August 8, 2023

Joint Comments of Clean Air Task Force, the National Wildlife Federation, Natural Resources Defense Council, and the Southern Environmental Law Center on New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions from Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule (88 Fed. Reg. 33240 (proposed May 23, 2023))

Docket No. EPA-HQ-OAR-2023-0072-0001

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Clean Air Task Force, the National Wildlife Federation, Natural Resources Defense Council, and the Southern Environmental Law Center ("Joint Commenters") appreciate the opportunity to comment on the Environmental Protection Agency's ("EPA" or "the Agency") proposed rule on New Source Performance Standards for Greenhouse Gas Emissions From New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions From Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule ("proposed rule" or "proposal").[1] Joint Commenters share an interest in managing climate change through reductions in greenhouse gas emissions from the power sector. Our comments focus on the appropriate treatment of biogenic emissions under these rules and specifically provide support for EPA's decision to not identify co-firing forest biomass as a best system of emission reduction ("BSER"). Joint Commenters urge EPA to finalize the strongest possible standards for power plants under Section 111 of the Clean Air Act ("CAA").[2]

I. Introduction

Limiting and reducing greenhouse gas emissions from the nation's coal- and gas-fired power plants is an essential component of managing the harmful externalities associated with fossil fuel-based energy generation. Congress requires EPA, under Section 111 of the CAA, to regulate greenhouse gas emissions from categories of stationary sources by establishing "standards of performance."[3] A "standard of performance" must "reflect[] the degree of emission limitation achievable through the application of the best system of emission reduction."[4] In this proposed rule, EPA explains that it considered many emission reduction approaches when determining appropriate BSERs for coal- and gas-fired electric generating units ("EGU").

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[1] 88 Fed. Reg. 33240 (proposed May 23, 2023).
[2] In addition to these comments, several of the Joint Commenters are also submitting separate comments on other aspects of the proposal.
[3] 42 U.S.C. § 7411(b).
[4] 42 U.S.C. § 7411(a)(1).

Importantly, EPA did not identify co-firing forest biomass[5] as BSER for any category or subcategory of sources covered in this rulemaking. Joint Commenters support this decision and submit these comments articulating our basis of support.[6]

Proponents of forest biomass co-firing often claim that this practice is inherently carbon neutral. This argument rests on the categorical assumption that emissions released through the combustion of forest biomass are inherently offset by forest regrowth, can be mitigated through that biogenic process, and thus should not be counted.[7] This assumption is fundamentally flawed and has been rebutted by numerous scientific bodies, including EPA's Scientific Advisory Board ("SAB").[8] Co-firing forest biomass in fact increases stack emissions, introduces a carbon debt period, and relies on uncertain future mitigation. There are also inefficiencies, costs, and other environmental and health impacts associated with co-firing forest biomass. These comments will present the robust evidence supporting the conclusion that co-firing forest biomass is not inherently carbon neutral.

Joint Commenters support EPA's decision that co-firing forest biomass is not a suitable BSER for EGUs. In the final rule, EPA should provide further background outlining why co-firing forest biomass was not deemed an appropriate system of emission reduction.

II. Forest biomass-based power is not categorically carbon neutral.

Claims regarding the categorical carbon neutrality of forest biomass-based power, at their core, presume that land-based biogenic mitigation can be counted immediately because forests sequester CO_2 from the atmosphere through photosynthesis.[9] Such assumptions fail to encompass the scientific fundamentals of carbon accounting.[10] Burning forest biomass in EGUs releases more CO_2 per unit of usable energy compared to fossil fuels,[11] and in most cases, these emissions persist in the atmosphere for decades to centuries.[12] Subsequent CO_2 removals

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[5] For sole purposes of these comments, the term "forest biomass" refers to woody fuel removed directly from a forest.

[6] Please note that these comments focus specifically on forest biomass.

[7] For the purposes of these comments, the term "offset," or "offsetting" refers specifically to subsequent biogenic uptake and storage of a matching volume of carbon elsewhere in the global system, for example, as a harvested forest regrows. We use the term here as distinct from any association with the Voluntary Carbon Market.

[8] EPA Science Advisory Board ("SAB"), *SAB Review of EPA's Accounting Framework for Biogenic CO_2 Emissions from Stationary Sources (September 2011)*, EPA-SAB-12-011 (Sept. 28, 2012); EPA SAB, *SAB Review of Framework for Assessing Biogenic CO_2 Emissions from Stationary Sources (2014)*, EPA-SAB-19-002 (Mar. 4, 2019). Both of these reports are available by searching "biogenic" on the SAB's Advisory Reports webpage: https://sab.epa.gov/ords/sab/r/sab_apex/sab/advisoryreports?session=9980983204871.

