP-2 case makes up approximately 40 percent of the total generation mix, compared with 31 percent of the total generation in the BAU. On a generation basis, combined cycle generation in the CPP-2 case exceeds the BAU by 26 percent. The CPP-2 outcomes are consistent with the sectoral trends that can be currently observed and are merely a continuation of the shifts already underway.

Notably, the policy modeled in CPP-2 leads to a greater amount of nuclear generation and, by extension, fewer nuclear retirements than in the BAU. Approximately 5 GW of nuclear power that retire in the BAU remain online in the CPP-2 case, driving 746 TWh of nuclear generation compared with 707 TWh of nuclear generation in the BAU. This demonstrates that a policy setting emissions reductions requirements equivalent to the updated CPP targets represented in CPP-2 could incentivize the continued operations of nuclear units compared with a no-policy scenario. Coal generation in the CPP-2 case is strongly outcompeted by the low- and non-emitting sources of generation. Compared with a total of 1,037 TWh (including coal with CCS and coal without CCS) or 24 percent of the total generation in BAU, 2030 coal generation dips to 448 TWh in the CCP-2 case. It is replaced with expansion in wind, solar, gas, and nuclear generation that would otherwise have retired in the BAU.

In CPP-2EE, all states increase investment in cost-effective energy efficiency saves to achieve *at least* annual incremental savings of 1.5 percent of retail sales. If a state already achieves greater than 1.5 percent savings in current practice, that state maintains the level of savings it currently achieves. Investment in utility energy efficiency programs changes the resulting generation mix in CPP2-EE compared with CPP-2 because the saved energy load reduces the amount of total generation required. For instance, in 2030, energy efficiency savings total 238 TWh in 2030. Total gross generation (including energy efficiency savings) is 4,306 TWh and total generation net of energy efficiency is 4,023 TWh. Energy efficiency savings in CPP-2EE displace non-emitting sources and gas combined cycle in the generation mix. Between CPP-2 and CPP-2EE, gas combined cycle generation declines by 40 TWh or 3 percent in CPP2-EE, as new solar and wind both decline by 24 TWh respectively (10 percent of the solar generation and 15 percent of the wind generation are displaced by energy efficiency). Nuclear generation remains unchanged between the two cases. Energy efficiency also displaces generation from coal CCS, and the reduced emissions from lower gas combined cycle generation provide an opportunity for coal plants to run more by purchasing allowance.

Figure 9. Projected 2030 Generation in Updated CPP Cases (CPP-2, CPP-2EE)



Note: Other includes oil/gas steam, biomass, geothermal, other renewable and other non-renewable generation.

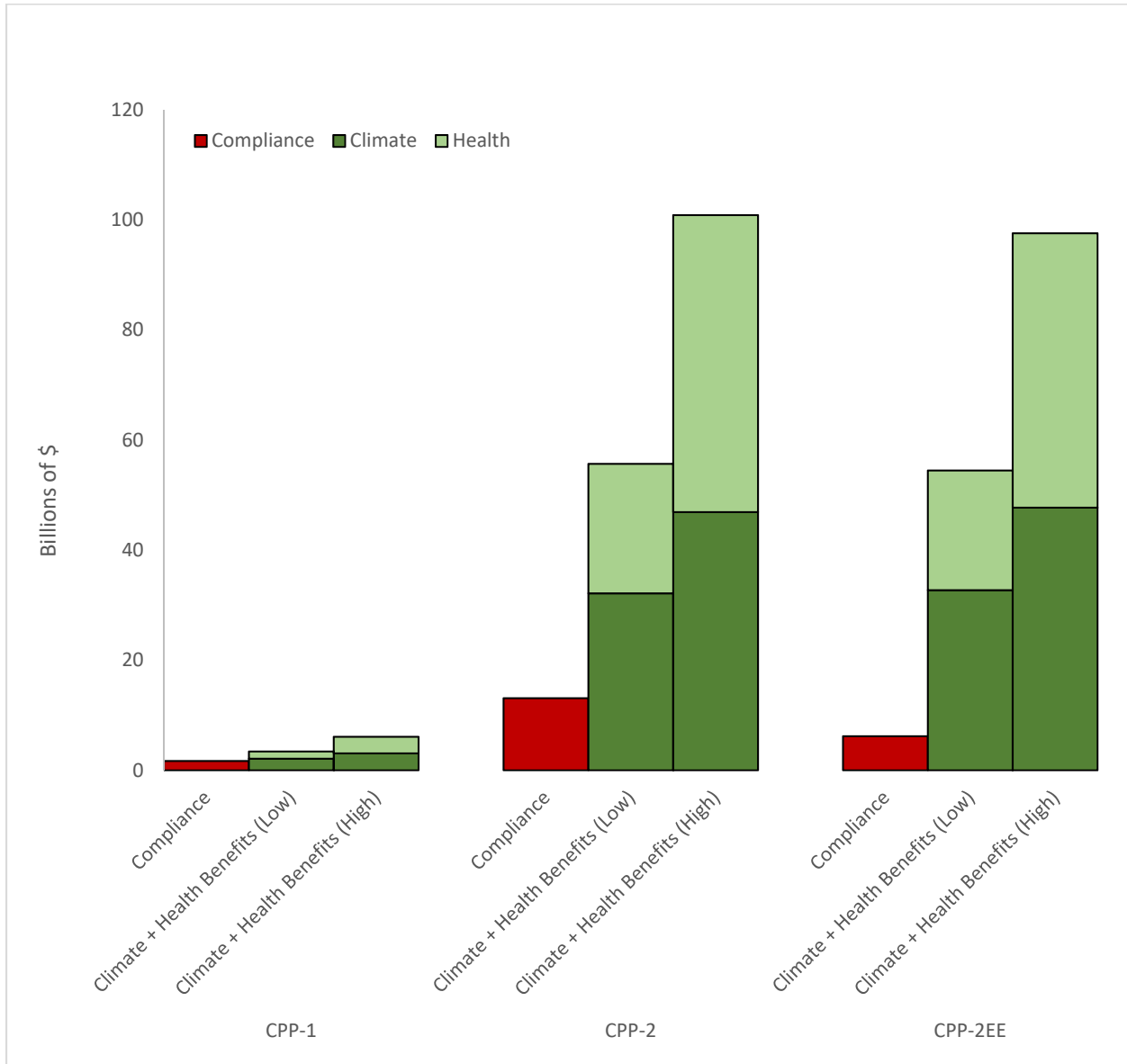
The total system compliance costs of CPP-2 in 2030 are \$13.1 billion (\$2016), producing CO2 allowance prices of \$21 per ton. CPP-2EE total compliance costs are \$6.2 billion, and the CO2 allowance price is estimated to be \$9.84 in 2030, less than half of the allowance price in CPP-2.

With smart planning and investment in the most cost-effective compliance measures including energy efficiency, updating the CPP targets to require a reduction of 49 percent below 2016 is achievable at a reasonable cost.

Using global estimates for the social cost of carbon based on a 3 percent discount rate and the low-range factors taken from the EPA’s 2015 CPP RIA to estimate public health benefits, the total climate and health benefits of reducing climate and public health pollution outweigh the benefits by at least 4 times. Some economists, however support the application of a lower discount rate to the global social cost of carbon because the 3 percent discount rate undervalues future generations, and because there are a range of future impacts associated with climate change that the economic models do not adequately capture. The benefits of reducing CO2 and hazardous air pollution emissions increase to \$101 billion using a 2.5 percent social cost of carbon, and the high-range public health benefit coefficients, equal to eight-fold the compliance costs of the policy in CPP-2.



Figure 10. 2030 Compliance Costs, Climate and Health Benefits in Updated CPP Cases (CPP-2, CPP-2EE)



The value of climate and health benefits in CPP2-EE similarly outweigh the costs of the policy by 4 to 8 times.

If the 2015 CPP targets were updated to account for the shifts in the electricity sector up until 2016, the emissions reductions targets produced using the same methodology would be significantly stronger, delivering emissions reductions of 49 percent below 2016 levels in 2030. The methodology that EPA designed to derive the 2015 CPP targets was consistent with the Clean Air Act statutory requirements and appropriately interpreted the BSER. Moreover, the gradual phase-in of the targets aligned the program with the continuing trend away from high-polluting resources that the electricity sector has experienced since 2013. If the same

methodology that EPA relied on to derive the 2015 CPP targets was applied to a baseline year of 2016 and took into account the most recent available projections for growth in low-and zero-emitting generation, the required reduction would have been approximately 60 percent below 2005 levels, or 50 percent below 2016 levels. Our modeling results are based on analysis using the same model that EPA relied on to evaluate the impacts of the proposed ACE Rule and demonstrate that the electricity sector can achieve these levels of emissions reductions at costs falling within a similar range of the projected costs of the 2015 CPP.<sup>62</sup> The CPP2 and CPP2-EE cases described in this section illustrate that the sector is well-positioned to comply with a strong rule requiring the sector to halve its current emissions in 2030. Such an updated CPP would be highly cost-effective, with reasonable costs, and far greater climate and health benefits of up to \$101 billion. In proposing a replacement for the CPP that achieves virtually no emission reductions—much less than the level analyzed here—EPA has failed to meet its obligation to protect the public from dangerous emissions of carbon pollution.

#### **IV. Even under EPA’s flawed BSER interpretation, the proposed HRI-only approach is unreasonable.**

Even within the artificial constraints EPA has imposed, EPA must still base its determination of the “best system” on measures that achieve the greatest reductions without imposing unreasonable costs. Heat-rate improvements at steam generating units alone cannot comprise the BSER because the result is either minimal reductions or an overall emission increase. Moreover, there are multiple control options available that meet EPA’s improperly narrow definition of measures that are “applied to or at the source,” including co-firing and carbon capture and sequestration.

##### **A. EPA’s list of suggested HRI measures cannot comprise the BSER.**

EPA’s approach to narrowly target emissions reductions at coal-fired steam EGUs through deployment of only modest heat rate improvements (HRI) is inappropriate as it would result in very little to no emissions reductions.

As also discussed in Joint Environmental Comments on RIA Issues, implementation of HRI in isolation not only would achieve insufficient emission reductions assuming generation levels from affected sources were held constant, but also has the potential to result in a rebound effect. The rebound effect arises from improved competitiveness and increased generation at the EGUs implementing HRI, and would weaken or potentially even eliminate the ability of HRI to achieve carbon emission reductions.

Both NRDC’s and EPA’s own modeling (discussed below) showcase this rebound effect, which is inevitable in the context of the integrated electricity system absent other incentives for coal-fired EGUs to reduce their generation and carbon emissions. It is also worth noting that both the NRDC and EPA modeling results likely reflect the most optimistic emissions outlook that could

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<sup>62</sup> The 2015 CPP RIA estimated compliance costs to be \$5.1 to \$8.4 billion by 2030. See EPA, *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, ES-9 (October 23, 2015), [https://www3.epa.gov/ttnecas1/docs/ria/utilities\\_ria\\_final-clean-power-plan-existing-units\\_2015-08.pdf](https://www3.epa.gov/ttnecas1/docs/ria/utilities_ria_final-clean-power-plan-existing-units_2015-08.pdf).

ensue from the EPA proposal; neither analysis considers the degradation of efficiency upgrades and pollution controls over time and both assume that *all* affected EGUs in the U.S. would implement HRI in response to the EPA rule. In reality, and as discussed in greater detail in Joint Environmental Comments on RIA Issues, the extent to which affected EGUs will actually improve heat rates is highly uncertain due to EPA's failure to promulgate a numerical emission guideline and the flexibility EPA provides states to determine their own standards and requirements. For these reasons, NRDC's and EPA's own results showing a clear rebound effect, coupled with the optimism embedded in the assumptions, refute the agency's baseless conclusion that "system-wide emission decreases from [HRI] will likely outweigh any potential emission increases."<sup>63</sup>

NRDC utilized IPM to replicate EPA's three HRI cases as follows:

- 1- 2 percent HRI at \$50/kW. This run will be referred to as HRI-1 in this discussion.
- 2- 4.5 percent HRI at \$50/kW. This run will be referred to as HRI-2 in this discussion.
- 3- 4.5 percent HRI at \$100/kW. This run will be referred to as HRI-3 in this discussion.

As discussed in greater detail in Joint CCS Comments, our No CPP (business as usual) case includes 8 gigawatts (GW) of cost-effective carbon capture and storage (CCS) retrofits on existing coal EGUs by 2025. The three HRI cases include the same level of coal CCS retrofits as the No CPP case. In light of these results, and to enable an appropriate comparison to EPA's own ACE analysis that did not appropriately reflect tax incentives that lower the cost of CCS, NRDC ran two sets of HRI cases: one that considers CCS retrofits as a build option and one that does not.<sup>64</sup> Each set of HRI cases was compared to a No CPP case with and without CCS, as appropriate.

The HRI cases only differ from EPA's in the set of modeling corrections that apply to the full set of scenarios that NRDC ran (those are discussed in detail in Appendix B). The HRI requirements are assumed to take effect in 2025.

Table 2 compares the power sector carbon emissions outcome for the HRI cases compared to a No CPP case (with and without CCS).

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<sup>63</sup> 83 Fed. Reg. at 44,756 n.17.

<sup>64</sup> The flaws in EPA's failure to model CCS are discussed in greater detail in Joint CCS Comments.

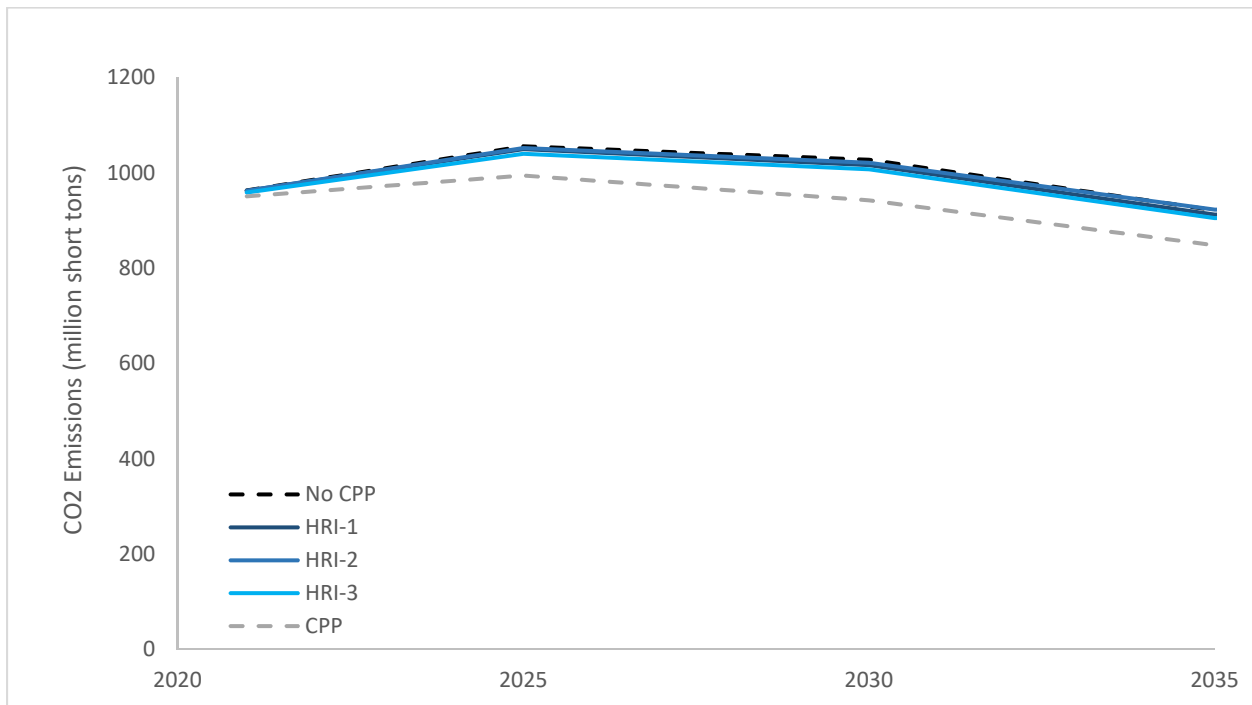
Table 2. U.S. power sector carbon emissions comparisons (NRDC IPM modeling)

	2030 Emissions			2040 Emissions	
	Million Short Tons	Compared to No CPP	% Below 2005 Emissions	Million Short Tons	Compared to No CPP
<b>Runs excluding CCS as a retrofit option:</b>					
No CPP (no CCS)	1,771	-	33%	1,815	-
HRI-1 (no CCS)	1,758	-0.7%	34%	1,821	0.3%
HRI-2 (no CCS)	1,743	-1.6%	35%	1,807	-0.5%
HRI-3 (no CCS)	1,742	-1.6%	35%	1,800	-0.9%
<b>Runs including CCS as a retrofit option:</b>					
No CPP (with CCS)	1,710	-	36%	1,754	-
HRI-1 (with CCS)	1,695	-0.9%	36%	1,761	0.4%
HRI-2 (with CCS)	1,686	-1.4%	37%	1,750	-0.2%
HRI-3 (with CCS)	1,682	-1.6%	37%	1,737	-0.9%

1. HRI implemented in isolation result in very little emissions reductions

Consistent with EPA’s own analysis, HRI result in a very limited decline in carbon emissions from coal plants. As shown in the Figure 11 below, HRI only reduce coal plant emissions by 0.2 to 1.6 percent compared to a No CPP case in 2030, with total power sector carbon emissions dropping by a mere 0.7 to 1.5 percent.

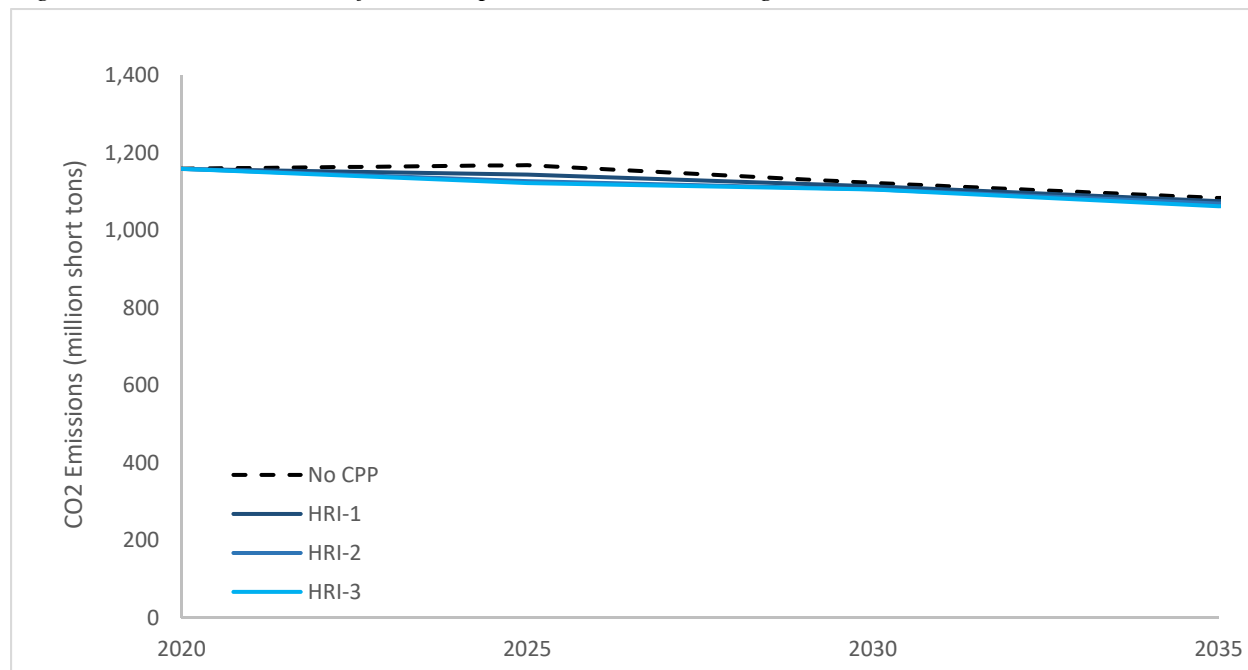
Figure 11. Carbon emissions from coal plants - EPA ACE Rule



Data sourced from EPA’s Regulatory Impact Assessment for the ACE Rule

The NRDC modeling corroborates those findings. As shown in the Figure 12 below, HRI improvements at coal plants would result in minimal emissions reductions. By 2030, carbon emissions from coal plants are between 0.8 and 1.5 percent lower compared to a No CPP case, while total power sector emissions drop by a mere 0.7 to 1.6 percent compared to a No CPP case.

Figure 12. Carbon emissions from coal plants - NRDC Modeling



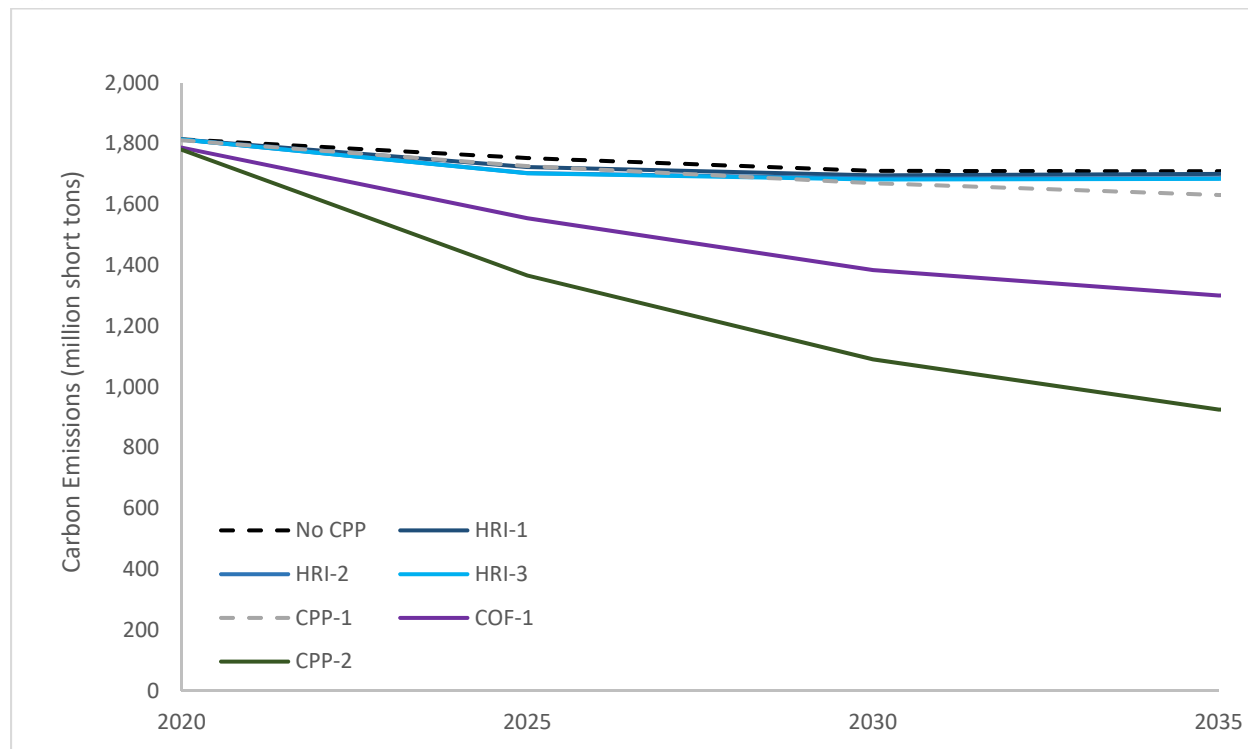
Similar to EPA’s own findings, our modeling concludes that HRI results in minor emissions reductions compared to a do-nothing approach. These results confirm the inadequacy of determining a BSER based on HRI alone; as discussed in greater detail in Joint Environmental Comments on BSER Issues and Joint Environmental Comments on RIA Issues, EPA must consider the magnitude of emissions reductions in determining the BSER. An upper bound of 1.6 percent for emissions reductions reflects what effectively is a do-nothing approach. As EPA recognized in 2015, an HRI-only approach thus fails to meet the critical objective of the BSER determination- reducing carbon pollution from affected EGUs at levels that are both in proportion to the significant GHG emissions from fossil fueled-plants and necessary to address the dangers presented by climate change.<sup>65</sup>

The miniscule impact of HRI is in stark contrast with the emissions reductions achieved at reasonable cost under a system-wide CPP-like approach or the implementation of more ambitious but achievable source-specific measures like gas co-firing and CCS (Figure 13). As discussed in greater detail in Part III and Parts IV.B. and IV.C., the system-wide updated CPP

<sup>65</sup> 80 Fed. Reg. at 64,787.

approach (CPP-2) and gas co-firing applications (COF-1) cut carbon emissions by 36 percent and 19 percent compared to a No CPP case, by 2030, respectively, at modest costs.

Figure 13. U.S. power sector carbon emissions - NRDC Modeling (with CCS)<sup>66</sup>

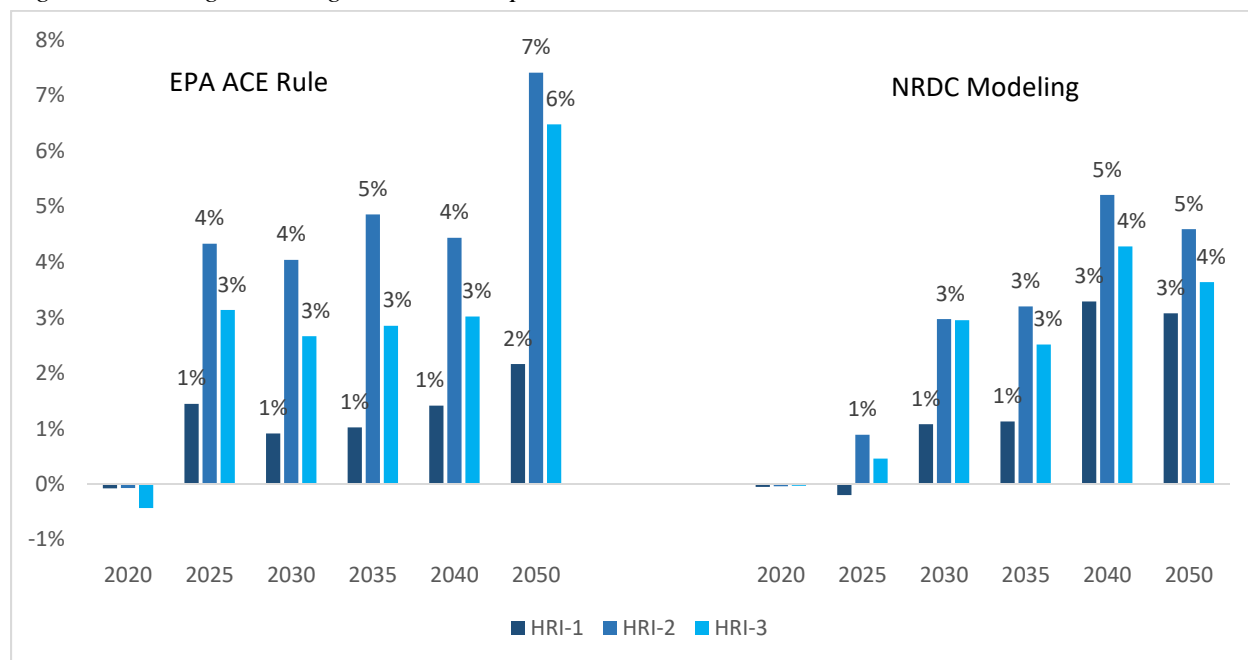


## 2. HRI implemented in isolation results in the partial erosion of emissions reductions

Further exacerbating the inadequacy of emissions reductions achieved by HRI alone, the NRDC analysis concludes that HRI fail to deliver their intended emissions reductions; although the policy would result in an average fleet-wide efficiency improvement between 2 and 4.5 percent at coal plants, U.S. power sector carbon emissions reductions do not exceed 1.6 percent by 2030, compared to a No CPP case. This large erosion of the intended emissions reductions is driven by an inevitable rebound effect - the increased dispatch of the more efficient coal fleet. In fact, coal generation increases every year after 2025 compared to a No CPP case in both modeling efforts, with an increased differential in the 4.5 percent HRI cases (Figure 14).