[9] *See, e.g.*, *Center for Biological Diversity v. EPA*, 722 F.3d 401 (D.C. Cir. 2013) (holding that in the facility permitting context, a temporary exemption for biogenic CO_2 emissions from the evaluation of the stack emissions, as "carbon neutral," is not lawful, over industry arguments re same); *see also* Michael Ter-Mikaelian et al., *The Burning Question: Does Forest Bioenergy Reduce Carbon Emissions? A Review of Common Misconceptions about Forest Carbon Accounting*, 113 J. Forestry 57, 57–68 (2015) (Attachment 1).

[10] Ter-Mikaelian, *The Burning Question*, *supra* note 9.

[11] Janusz A. Lasek et al., *The Combustion of Torrefied Biomass in Commercial-Scale Domestic Boilers*, 216 Renewable Energy (Nov. 2023) (Attachment 2).

[12] Pierre Bernier et al., *Using Ecosystem CO_2 Measurements to Estimate the Timing and Magnitude of Greenhouse Gas Mitigation Potential of Forest Bioenergy*, 5 GCB Bioenergy 67–72 (Jan. 2013) (Attachment 3); Gert-Jan

attributed to forest regrowth and/or avoided decay (herein, biogenic mitigation) are thus significantly delayed. The length of this recovery period—known as the "carbon debt period"—depends upon many factors (e.g., *see* Figure 1) including the model used to estimate carbon debt and payback projections, the land use history, location, forest biomass feedstock (e.g., stump vs. whole tree, moisture content, oxygen to carbon ratio), the efficiency of the energy facility, how the forest biomass is harvested, growth and decay rates of living and dead forest biomass, and whether harvested forest biomass induces land-use change.[13]

Nabuurs et al., *European Forests Show No Carbon Debt, Only a Long Parity Effect*, 75 Forest Pol'y Econ. 120–25 (2017) (Attachment 4); Niclas Scott Bentsen, *Carbon Debt and Payback Time–Lost in the Forest?*, 73 Renewable & Sustainable Energy Rev. 1211–17 (2017) (Attachment 5); David Pare, *Using Ecosystem CO_2 Measurements to Estimate the Timing and Magnitude of Greenhouse Gas Mitigation Potential of Forest Bioenergy*, 5 GCB Bioenergy 67–72 (2013) (Attachment 6); Bjart Holtsmark, *Harvesting in Boreal Forests and the Biofuel Carbon Debt*, 112 Climate Change 415–28 (May 2012) (Attachment 7); Jerome Laganière et al., *Range and Uncertainties in Estimating Delays in Greenhouse Gas Mitigation Potential of Forest Bioenergy Sourced from Canadian Forests*, 9 GCB Bioenergy 358–69 (Feb. 2017) (Attachment 8); Jon McKechnie et al., *Forest Bioenergy or Forest Carbon? Assessing Trade-offs in Greenhouse Gas Mitigation with Wood-based Fuels*, 45 Env't Sci. Tech. 789–95 (Jan. 2011) (Attachment 9); Kim Pingoud et al., *Global Warming Potential Factors and Warming Payback Time as Climate Indicators of Forest Biomass Use*, 17 Mitigation & Adaptation Strategies for Glob. Change 369–86 (Apr. 2012) (Attachment 10); Anna Stephenson et al., UK Department of Energy and Climate Change, *Life Cycle Impacts of Biomass Electricity in 2020: Scenarios for Assessing the Greenhouse Gas Impacts and Energy Input Requirements of Using North American Woody Biomass for Electricity Generation in the UK* (July 2014), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/349024/BEAC_Report_290814.pdf; Michael Ter-Mikaelian et al., *Debt Repayment or Carbon Sequestration Parity? Lessons from a Forest Bioenergy Case Study in Ontario, Canada,* 7 GCB Bioenergy 704–16 (July 2015) (Attachment 11); Giuliana Zanchi et al., *Is Woody Bioenergy Carbon Neutral? A Comparative Assessment of Emissions from Consumption of Woody Bioenergy and Fossil Fuel*, 4 GCB Bioenergy 761–72 (Nov. 2012) (Attachment 12); Thomas Walker et al., Manomet Center for Conservation Sciences, *Biomass Sustainability and Carbon Policy Study* (June 2010) (Attachment 13).