<sup>66</sup> The CPP-2 run is discussed in Part III.C.; COF-1 is discussed in Part IV.B.

Figure 14. Change in coal generation compared to a No CPP case



These results reflect the inherent flaw in implementing HRI in isolation in the context of the integrated nature of the electricity system; absent additional incentives for affected sources to cut emissions, HRI and consequent variable cost reductions at those sources would lead to increases in utilization of those EGUs as compared to other generating options.

The failure of an HRI-only approach to deliver significant emissions reductions does not mean that HRI could not be an element, albeit a minor element, of a broader reduction strategy.<sup>67</sup> But as discussed in greater detail in Parts III.C. and IV.B. and C., most of the emissions reductions result from other source-specific measures like CCS and gas co-firing and/or from those measures that are available to the power sector due to the integrated nature of the electricity system. Those include the deployment of additional lower-or zero-emitting resources and the decreased use of higher-emitting generation. Figure 13 above compares carbon emissions reductions from HRI implemented in isolation to the CPP system-wide approach reflected in CPP-1 and CPP-2- which recognizes the integrated nature of the power sector.

3. *HRI implemented in isolation could result in the full erosion of emissions reductions and extend the lifetime of high-emitting coal plants*

In addition to offsetting some of the intended emissions reductions, the rebound effect ensuing from HRI applied in isolation could fully erode those reductions. Both the NRDC and EPA modeling show that HRI at affected sources could actually result in *higher* emissions compared

<sup>67</sup> Up to 1.6 percent compared to a No CPP case.

to the No CPP scenario. EPA explicitly recognizes the potential for such a rebound effect in the proposal without providing any recommendation for mitigating it.

The NRDC modeling shows an increase in emissions from coal plants ranging between 0.5 and 1.3 percent under the 4.5 percent at \$50/kW and 2 percent cases, respectively, compared to a No CPP case in 2040 (Table 3). This is driven by the increase in coal generation in the 2 percent and 4.5 percent at \$50/kW HRI cases, reaching up to 5 percent in 2040 compared to No CPP (Figure 5 above). In this case, the system-wide emission increases due to increased coal plants operations negate and exceed system-wide emissions decreases due to reduced heat rates. EPA’s own analysis shows similar results in the outer years, whereby coal plant emissions increase by 1.6 to 2.5 percent compared to the No CPP case in 2050, under both 4.5 percent HRI cases (Table 4).

*Table 3. Carbon emissions from coal EGUs and coal capacity relative to No CPP - NRDC Modeling (no CCS)*

	2030		2040		2050	
	Carbon Emissions Coal Plants	Capacity Coal Plants	Carbon Emissions Coal Plants	Capacity Coal Plants	Carbon Emissions Coal Plants	Capacity Coal Plants
No CPP	-	-	-	-	-	-
HRI-1	-0.8%	0.7%	1.3%	2.8%	1.1%	3.7%
HRI-2	-1.5%	0.7%	0.5%	2.8%	0%	3.7%
HRI-3	-1.5%	-0.4%	-0.4%	1.7%	-1.0%	2.6%

*Table 4. Carbon emissions from coal EGUs and coal capacity relative to No CPP – EPA Modeling*

	2030		2040		2050	
	Carbon Emissions Coal Plants	Capacity Coal Plants	Carbon Emissions Coal Plants	Capacity Coal Plants	Carbon Emissions Coal Plants	Capacity Coal Plants
No CPP	-	-	-	-	-	-
HRI-1	-1.1%	-1%	-0.6%	-1.2%	0.1%	0.6%
HRI-2	-0.6%	-0.3%	-0.2%	-0.1%	2.5%	3.1%
HRI-3	-2.0%	-2.3%	-1.6%	-3.1%	1.6%	2%

The increase in coal plant emissions compared to a do-nothing scenario is driven by the twofold impact of HRI on coal EGUs implemented in the 2025 timeframe: the increased utilization of coal plants (Figure 14) and the increased lifetime of coal EGUs (Table 3 and Table 4, and Figure 15 below). The NRDC modeling shows more coal capacity staying online by 2030 and in the later years, under the three HRI cases compared to a No CPP case (Table 3). The HRI requirements drive some very modest coal retirements in 2025, the year the standards are assumed to be enforced; an additional 0.7 to 1.9 percent – or 1 to 3 GW – of coal capacity retires in 2025 in the HRI cases compared to the No CPP case. However, by 2030 and each year thereafter, coal capacity in the HRI cases exceeds the capacity under the No CPP case by up to 0.7 percent in 2030 and 2.8 percent in 2040<sup>68</sup> (Table 3). This reversal is driven by the HRI

<sup>68</sup> This is equivalent to an additional 1 GW of coal capacity staying online in 2030 under the 2 percent and 4.5 percent at \$50/kW cases; and an additional 3 to 5 GW of capacity staying online in 2040.



investments made in the 2025 timeframe that prolong the life of affected coal plants; those investments lead to lower operating costs and greater use of these plants compared to the No CPP case. The additional revenue stream from increased electricity sales improves the economics of these coal plants and enable them to remain online longer than they would under a do-nothing approach. These results confirm that in addition to increasing the utilization of affected EGUs, HRI can also increase their lifetime. This is inconsistent with the Clean Air Act’s objective of protecting our atmosphere which requires continued reductions in carbon emissions and air pollution.

Figure 15. U.S. coal capacity under the No CPP and HRI cases - NRDC Modeling (no CCS)

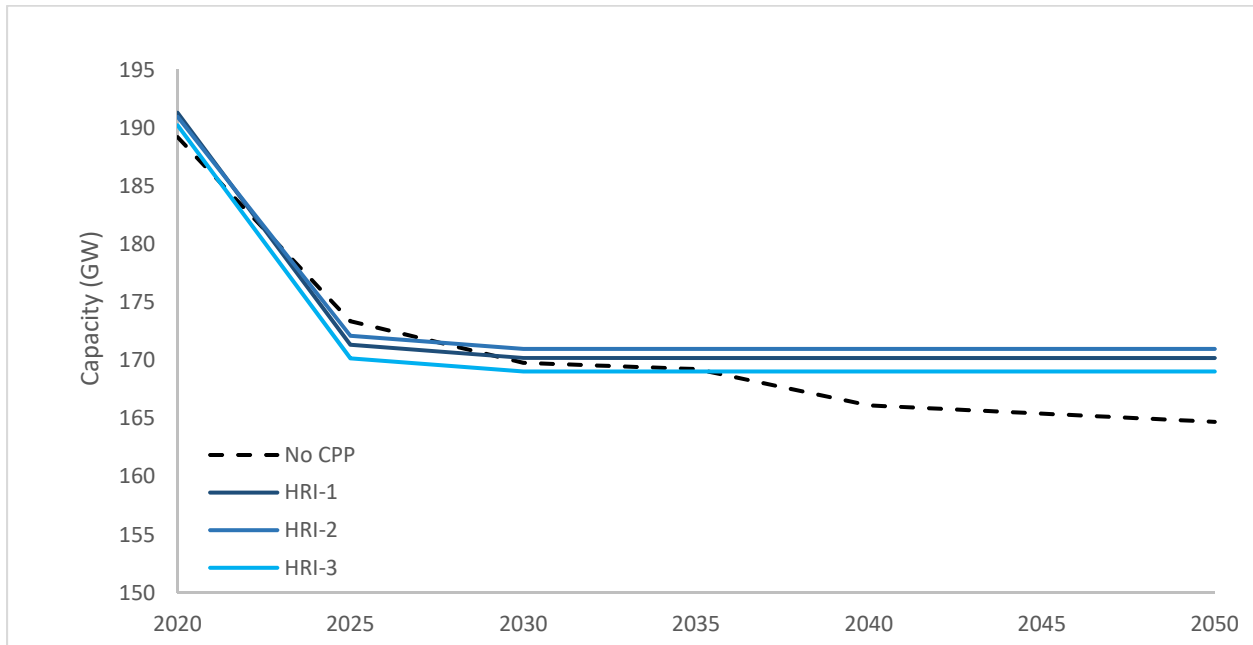
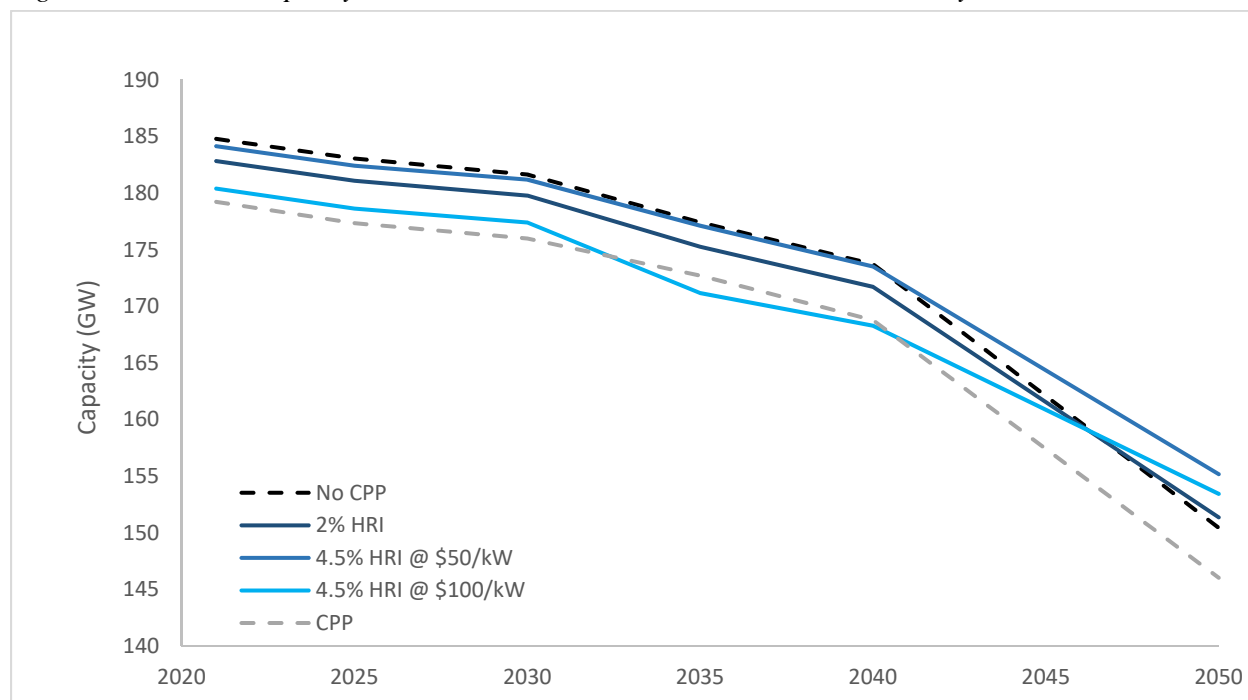


Figure 16. U.S. coal capacity under the No CPP and HRI cases - EPA ACE analysis



EPA found a similar pattern in its own modeling. Up to an additional 5 GW – or 3 percent – of coal capacity remains by 2050 in the 4.5% HRI case at \$50/kW compared to the No CPP case (Table 4). Both the increased utilization of coal plants and their extended lifetime in all three HRI cases by 2050 drive a 2.5 percent increase in carbon emissions from coal EGUs by 2050, compared to the No CPP case (Table 4). It is worth noting that the impact of HRI on the lifetime extension of coal EGUs is less pronounced in EPA’s modeling in large part due to the low gas prices that EPA assumed in its modeling; lower gas price assumptions make coal less competitive compared to gas and likely dampens the impact of HRI on coal utilization.<sup>69</sup> However, the converging results between both modeling efforts, despite their reliance on a different set of assumptions, point to their robustness; in the context of the integrated nature of the power sector and the lack of additional incentives for carbon reductions, HRI alone would result in an undesirable emissions outcome.

In addition, both the NRDC and EPA modeling show an increase in harmful sulfur dioxide pollution under the HRI cases (Table 5 and Table 6). NRDC’s modeling shows an increase of up to 22,000 tons of SO<sub>2</sub> by 2040, or 2 percent, compared to a No CPP case; the increase in SO<sub>2</sub> emissions results in forgone benefits of up to \$2 billion by 2040 (Table 5). The minuscule reduction in SO<sub>2</sub> emissions in 2030 and increase in emissions after 2030 is in stark contrast to the large SO<sub>2</sub> emissions reductions and associated benefits under an updated CPP approach; in the

<sup>69</sup> EPA’s gas price assumptions are discussed in greater detail in Appendix B.

CPP-2 case, SO<sub>2</sub> emissions are more than halved compared to No CPP, while the health benefits associated with this reduction reach up to \$50 billion in 2030.<sup>70</sup>

EPA’s modeling shows an increase of up to 20,000 tons of SO<sub>2</sub> by 2050 – or 2.6 percent – compared to a No CPP case; the increase in SO<sub>2</sub> emissions results in forgone benefits of up to \$1.8 billion by 2040 (Table 6).

*Table 5. Change in SO<sub>2</sub> emissions from power plants compared to No CPP and associated co-benefits - NRDC Modeling (with CCS)*

	Change in SO <sub>2</sub> compared to No CPP			Co-Benefits (2016\$ Millions)		
	2030	2040	2050	2030	2040	2050
<b>No CPP</b>	-	-	-	-	-	-
<b>HRI-1</b>	-0.8%	2.1%	1.6%	\$340 to \$780	-\$883 to -\$2,026	-\$706 to -\$1,620
<b>HRI-2</b>	0.3%	1.4%	-0.2%	-\$136 to -\$312	-\$586 to -\$1,346	\$72 to \$165
<b>HRI-3</b>	-0.5%	0.8%	-0.4%	\$225 to \$516	-\$345 to -\$792	\$185 to \$424
<b>CPP-1</b>	-2.8%	-6.9%	-10.6%	\$1,240 to \$2,846	\$2,924 to \$6,710	\$4,652 to \$10,677
<b>CPP-2</b>	-51%	-68%	-71%	\$22,375 to \$51,351	\$28,513 to \$65,438	\$31,142 to \$71,471

*Table 6. Change in SO<sub>2</sub> emissions from power plants compared to No CPP and associated co-benefits – EPA’s ACE Rule*

	Change in SO <sub>2</sub> compared to No CPP			Co-Benefits (2016\$ Millions)		
	2030	2040	2050	2030	2040	2050
<b>No CPP</b>	-	-	-	-	-	-
<b>HRI-1</b>	-0.7%	-0.8%	1.0%	\$279 to \$641	\$261 to \$59	-\$298 to -\$683
<b>HRI-2</b>	-0.7%	-0.5%	2.6%	\$275 to \$632	\$167 to \$382	-\$808 to -\$1,854
<b>HRI-3</b>	-1.6%	-1.5%	2.3%	\$595 to \$1,365	\$515 to \$1,181	-\$719 to -\$1,650
<b>CPP</b>	-6.3%	-4.3%	-3.5%	\$2,388 to \$5,481	\$1,479 to \$3,394	\$1,081 to \$2,482

In addition, both the EPA and NRDC modeling show an increase in SO<sub>2</sub> emissions every year starting 2025 in the HRI cases compared to the 2015 CPP; the differential reaches up to 95,000 tons in 2040 in the NRDC modeling – or 9.6 percent compared to the CPP – and 37,000 tons in the EPA modeling – or 4.5 percent compared to the CPP (Table 7 and Table 8). The increase in

<sup>70</sup> The benefits of SO<sub>2</sub> emissions reductions are based on the monetized per ton benefits that EPA relied on in the *Regulatory Impact Analysis for the Clean Power Plan Final Rule* (Aug. 2015) (“CPP RIA”).

SO<sub>2</sub> emissions compared to the CPP results in large foregone health benefits, reaching up to \$3 billion in 2030 in the NRDC modeling and nearly \$5 billion in 2030 in the EPA modeling.

Table 7. Change in SO<sub>2</sub> emissions from power plants compared to CPP-1 and associated co-benefits – NRDC Modeling (with CCS)

	Change in SO <sub>2</sub> compared to CPP			Co-Benefits (2016\$ Millions)		
	2030	2040	2050	2030	2040	2050
No CPP	2.9%	7.4%	11.8%	-\$1,240 to -\$2,846	-\$2,924 to -\$6,710	-\$4,652 to -\$10,677
HRI-1	2.1%	9.6%	13.6%	-900 to -\$2,066	-\$3,806 to -\$8,736	-\$5,358 to -\$12,297
HRI-2	3.2%	8.9%	11.6%	-\$1,376 to -\$3,158	-\$3,510 to -\$8,056	-\$4,580 to -\$10,511
HRI-3	2.4%	8.3%	11.3%	-\$1,015 to -\$2,330	-\$3,269 to -\$7,502	-\$4,467 to -\$10,253
CPP-1	-	-	-	-	-	-
CPP-2	-49.3%	-64.8%	-67.1%	\$21,135 to \$48,505	\$25,589 to \$58,728	\$26,490 to \$60,794

Table 8. Change in SO<sub>2</sub> emissions from power plants compared to CPP and associated co-benefits – EPA Modeling

	Change in SO <sub>2</sub> compared to CPP			Co-Benefits (2016\$ Millions)		
	2030	2040	2050	2030	2040	2050
No CPP	6.7%	4.5%	6.4%	-\$2,388 to -\$5,482	-\$1,479 to -\$3,394	-\$2,114 to -\$4,851
HRI-1	5.9%	3.7%	5.9%	-\$2,109 to -\$4,840	-\$1,218 to -\$2,796	-\$1,942 to -\$4,458
HRI-2	5.9%	4.0%	5.1%	-\$2,113 to -\$4,849	-\$1,312 to -\$3,012	-\$1,684 to -\$3,864
HRI-3	5.0%	2.9%	5.2%	-\$1,793 to -\$4,116	-\$964 to -\$2,213	-\$1,699 to -\$3,900
CPP	-	-	-	-	-	-

The modeling further confirms that HRI in isolation are not an adequate determination of BSER. Even if the advertised 2.5 to 4 percent emission reductions did occur, those would be too small. And further exacerbating the inadequacy of HRI as the sole component of BSER, the emission reductions that would actually ensue are much smaller because efficiency improvements in isolation result in a rebound effect that largely undermines the already meager reductions. Just as EPA concluded in 2015, these results show that HRI improvements can only be effectively used in combination with other building blocks; a combination would achieve the pollution reduction purpose of the Clean Air Act and section 111(d) by ensuring significant emission reductions from the system as a whole.

## **B. EPA arbitrarily rejected including co-firing natural gas in steam units in the BSER.**

The potential to reduce the carbon pollution from steam boilers by using natural gas in lieu of coal is well demonstrated and should have been included in EPA’s determination of the best system of emission reduction.

Co-firing refers to the ability to run on or combust two fuel types in a single boiler. Commonly, coal-fired boilers are modified to co-fire with natural gas.<sup>71</sup> These types of measures—which can range from co-firing a coal boiler with low levels of natural gas to a full 100 percent conversion of the boiler to natural gas—have been noted as “perhaps the most familiar and most proven method for reducing greenhouse gas emissions from existing EGUs.”<sup>72</sup> The EPA previously found that most coal-fired units in the U.S. could be modified to burn natural gas and—can do so “within price ranges that the EPA... [is] already using to reduce their CO2 emissions.”<sup>73</sup>

Co-firing can be a simple and low-cost option for existing facilities, depending on a few factors like natural gas burn and the existing gas infrastructure available. Major plant equipment, such as the boiler, turbines, and heaters do not need to be replaced to co-fire or even fully convert a boiler. Retrofitting a coal boiler to co-fire with natural gas can be as simple as replacing the existing oil-fired ignitors with new natural gas-fired ignitors. This low-cost modification typically allows a boiler to use between 10 and 20 percent natural gas. To burn higher levels of natural gas, additional modifications to the unit may be required. For example, a unit’s oil-fired warm up guns can also be replaced with natural gas-fired guns, which would allow the boiler to burn between 30 and 50 percent natural gas. Operators can also install gas rings around existing coal burners or dual-fuel burners to allow boilers to burn up to 100 percent natural gas. These fuel modifications involve only modest capital costs: studies suggest the costs range between \$10/KW to \$100/KW, depending on the suite of modifications taken.<sup>74</sup>

### *1. Co-firing in the U.S.: trends and operator performance*

Co-firing is already a common practice in the U.S. 399 coal units currently co-fire with natural gas (see Appendix H). These co-fired units represent 53.5 GW of capacity (or 21.7 percent of the current operating fleet).<sup>75</sup> The quantity of gas burned varies significantly between different co-firing units depending on the modifications and configurations used at each individual boiler. As shown in Figure 17, a sample of U.S. co-fired units show that modifications already allow

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<sup>71</sup> Co-firing biomass is discussed in separate Joint Comments on the Treatment of Biomass-Based Generation.

<sup>72</sup> National Association of Clean Air Agencies, “Switch Fuels at Existing Power Plants” in *Implementing EPA’s Clean Power Plan: A Menu of Options*, 9-1 (May 2015).

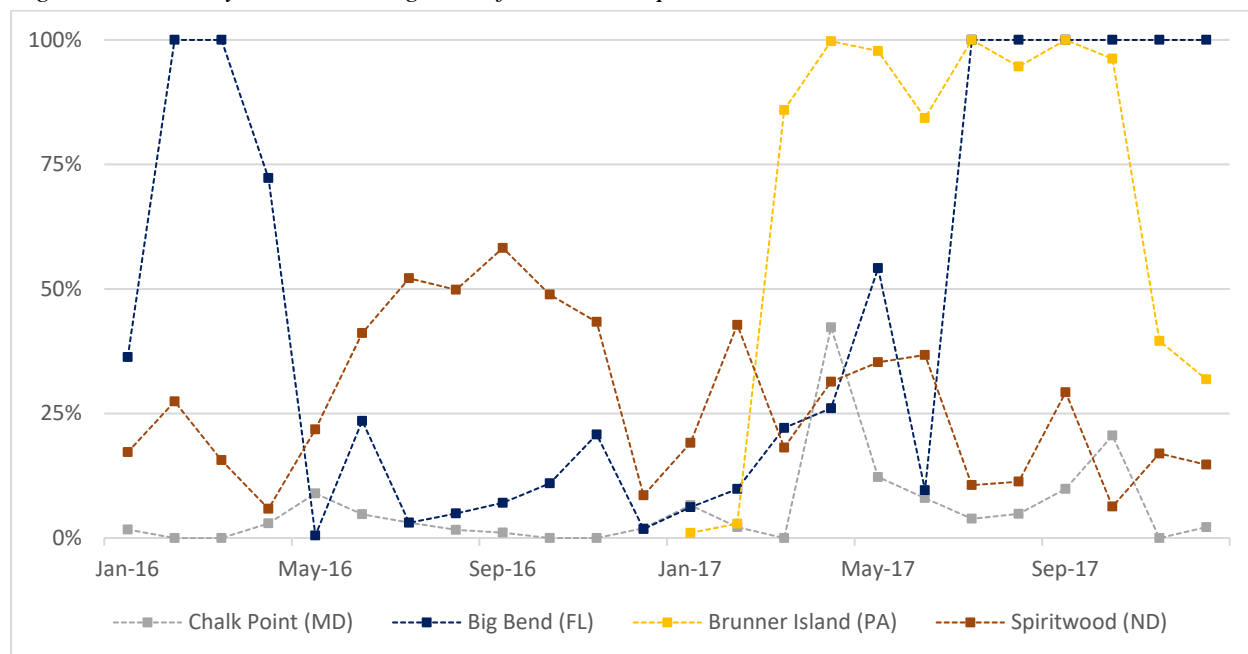
<sup>73</sup> 80 Fed. Reg. at 64,727.

<sup>74</sup> These costs do not include pipeline-associated costs; proximity to existing natural gas pipelines can significantly affect the economics of a project.

<sup>75</sup> EIA, *Electric Power Monthly*, Table 6.2.C: Net Summer Capacity of Utility Scale Units Using Primarily Fossil Fuels and by State, July 2018 and 2017 (Sept. 2018), [https://www.eia.gov/electricity/monthly/epm\\_table\\_grapher.php?t=epmt\\_6\\_02\\_c](https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_02_c).

operators to routinely co-fire gas at 50 percent or more on a monthly basis. Several have even maintained 100 percent gas for a month or longer.

Figure 17. Monthly Gas Co-Firing Rates for Four Sample Units



By co-firing gas, number of these units have been able to sustain much lower CO<sub>2</sub> emission rates than the average coal-fired unit. For example, W.A. Parish in Texas, Cope in South Carolina, and Brunner Island have seen CO<sub>2</sub> emission rates drop by up to a third by utilizing added co-firing capabilities (see Table 9 below for select emissions rates over the last three years at co-fired facilities). This is in line with EPA’s own analysis of the emission reduction potential of these fuel-switching measures in the Clean Power Plan rulemaking: EPA found CO<sub>2</sub> emissions could fall by “approximately 40 percent in the case of conversion from 100 percent coal to 100 percent natural gas, and proportionately smaller for partial co-firing of coal with natural gas.”<sup>76</sup> In addition to reductions in carbon emissions from coal-fired Electric Generating Units (EGUs), co-firing can also significantly reduce co-pollutants, like NO<sub>x</sub> and SO<sub>2</sub>. Breen Energy Solutions, headquartered in Bridgeville, Pennsylvania, has noted that a 35 percent natural gas feed with their co-firing system could reduce SO<sub>2</sub> emissions by 35 percent, NO<sub>x</sub> emissions by 45 percent, particulates by 35 percent, mercury by 35 percent, and CO<sub>2</sub> by 20 percent.<sup>77</sup>

<sup>76</sup> 80 Fed. Reg. at 64,756.

<sup>77</sup> Stephen Mills, *Combining Solar Power with Coal-Fired Power Plants, or Cofiring Natural Gas*, IEA Clean Coal Centre, 62 (October 2017).