[13] Richard Birdsey et al., *Climate, Economic, and Environmental Impacts of Producing Wood for Bioenergy*, 13 Env't Rsch. Letters (Mar. 2018) (Attachment 14); Stephen Mitchell et al., *Carbon Debt and Carbon Sequestration Parity in Forest Bioenergy Production*, 4 GCB Bioenergy 818–27 (May 2012) (Attachment 15); Ana Repo et al., *Sustainability of Forest Bioenergy in Europe: Land-Use-Related Carbon Dioxide Emissions of Forest Harvest Residues*, 7 GCB Bioenergy 877–87 (Mar. 2014) (Attachment 16); Walker, *supra* note 12; Alessandro Agostini et al., *Flaws in the Interpretation Phase of Bioenergy LCA Fuel the Debate and Mislead Policymakers*, 25(1) Int'l J. Life Cycle Assessment 17–35 (Attachment 17).

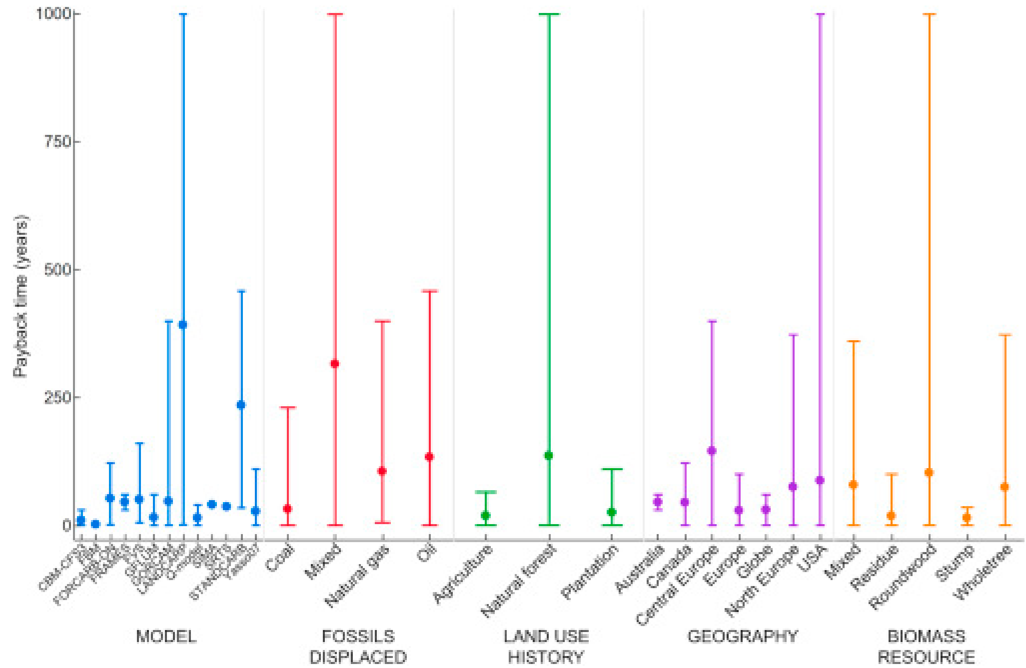

Figure 1: Mean and range of carbon payback times in years across influential independent variables (Bentsen et al. 2017). The most influential parameter is the model used to estimate payback time followed by fossils displaced. This meta-analysis found when forest biomass is used to displace coal the mean payback time is 31 years and 105 years for natural gas substitution.[14]

In the case of whole trees and other large-diameter materials, it can take anywhere from decades to several centuries[15] for forest regrowth and the associated carbon sequestration just to reach net emissions parity[16] with fossil fuels.[17] In a scenario where the feedstock is forest harvest residues[18] that would otherwise decay and release their carbon, the carbon debt period is often shorter because it is tied to the decomposition rate of that material and its size, but is still

[14] Bentsen, *supra* note 12.
[15] *Id.*
[16] *See* Thomas Buchholz et al., *When Biomass Electricity Demand Prompts Thinnings in Southern US Pine Plantations: A Forest Sector Greenhouse Gas Emissions Case Study*, 4 Frontiers Forests & Glob. Change (May 2021) (Attachment 18). Carbon sequestration parity is achieved when the sum of carbon in the regenerating stand and the greenhouse gas ("GHG") benefits of replacing fossil fuel equals the amount of carbon in the stand if it had remained unharvested. *See* Ter-Mikaelian, *The Burning Question*, *supra* note 9; Bentsen, *supra* note 12. In addition to full re-sequestration of the carbon stored within the biomass and released at the stack, achieving this parity would require an owner or operator to demonstrate that *additional* regrowth of biomass in the landscape occurred in order to compensate for other emissions across the value chain, including fossil emissions from harvest and transportation.
[17] Andrea Colnes et al., The Biomass Energy Resource Center, Forest Guild, and Spatial Informatics Group, *Biomass Supply and Carbon Accounting for Southeastern Forests* (Feb. 2012) (Attachment 19); John Hagan, The Manomet Center for Conservation Sciences, *Biomass Energy Recalibrated* (Jan. 2012) (Attachment 20); Walker, *supra* note 12.
[18] Forest harvest residues are defined by Booth (2018) as "materials generated by some other process, where the alternative fate is decomposition or burning without energy recovery." Mary Booth, *Not Carbon Neutral: Assessing the Net Emissions Impact of Residues Burned for Bioenergy*, 13 Env't Rsch. Letters 035001 (2018) (Attachment 21).