Table 9. Historic carbon emission rates for select co-fired U.S. facilities in 2015, 2016, and 2017<sup>78</sup>

Power Plant	Unit Code	Co-fired/Fuel-switching?	All Fuel Types	CO2 Rate in lbs/MWh		
				2017	2016	2015
Jones	1	Co-Fired	Distillate Fuel Oil, Natural Gas, Subbituminous Coal	1,378	1,363	1,289
Brunner Island	3	Co-Fired	Bituminous Coal, Distillate Fuel Oil, Natural Gas, Refined Coal	1,390	2,038	2,033
Jones	2	Co-Fired	Distillate Fuel Oil, Natural Gas, Subbituminous Coal	1,399	1,371	1,359
Brunner Island	2	Co-Fired	Bituminous Coal, Distillate Fuel Oil, Natural Gas, Refined Coal	1,540	2,326	2,081
Brunner Island	1	Co-Fired	Bituminous Coal, Distillate Fuel Oil, Natural Gas, Refined Coal	1,723	2,524	2,191
W.A. Parish 5-8	8	Co-Fired	Natural Gas, Subbituminous Coal	1,729	2,273	2,104
Cope	ST1	Co-Fired	Bituminous Coal, Distillate Fuel Oil, Natural Gas, Refined Coal	1,791	1,786	1,788
W.A. Parish 5-8	7	Co-Fired	Natural Gas, Subbituminous Coal	1,959	2,108	2,061
H.L. Spurlock	4	Co-Fired	Bituminous Coal, Distillate Fuel Oil, Tires, Waste Coal, Wood Waste Solids	1,962	1,996	2,483
Tolk	1	Co-Fired	Natural Gas, Subbituminous Coal	2,008	2,043	2,029
Bay Front	4	Co-Fired	Natural Gas, Subbituminous Coal, Tires, Wood Waste Solids	2,013	1,938	1,884
H.L. Spurlock	3	Co-Fired	Bituminous Coal, Distillate Fuel Oil, Tires, Waste Coal, Wood Waste Solids	2,037	2,035	2,705
Monroe	3	Co-Fired	Bituminous Coal, Distillate Fuel Oil, Petroleum Coke, Refined Coal, Subbituminous Coal	2,071	2,119	2,058
Virginia City Hybrid Energy Center	1	Co-Fired	Bituminous Coal, Distillate Fuel Oil, Waste Coal, Wood Waste Solids	2,088	2,084	2,210
Merom Generating Station	2	Co-Fired	Bituminous Coal, Distillate Fuel Oil	2,090	2,143	2,081
W.A. Parish 5-8	5	Co-Fired	Natural Gas, Subbituminous Coal	2,096	2,188	2,072

Plant operators have added co-firing capabilities for a variety of reasons, beyond just emission reductions. FirstEnergy has explored co-firing at its West Virginia facilities, noting that “co-firing has several benefits. It provides fuel diversity and ensures our Mon Power coal units can continue to produce low-cost electricity while supporting both the abundant low-cost natural gas supply prevalent in the region... [and] could help our fleet comply with future federal and/or state environmental regulations.”<sup>79</sup> FirstEnergy did not find building new natural gas plants cost-effective but did find co-firing with up to 30 percent prudent.<sup>80</sup>

Co-firing with natural gas can also reduce warm-up times, allowing a unit to be brought online faster, and helping coal-fired boilers reduce their minimum operating threshold. This can make

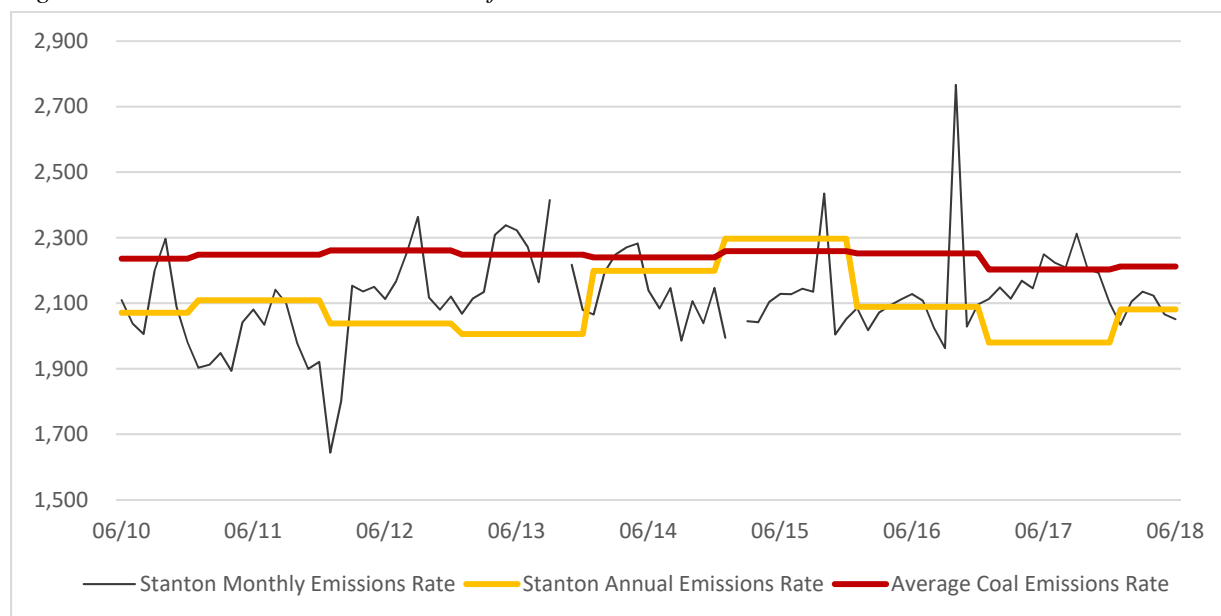
<sup>78</sup> S&P Global Market Intelligence. Screener Tool: Power Plant Unit Details (*Subscription required*); U.S. Energy Information Administration, *EIA 923 detailed data with previous form data (EIA-906/920)* (September 2018), <https://www.eia.gov/electricity/data/eia923/>.

<sup>79</sup> Ken Silverstein, *Will Co-Firing Natural Gas and Coal Meet Clean Power Plan Standards?* Energy Manager Today (May 2016), <https://www.energymanagertoday.com/123894-0123894/>.

<sup>80</sup> *Id.*

coal-fired units more competitive and cost-effective by reducing cycling costs and allowing for more flexible economics in response to market conditions. For example, Orlando Utilities’ Stanton Plant regularly co-fires.<sup>81</sup> The main aim of these modifications was to increase fuel diversity and address increasing needs to cycle these facilities. Both 450 MW coal-fired units are regularly cycled to reduce load. During periods of high demand, each unit operates five pulverizer mills, and at night, only a single mill remains in operation, reducing generation to 90–120 MW. When operating with only one pulverizer, the units can run at greater than 50 percent natural gas, which allows them to both operate more effectively during low-load periods at night and then respond more rapidly to changes in load demand during the morning periods. The monthly and annual emissions profile of Stanton Unit 2 is shown below. Between 2011 and 2017, Stanton Unit 2 avoided the equivalent of 1.46 million tons of CO<sub>2</sub> compared to if the plant had operated at the average emissions rate for coal-fired plants in the U.S. This is equivalent to a seven percent reduction in total reported emissions from the unit during the same period—a substantial reduction, especially given the fact that emission considerations were not a driver of the modifications.

Figure 18. Stanton Unit 2 Emissions Profile



## 2. EPA’s justification for excluding co-firing from the BSER is flawed.

As part of the ACE proposal, EPA supports its determination that co-firing should not be a BSER measure by reference to EPA’s previous finding in the 2015 Final Clean Power Plan rule: “EPA has previously determined that co-firing of alternative fuels (biomass or natural gas) in coal-fired utility boilers is not part of BSER for existing fossil fuel-fired sources due to cost and

<sup>81</sup> Stephen Mills, *Combining Solar Power with Coal-Fired Power Plants, or Cofiring Natural Gas*, IEA Clean Coal Centre, 67, 71 (Oct. 2017).



feasibility considerations.”<sup>82</sup> However, this statement mischaracterizes the 2015 CPP’s reason for excluding co-firing as a BSER measure in the final CPP rulemaking.

The EPA did not conclude that co-firing should be excluded “due to cost and feasibility considerations.” In fact, the 2015 rule explicitly notes that “The EPA found that some of these co-firing and CCS measures *are technically feasible and within price ranges* that the EPA throughout the U.S. and in foreign nations are already using to reduce their CO<sub>2</sub> emissions.”<sup>83</sup> [emphasis added] The EPA only excluded co-firing as a BSER measure “because the integrated nature of the electricity system affords significantly lower cost options.”<sup>84</sup> Specifically, they concluded in the 2015 rule that “were the EPA to include co-firing and CCS in the BSER and promulgate performance standards accordingly, few EGUs would likely comply with their emission standards through co-firing and CCS,” instead choosing to rely on the measures in the CPP’s building blocks 2 and 3.<sup>85</sup> This is because “less expensive options include shifting generation to existing NGCC units... as well as shifting generation to new RE generating units.”<sup>86</sup>

However, in this rule, the EPA proposes to not allow for these lower-cost non-source-specific measures. It was only the availability of lower-cost options such as re-dispatching of coal to existing gas or the addition of new renewables that provided the basis for EPA to exclude co-firing or CCS in the CPP’s BSER calculation. Since the EPA has adjusted the scope of measures to only those that are source specific, this prior determination not to include co-firing cannot be used to justify its exclusion in the current ACE proposal.

In fact, in the 2015 rule, the EPA also states that the measures included in building block 1—which is only heat rate improvements—are inadequate in and of themselves.<sup>87</sup> It notes that the additional building block 1 measures considered—namely co-firing and CCS—would significantly bolster the emission reductions from this building block, if not for the fact that building block 2 and building block 3 had cheaper reduction measures.<sup>88</sup> Given the exclusion of these two other “building blocks” in this rule, the EPA must fully consider these other building block 1 measures that would, in the EPA’s own words, “yield much greater emission reductions” than just HRI.<sup>89</sup>

In the proposal, EPA also argues that co-firing should not be considered because of regional differences in the availability of natural gas. EPA notes that “fuel use opportunities are dependent upon many regional considerations and characteristics (e.g., access to biomass, or

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<sup>82</sup> 83 Fed. Reg. at 44,762.

<sup>83</sup> *Id.* at 64,727-28.

<sup>84</sup> *Id.* at 64,727.

<sup>85</sup> *Id.* at 64,728.

<sup>86</sup> *Id.*

<sup>87</sup> *Id.* at 64,769.

<sup>88</sup> *Id.*

<sup>89</sup> *Id.*

natural gas pipeline infrastructure limitations), that prevent its adoption as BSER on a national level (whereas nearly all sources can or have implemented some form of heat rate improvement measures).”<sup>90</sup> This is in error both as a matter of the facts and of the law. The common availability of co-firing is addressed both in this section and in Appendix J, where NRDC provides the results of a co-firing study conducted by ICF for NRDC. This analysis identified and summarized the costs of 10% co-firing at the unit level for all coal-plants in the U.S. The analysis considered necessary laterals, miles of pipe, and diameter of laterals required for each of the 872 individual operating coal-fired boilers. Of the 872 boilers, 510 could connect to an available pipeline and co-fire at 10 percent at a cost of less than \$100/kW (in 2016\$)—equivalent to EPA’s assumed cost of HRI in one of the scenarios in the proposed rule—with a total median cost across all 872 units of \$72/KW (as shown in Table 10 and Figure 19). This robust analysis directly conflicts with EPA’s unsupported assertion that “broader application of fuel co-firing methods has been shown to be costly.”<sup>91</sup>

*Table 10. Characteristics of coal-fired boilers for 10 percent co-firing*

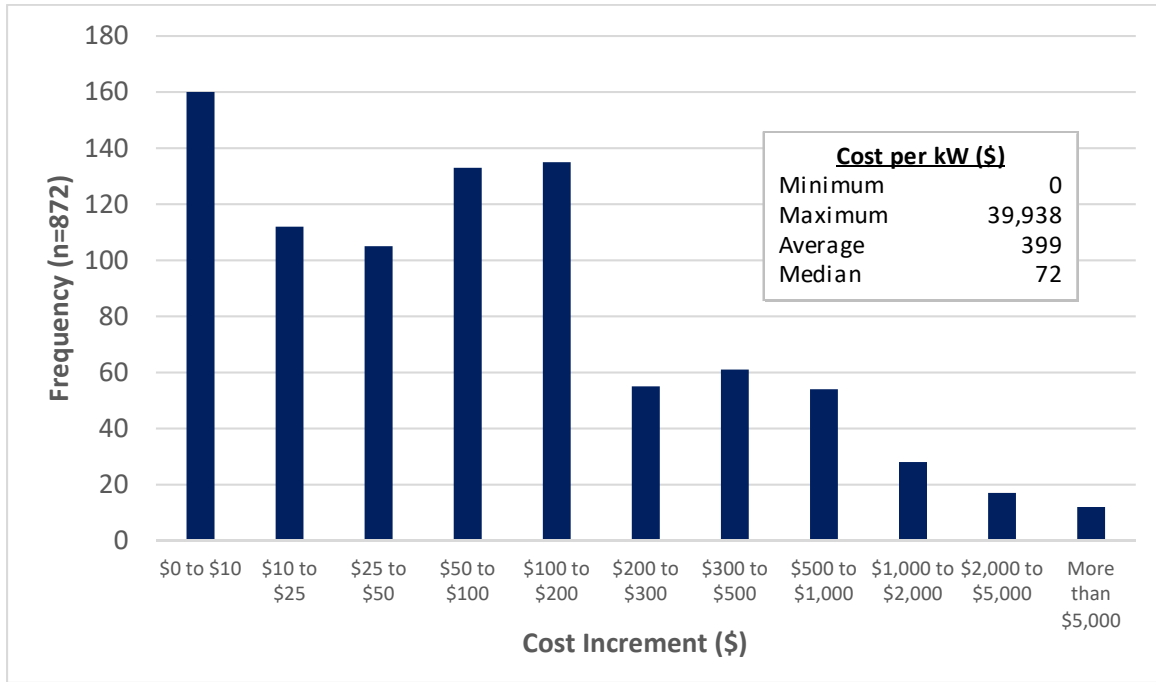
<b>Per Boiler Values for 10 percent co-firing</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Average</b>	<b>Median</b>
<b>Number of Laterals Required per Boiler</b>	1	2	1.0	1
<b>Miles of Pipeline Required per Boiler</b>	0.0	170	27	16
<b>Diameter of Laterals, in Inches</b>	4	10	6	6
<b>Total Inch-Miles of Laterals Required per Boiler</b>	0	1,146	167	92
<b>Total Cost to Each Boiler (Million\$2016)</b>	0.0	\$172	\$27	\$14
<b>Cost per kW of Boiler Capacity (\$2016)</b>	0	\$39,938	\$399	\$72

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<sup>90</sup> *Id.* at 44,762.

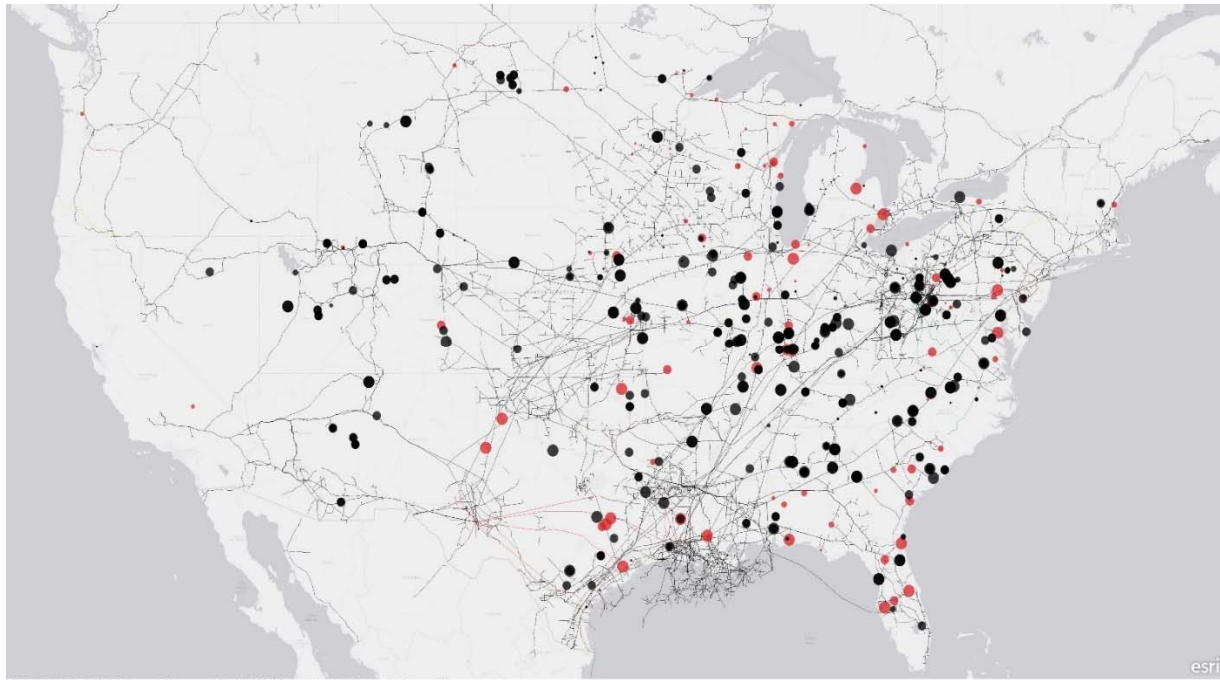
<sup>91</sup> *Id.*

Figure 19: Distribution of boiler cost per kW



In addition, as shown in Figure 20 below, the existing natural gas pipeline system in the U.S. is expansive and well-situated near the existing coal fleet. Coal facilities that already co-fire with natural gas are also dispersed across the country, indicating that co-firing is a viable and cost-effective option for many different regions in the U.S.

Figure 20. Proximity to existing natural gas pipelines<sup>92</sup>



Red dots represent coal-fired EGUs that co-fire with natural gas; black dots represent coal-fired EGUs that currently do not co-fire. Dots are sized based on installed nameplate capacity. Black lines represent operating natural gas pipelines; colored lines represent propose pipeline projects.

EPA’s argument is also flawed as a legal matter because, as noted in the Joint Comments, ruling out certain systems of emission reduction based on concerns regarding source-specific applicability is inconsistent with EPA’s proposed framework. EPA proposes to ask states to carry out a source-specific analysis of HRI for each existing EGU in the framework set up in the Proposed Rule. EPA cannot claim that source-specific geographic or infrastructure constraints justify its refusal to include CCS or natural gas co-firing or conversion among the pollution reduction measures available and feasible on a source-specific basis. Indeed, EPA’s PSD permitting guidance requires permitting authorities to consider such options at Step 1 of the BACT process,<sup>93</sup> even if they must ultimately be ruled out as infeasible due to source-specific constraints.

<sup>92</sup> Map developed by NRDC using S&P Global Market Intelligence’s Map Tool and data sets.

<sup>93</sup> EPA, PSD and Title V Permitting Guidance for Greenhouse Gases at 32 (“For the purposes of a BACT analysis for GHGs, EPA classifies CCS as an add-on pollution control technology that is “available” for facilities emitting CO<sub>2</sub> in large amounts, including fossil fuel-fired power plants, and for industrial facilities with high-purity CO<sub>2</sub> streams (e.g., hydrogen production, ammonia production, natural gas processing, ethanol production, ethylene oxide production, cement production, and iron and steel manufacturing). For these types of facilities, CCS should be listed in Step 1 of a top-down BACT analysis for GHGs.”).

3. *NRDC modeling shows that co-firing would achieve significant benefits compared to EPA's HRI based proposal, although the CPP approach is still preferable.*

NRDC developed and modeled five illustrative policy scenarios to represent possible standards using co-firing as BSER. NRDC used IPM to compare the projected impacts on the electricity sector from these co-firing-based standards with the impacts from EPA's proposed HRI-based standard. NRDC's modeling of the HRI scenarios is described in more detail in Part IV.A. above.

Table 11 details the five co-firing standards, with the corresponding CO<sub>2</sub> emissions rate limits for 2030.<sup>94</sup>

The two least stringent co-firing scenarios (COF-1 and COF-1US in Table 11) apply a co-firing standard only to coal plants, with no standard for natural gas plants. In the first scenario, the emissions rate of a given coal power plant, averaged across all units of the plant, must be equal to or less than the specified rate. In the second scenario, facilities are allowed greater flexibility and could trade emissions allowances with other power plants across the country to reduce compliance costs.

The two more-stringent rate-based scenarios (COF-GHRI-1 and COF-CCS-1 in Table 11) apply a co-firing standard to coal plants and a CCS standard to natural gas combined cycle (NGCC) plants. COF-GHRI-1 assumes 30 percent co-firing across the coal fleet, 40 percent repowering of coal with natural gas, and a 2 percent Heat Rate Improvement (HRI) on existing NGCC, along with an updated 111(b) rule requiring 90 percent CO<sub>2</sub> capture on all new NGCC facilities. Existing NGCC plants could achieve 2 percent HRI through a variety of measures at a reasonable cost, including turbine inlet cooling, turbine inlet fogging, wetted media evaporative cooling, gas turbine upgrades, and steam turbine upgrades.<sup>95</sup> In COF-CCS-1, the standard is derived by assuming 60 percent co-firing on the entire coal fleet, 90 percent CO<sub>2</sub> capture on almost 60 percent of the existing NGCC fleet, and an updated 111(b) rule requiring 90 percent CO<sub>2</sub> capture on all new NGCC facilities.

The final scenario (MASS-1 in Table 11) reflects a system-wide approach with a mass-based emissions cap on coal and gas units that achieves the same level of emissions reductions as COF-GHRI-1, which reflects a source-specific, rate-based approach. The mass limits are then applied to the system as a whole—emissions from existing and new coal and NGCC units must be less than the specified mass limits, and covered EGUs must obtain an emission allowance for each ton of pollution emitted. In MASS-1, source-specific measures to reduce emissions, like co-firing and CCS, can be used to reduce emissions, along with other system-wide emissions reduction measures. MASS-1 allows for national trading of emissions allowances among coal and gas units. NRDC includes this scenario to illustrate the difference between source-specific and system-based approaches.

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<sup>94</sup> See Appendix C for the rate calculations and the rates for 2025, 2030, and 2035.

<sup>95</sup> Andover Technology Partners, *Improving Heat Rate on Combined Cycle Power Plants* (Oct. 3, 2018).

Table 11. Illustrative policy scenarios for a co-firing-based standard

Code	Standard	2030 rate limits (lbs/MWh)		
		Coal	Existing NGCC	New NGCC
No CPP	No standard, CPP is repealed			
HRI-2	4.5% Heat Rate Improvement at \$50/kW for coal, no standard on NGCC			
CPP-1	2015 CPP with mass caps on existing and new sources			
COF-1	60% co-firing on coal, no standard on NGCC	1,730	842	None
COF-1US	60% co-firing on coal, no standard on NGCC, with national trading	1,730	842	None
COF-GHRI-1	30% co-firing on 60% of coal fleet, NGCC repowering on 40% of coal fleet, 2% Heat rate Improvement on existing NGCC, 90% CCS capture on new NGCC	1,415	825	100
MASS-1	System-wide approach with mass limits equivalent to the emission reduction of COF-GHRI-1			
COF-CCS-1	60% co-firing on coal fleet, 90% CCS capture on nearly 60% of existing NGCC fleet, 90% CCS capture on new NGCC	1,730	404	100

- i. The illustrative co-firing-based standards result in more significant CO<sub>2</sub> emission reductions than EPA’s HRI proposal and do so at a reasonable cost. EPA should reconsider co-firing as a BSER measure for coal-fired power plants.

A standard that includes co-firing would result in significantly greater reductions in emissions than an HRI-only BSER. As discussed in depth in Part IV.A. above, EPA’s HRI proposal would result in little to no emissions reductions compared to a business-as-usual scenario—and could even increase emissions due to the rebound effect and life extension of coal plants.<sup>96</sup> In considering and comparing source-specific strategies for reducing emissions, EPA should analyze co-firing among their source-specific options for BSER. When compared to EPA’s proposal to use HRI as BSER, co-firing would show greater reductions in emissions at a reasonable cost.

<sup>96</sup> For example, see Dallas Burtraw, Comments to the EPA on the Advanced Notice of Proposed Rulemaking for a Replacement to the Clean Power Plan (Feb. 26, 2018), [http://www.rff.org/files/document/file/RFF-PC-Burtraw\\_Comments%20to%20the%20EPA%20on%20the%20Advanced%20Notice%20of%20Proposed%20Rulemaking%20for%20a%20Replacement%20to%20the%20Clean%20Power%20Plan.pdf](http://www.rff.org/files/document/file/RFF-PC-Burtraw_Comments%20to%20the%20EPA%20on%20the%20Advanced%20Notice%20of%20Proposed%20Rulemaking%20for%20a%20Replacement%20to%20the%20Clean%20Power%20Plan.pdf).

By 2030, the illustrative co-firing scenarios achieved between 13 and 29 percent lower emissions compared to the No CPP scenario, while the HRI scenarios reduced emissions by only 0.7 to 1.6 percent. Figure 21 and Table 12 below detail the emissions outcomes of the co-firing scenarios compared to three runs: No CPP, a scenario based on the 2015 CPP final rule (CPP-1), and one of EPA’s HRI proposals (HRI-2). Out of all the illustrative policy scenarios, EPA’s HRI case achieves the lowest levels of carbon emission reductions, while the scenario with reasonable source-specific standards on both coal and gas (COF-GHRI-1) achieves the greatest CO<sub>2</sub> emission reductions, equivalent to 54 percent below 2005 levels in 2030.

NRDC’s modeling further demonstrates that a co-firing standard could result in substantial reductions in both CO<sub>2</sub> and criteria pollutant emissions at a reasonable cost and with far greater benefits than costs. In 2030, the COF-1 scenario results in annual compliance costs of \$8.0 billion and benefits ranging from \$29.6 to \$53.9 billion, with an average cost of \$24 per ton of reduced emissions. In 2030, COF-GHRI-1 results in costs of \$15.6 billion and benefits ranging from \$42.8 to \$76.8 billion, with an average cost of \$32 per ton of reduced emissions.

Figure 21. Modeled CO<sub>2</sub> emissions from illustrative co-firing scenarios

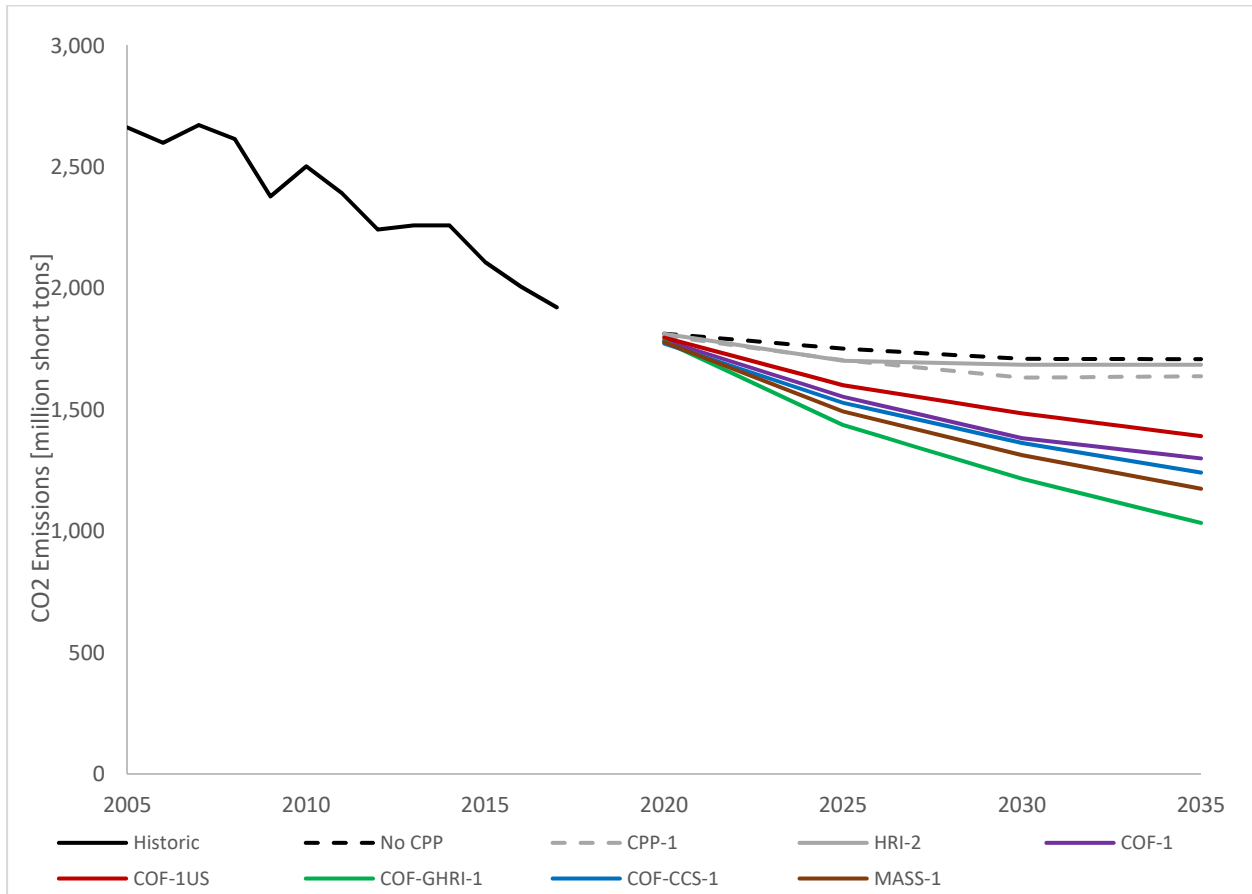


Table 12. CO2 emission reductions, benefits, compliance costs of illustrative co-firing standards

Code	CO2 emissions in 2030 (million short tons)	Reductions in CO2 emissions compared to 2005 in 2030	2030 CO2 emissions reductions compared to No CPP	2030 Reduction in NOx Emissions compared to No CPP	2030 Reduction in SO2 Emissions compared to No CPP	Total Climate and Health Benefits (2016\$ billion)	2030 compliance cost over No CPP (2016\$ billion)
No CPP	1,710	36%					
HRI-2	1,686	37%	1%	2%	0%	1.2 to 1.7	0.3
CPP-1	1,669	37%	2%	2%	3%	3.4 to 6.1	1.7
COF-1	1,384	48%	19%	16%	28%	29.6 to 53.9	8.0
COF-1US	1,486	44%	13%	5%	10%	16.1 to 27.3	3.9
COF-GHRI-1	1,216	54%	29%	21%	38%	42.8 to 76.8	15.6
MASS-1	1,314	51%	23%	24%	26%	32.9 to 58.2	7.1
COF-CCS-1	1,364	49%	20%	-10%	10%	21.9 to 35.2	28.0

- ii. NRDC’s modeled scenarios demonstrate co-firing is an economic and viable option to achieve emissions reductions.

NRDC’s illustrative co-firing scenarios resulted in increased levels of co-firing to meet emissions rate standards. The IPM model chooses to comply with this emission rate standard based on any method that achieves sufficient reductions at each facility using only the flexibilities considered in setting the standard. For these runs, the IPM model selected a combination of co-firing and carbon capture and sequestration as the lowest cost means of meeting the standard, and power plants that could not meet source-specific standards retired and were replaced by other EGUs—some covered by the standards and some not. The fact that the model chooses to co-fire as a cost-effective strategy to meet emissions reductions is evidence that co-firing is a viable approach that EPA should consider in its analysis of BSER for coal plants, as co-firing achieves significantly greater emission reductions than does EPA’s heat rate improvement approach.

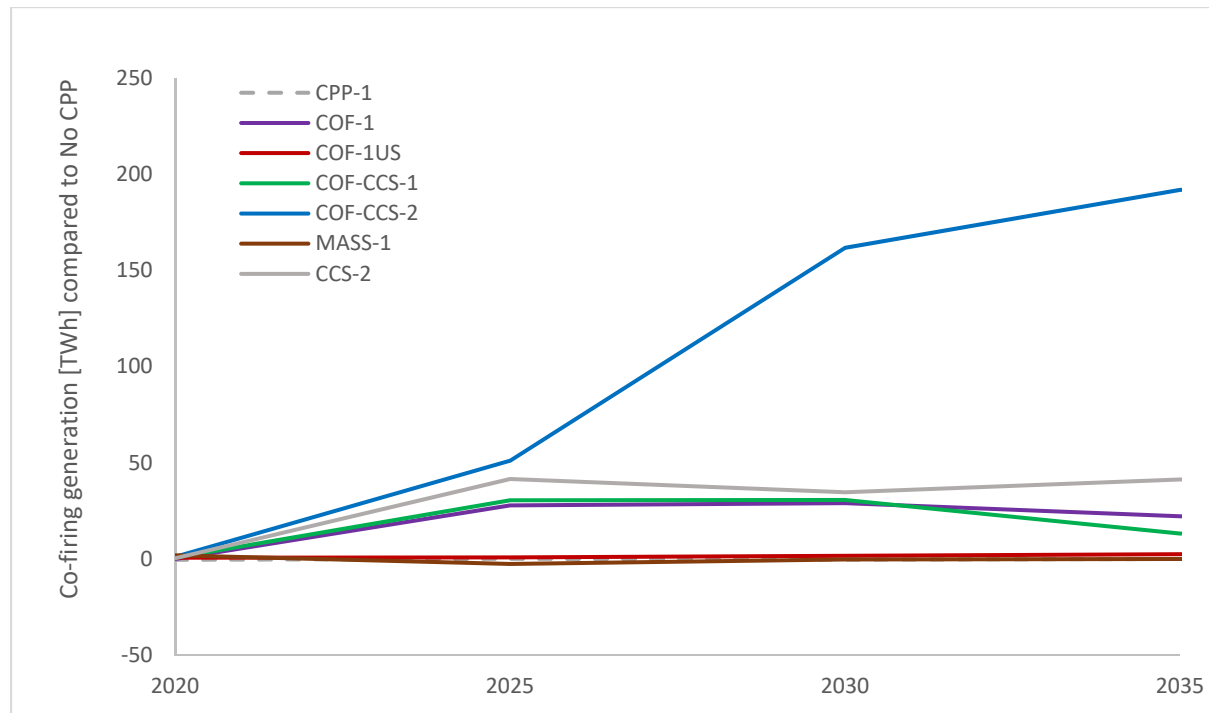
Figure 22 shows the increase in generation from co-firing compared to No CPP in each of the illustrative co-firing policy scenarios. In all but COF-1US (co-firing on coal, no standard on gas, nationwide averaging), the model relies on co-firing for a significant portion of the generation mix. In COF-CCS-1 (co-firing on coal, CCS on gas), co-firing grows to almost 15 percent of the coal fleet’s total generation in 2030.

Figure 22 also includes CCS-2, a policy scenario with source-specific standards derived assuming CCS on both coal and gas. CCS-2 is detailed in greater depth in Joint CCS Comments. Under CCS-2, the model still relies on co-firing to meet a portion of the required emissions reductions, even though co-firing is not the measure used to determine the BSER for coal facilities. This result further illustrates the viability of co-firing as a cost-effective emission reduction measure for the U.S. coal fleet and demonstrates that co-firing should be considered



along with the full suite of compliance measures that are available to reduce emissions. In short, NRDC’s illustrative scenarios demonstrate that co-firing is a viable option, is better than heat-rate-only compliance, and merits greater consideration in EPA’s analysis of BSER.

Figure 22. Generation from co-firing (natural gas at coal plants), compared to No CPP case



- iii. A co-firing standard is better than a heat-rate only standard but, a system-wide approach that incorporates all the strategies that are currently and will be used for compliance— including investment in energy efficiency and fuel switching to renewable energy sources and gas —is a more cost-effective and justifiable strategy to achieve emissions reductions.

The evidence presented above demonstrates that EPA made an arbitrary and unfounded decision when excluding co-firing from the consideration of source-specific BSER options. Our modeling indicates that a BSER standard based, in part, on co-firing would achieve more significant emissions reductions, at reasonable cost, than EPA’s HRI-only proposal.

However, EPA also should consider alternative BSER measures that reflect a system-wide approach. A system-wide approach should include measures similar to those adopted by the EPA in prior rules, such as re-dispatch from coal to natural gas or displacing fossil generation with new renewables as more cost-effective strategies to reduce power-related CO<sub>2</sub> emissions.

To illustrate the difference between implementation of a system-wide approach and a source-specific approach, NRDC modeled a system-wide standard (MASS-1) with a mass target that would achieve similar emissions reductions as COF-GHRI-1 (co-firing and repowering on coal, HRI on existing gas, CCS on new gas). This scenario resulted in emission reductions on par with

COF-GHRI-1 (51 percent below 2005 levels), but at a far lower compliance cost than its source-specific counterpart (\$7.1 billion in 2030, compared to \$15.6 billion for COF-GHRI-1). The MASS-1 scenario is projected to result in \$32.9 and \$58.2 billion in climate- and health-related benefits in 2030, at a much-lower cost of \$7.1 billion. While COF-GHRI-1 does achieve meaningful emissions reductions at a reasonable cost, this comparison clearly shows that the mass-based standard—and moreover a system-wide approach to BSER—would achieve comparable benefits as a similarly stringent source-specific standard but would do so at a much lower cost.

This finding is not surprising; as already noted in detail in these comments, a system-wide approach is the *best* system of emission reduction for the electricity system given that such an approach complements the sector’s integrated nature and because *a system-wide approach is far more cost-effective* than a source-specific standard that achieves adequate emissions reductions.

### **C. EPA failed to evaluate the potential to reduce emissions through application of carbon capture and sequestration.**

NRDC has submitted separate comments jointly with Clean Air Task Force that address EPA’s failure to consider reducing carbon pollution through use of CCS. We incorporate those comments by reference, and reiterate here that CCS is adequately demonstrated and cost reasonable. These separate comments include data and modeling results that show that CCS is a far better source-specific emission reduction technique than the heat rate improvements EPA proposes and demonstrate that the ACE Proposal is arbitrary, capricious and unlawful. If EPA does not pursue a system-based approach like the Clean Power Plan, EPA must establish a BSER that utilizes CCS as an effective source-specific emissions reductions measure.

### **V. EPA failed to properly consider the power sector-wide implications and effects of the ACE Proposal.**

NRDC’s modeling demonstrates that electricity markets respond whenever emission limits are placed on individual power plants – the very dynamic on which the Clean Power Plan BSER was based. Even when those emission limits are entirely source-specific there are system-wide effects, including increased generation from and new builds of renewable energy and new natural gas. The Clean Power Plan accounted for these effects by allowing compliance through flexible credit or allowance trading approaches. EPA ignores the power sector effects of the ACE Proposal, but takes comment on whether the agency should offer states and regulated entities substantial compliance flexibility, such as trading and averaging. Finalization of flexible compliance options not considered when establishing the BSER would violate the principle of symmetry between compliance and standard-setting that is foundational to the determination of the best system of emission reduction and the degree of emission limitation achievable through its application.

**A. The electricity system is integrated and any standard—even a source-specific approach—results in shifts and impacts across all system resources.**

The U.S. electricity grid is a dynamic and integrated system.<sup>97</sup> Grid operators balance power flows from second to second, ensuring that demand and supply are matched at a millisecond, daily, and annual basis. Even if a source-specific approach to emission reductions is used, implementing source-specific emission reductions will lead utilities and generators to make broader changes to the resources in the electricity system. For example, NRDC has previously detailed the systemwide response to the Mercury and Air Toxics Standards (MATS) (See Appendix B to NRDC Repeal Comments, Attachment 1 to these comments). In order to achieve compliance with pollution standards such as MATS, utilities have chosen to deploy a range of compliance strategies that allow for a more cost-effective response and did so without any reliability impacts. These strategies include plant-specific pollution controls as well as changes to a utility’s fleet, such as re-dispatch to lower-emitting existing facilities and investments in clean energy services or new zero-emitting renewable development. As NRDC noted in our comments on EPA’s Proposed Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources, “by taking action on a system-wide basis, utilities and plant owners have consistently been able to achieve pollution reductions required by Clean Air Act (CAA) standards at lower cost than projected by both EPA and the utilities themselves, without compromising grid reliability and resiliency.”<sup>98</sup>

NRDC’s IPM modeling for this proposal shows similar systemwide impacts, even when modeling source-specific standards. IPM is a power sector dispatch model, which determines the most cost-effective pathway available for the construction, economic retirement, and use of power plants, subject to resource adequacy requirements and environmental constraints. Similar to the more holistic, system-wide response utilities and independent power producers have taken to comply with previous CAA rules, IPM finds it least costly to comply with the source-specific standards modeled as part of these comments through a broader suite of energy resources and investments. The systemwide response to source-specific standards is most clearly demonstrated by two of NRDC’s modeled scenarios: COF-GHRI-1 and COF-CCS-1.

Table 13 shows the scenario names, descriptions of the standards, and the corresponding 2030 rate limits. COF-GHRI-1 models a source-specific standard based on co-firing and repowering of the coal fleet, an HRI-based standard on the existing natural gas combined cycle (NGCC) fleet, and a CCS-based standard on new NGCC plants. The coal emissions standard is based on a 30 percent co-firing rate on 60 percent of the coal fleet and a full repowering with natural gas on the other 40 percent of the coal fleet. The standard on existing NGCC facilities is equivalent to a 2 percent efficiency improvement<sup>99</sup> across the fleet. The standard on new NGCC is a 90 percent CCS capture rate. Trading is allowed at a facility level.

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<sup>97</sup> See Department of Energy, *Transforming the Nation’s Electricity System: The Second Installment of the QER*, (Jan. 2017), [https://www.energy.gov/sites/prod/files/2017/01/f34/Summary%20for%20Policymakers\\_1.PDF](https://www.energy.gov/sites/prod/files/2017/01/f34/Summary%20for%20Policymakers_1.PDF).

<sup>98</sup> See NRDC Repeal Comments, Appendix B.

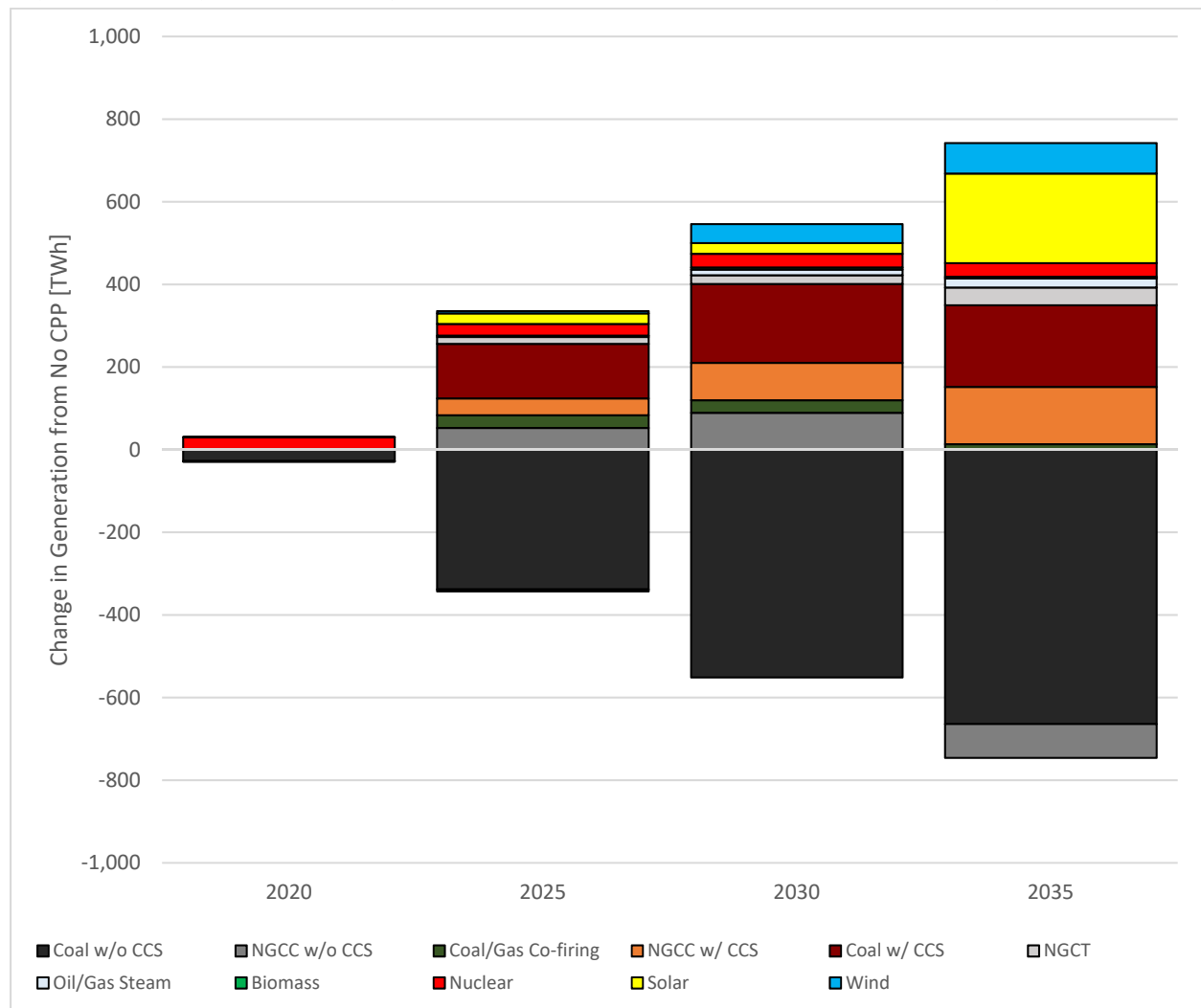
<sup>99</sup> Andover Technology Partners, *Improving Heat Rate on Combined Cycle Power Plants* (Oct. 3, 2018).

Table 13. Scenario names and descriptions of standards

Code	Standard	2030 rate limits (lbs/MWh)		
		Coal	Existing NGCC	New NGCC
<b>COF-GHRI-1</b>	30% co-firing on 60% of coal fleet, NGCC repowering on 40% of coal fleet, 2% HRI on existing NGCC, 90% CCS capture on new NGCC	1,415	825	100
<b>COF-CCS-1</b>	60% co-firing on coal fleet, 90% CCS capture on nearly 60% of existing NGCC fleet, 90% CCS capture on new NGCC	1,730	404	100

As shown in Figure 23, the imposition of these standards on existing and new fossil-fueled facilities results in generation shifts across a wider range of resources, including nuclear, wind, solar, and other non-covered sources. In 2025, when the standard is first implemented, coal generation without CCS decreases by 340 TWh compared to the No CPP business-as-usual (BAU) scenario, equivalent to the annual output of about 65 GW of coal operating at a 60 percent capacity factor. This lost output is replaced, in part, by coal with CCS (132 TWh increase) and coal and gas co-firing (31 TWh increase). These source-specific measures replace just under 50 percent of the lost coal generation in 2025. The other half of lost coal output is replaced instead with generation from nuclear facilities that continue to operate rather than retire (28 TWh), new renewable generation (31 TWh), increased utilization and build-out of non-covered gas combustion turbines, and increased utilization at existing natural gas facilities with and without CCS (110 TWh). When the rate standards reach their lowest and final level (represented by the 2035 model result), coal generation without CCS decreases by 664 TWh compared to the No CPP BAU. As in the earlier years, this lost output is replaced by new additions and increased utilization of existing facilities across all fuel types. Compared to the No CPP case, renewable generation from new solar and wind facilities is 290 TWh higher in the COF-GHRI-1 scenario, essentially replacing over 40 percent of the lost coal output. Incremental nuclear generation from existing facilities accounts for another 33 TWh of generation. There is also marked growth in natural gas with CCS and generation from uncovered gas combustion turbines.

Figure 23. Change in Generation from COF-GHRI-1 scenario compared to No CPP Reference Case

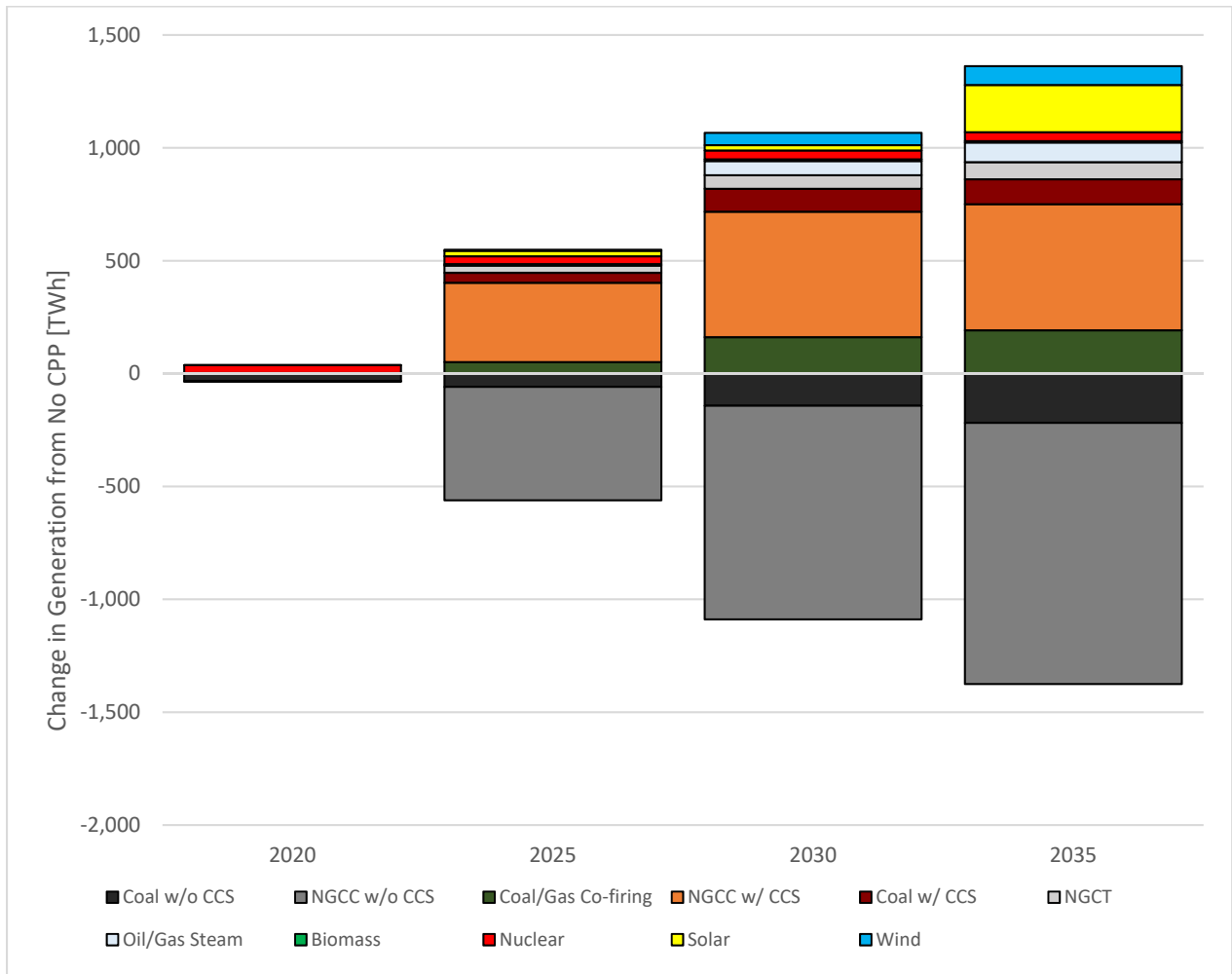


COF-CCS-1 models a co-firing-based rate standard on the existing coal fleet and a CCS standard on both existing and new NGCC plants. The coal rate is based on a 60 percent co-firing standard on the coal fleet. The standard on existing NGCC facilities is equivalent to a 90 percent CCS capture rate on nearly 60 percent of the existing NGCC fleet and the standard on new NGCC is a 90 percent CCS capture rate. Trading is only allowed at a facility level.

In this case, there is a substantially higher reliance on co-firing and CCS (see Figure 24). Compared to COF-GHRI-1, the standard on existing gas is significantly more stringent, resulting in increased co-firing at coal facilities. Still, there is a whole system response, with some existing nuclear generation remaining online, additional wind and solar generation, and increased utilization and development of existing and new combustion turbines to replace generation changes due to the coal- and gas-based standards. In total, source-specific measures account for about 75 percent of the lost coal and NGCC generation in 2030, while the other 25 percent is

made up by increases in generation from non-emitting or non-covered sources throughout the system, as shown in Figure 24.

Figure 24. Change in Generation from COF-CCS-1 scenario compared to No CPP Reference Case



EPA has suggested that one of the reasons why it has rejected the Clean Power Plan BSER is to avoid causing any changes to the power sector, which may require state officials to undertake regulatory actions. But this happens whenever EPA sets any standards, including those based on individual power plants. Our modeling results show that standards that require capital expenditures or increase the marginal cost of operation at coal plants result in increased generation from lower-emitting sources; even when those emission limits are entirely source-specific there are system-wide effects, including increased generation from and new builds of renewable energy and new natural gas. As described in Part IV.A., EPA’s proposed heat-rate-only-approach could cause mixed results: increased retirements of some coal plants (which will in turn have other effects in the power sector), and increased use and life extensions of those coal plants that do invest in heat rate improvements.

The fact that these systemwide effects occur when EPA purports to implement a source-specific emission control further emphasizes why EPA should incorporate such system-based responses into the process of setting the BSER, as EPA did in the Clean Power Plan. EPA's current refusal to consider such an approach arbitrarily blinds the agency to the fact that systemwide responses will occur under any approach. Indeed, some source-based standards can drive significant changes to the power sector. EPA is not legally compelled to view these effects as only accidental by-products of setting standards. Nor does it make any rational sense for EPA to do so. For a highly integrated sector like the electricity grid, the best system of emission reduction must recognize that these effects will occur when setting a standard and incorporate these systemwide impacts into that standard to achieve the desired emission reductions, rather than pretending that it is possible to set a standard for each source in isolation.

### **B. Treatment of target-setting and compliance should be symmetrical.**

The ACE Proposal requests comment on whether the agency should offer states and regulated entities substantial compliance flexibility, such as trading and averaging, that would enable regulated coal plants to take advantage of the cost-effective emissions-reducing measures that EPA has excluded from consideration as part of the BSER. As described fully in Part III.A. above and in the Joint Environmental Comments on BSER Issues, EPA is incorrect that the approach to BSER utilized in the CPP is legally impermissible. But if EPA does impose a constraint on BSER based on the terms identified in the proposed repeal of the CPP, those constraints must also be imposed when considering compliance flexibility.

In any replacement rule, the emission limit reflecting the degree of emission reduction achievable through the BSER must be based on the same options that are permitted for compliance. Consideration of the compliance options in determining the emission limit is required by the Clean Air Act's command that the adopted emission limits must reflect the best system of emission reduction that is *achievable*. Determining the reductions that are achievable is inextricably tied to the allowable means of compliance with the limit.<sup>100</sup>

If a guideline allows compliance through a given method of reducing emissions, then EPA must consider that compliance method when determining the level of reductions that the standard of performance or target requires. In other words, the statute requires symmetry. Accordingly, it would be legally impermissible for EPA to set a target based on a reasonably foreseeable emission reduction technique but not allow that technique to be used for compliance purposes. Likewise, it would be legally impermissible to allow the use of a reasonably foreseeable emission reduction technique for compliance purposes but exclude it from consideration when setting the target. The first standard would over-represent what is achievable; the second would under-represent it. Neither standard would represent the degree of emission reduction achievable at reasonable cost through the best system of emission reduction.

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<sup>100</sup> See, e.g., *Portland Cement Association v. Ruckelshaus*, 486 F.2d 375, 397 (D.C. Cir. 1973) (“a significant difference between techniques used by the agency in arriving at standards, and requirements presently prescribed for determining compliance with standards, raises serious questions about the validity of the standard”).

If they are available for compliance, flexible compliance measures such as trading or averaging must also be considered in identifying the BSER and setting the level of emission reductions achievable through the application of that system.

## **VI. Conclusion**

NRDC urges EPA to withdraw the ACE Proposal and CPP Repeal Proposal and instead strengthen and implement the Clean Power Plan.

The foregoing comments are respectfully submitted on behalf of NRDC.

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