typically on the order of decades.[19] In almost all of these cases, the carbon debt period extends well beyond timeframes to address the worst impacts of climate change.[20]

These findings are supported by two independent meta-analyses[21] of published studies, which summarize the full breadth of quantitative studies conducted over the past 25 years that assess the extent of carbon impacts/benefits incurred by burning forest biomass to produce energy. The Buchholz et al. (2016) meta-analysis shows that over 80 percent of peer-reviewed assessments found carbon debt periods associated with the use of forest biomass feedstocks, ranging from several years to many centuries. Similarly, a study done jointly by the Spatial Informatics Group and the Woods Hole Research Center, in reviewing both meta-analyses, found that "the vast majority of all published quantitative assessments of the GHG emissions of forest-derived biomass for electricity production have concluded that there are net emissions associated with the use of woody biomass feedstocks to generate energy when compared to generating an equivalent amount of energy from fossil sources, even when accounting for subsequent regrowth and avoided emissions."[22]

Taken together, these studies show that the presumed carbon neutrality of forest biomass is not supported in the peer-reviewed scientific literature. In the "vast majority" of cases, forest biomass for energy has been demonstrated to incur a carbon debt, in many cases for decades to centuries[23]—even when any land-based biogenic mitigation is considered.

Along these lines, the preeminent body on climate change science, the Intergovernmental Panel on Climate Change ("IPCC"), has clarified that its guidelines for greenhouse gas reporting and accounting "do not automatically consider biomass used for energy as 'carbon neutral,' even if the biomass is thought to be produced sustainably."[24] In its 2014 assessment of the science on climate change mitigation, the IPCC explicitly addressed this issue. Although some have assumed that "the CO_2 emitted from biomass combustion is climate neutral because the carbon that was previously sequestered from the atmosphere (before combustion) will be re-sequestered if the growing stock is managed sustainably," the report clarifies that "[t]he shortcomings of this assumption have been extensively discussed in environmental impact studies and emission accounting mechanisms."[25] The authors further reject carbon neutrality as a fundamental misunderstanding of its guidelines, arguing "the neutrality perception is linked to a misunderstanding of the guidelines for GHG inventories."[26] More recently, the IPCC's 2022 report on mitigation of climate change noted, "The use of bioenergy can lead to either increased or reduced emissions, depending on the scale of deployment, conversion technology, fuel

[19] Repo, *supra* note 13; Stephenson, *supra* note 12; Booth, *supra* note 18.
[20] Bentsen, *supra* note 12; Thomas Buchholz et al., *A Global Meta-Analysis of Forest Bioenergy Greenhouse Gas Emission Accounting Studies*, GCB Bioenergy (Mar. 2016) (Attachment 22).
[21] Buchholz (2016), *supra* note 20; Bentsen, *supra* note 12.
[22] John Gunn et al., *Scientific Evidence Does Not Support the Carbon Neutrality of Woody Biomass Energy: A Review of Existing Literature*, Spatial Informatics Group Report 2018-01 (Oct. 2018) (Attachment 23).
[23] *Id.*
[24] IPCC Task Force on National Greenhouse Gas Inventories, Frequently Asked Questions, Q2-10, https://www.ipcc-nggip.iges.or.jp/faq/faq.html.
[25] IPCC, *Fifth Assessment Report, Working Group III Agriculture, Forestry and Other Land Use (AFOLU)*, Section 11.13.4, at 879 (2014), http://www.ipcc.ch/pdf/assessmentreport/ar5/wg3/ipcc_wg3_ar5_chapter11.pdf.
[26] *Id.* at 879 n.14.

displaced, and how, and where, the biomass is produced," a conclusion the panel made with high confidence.[27] Net emissions from forest biomass depend "on factors such as the source of biomass, conversion pathways and energy used for production and transport of biomass, and land-use changes, as well as assumed analysis boundary and considered time scale."[28] Moreover, the use of forest biomass for energy generation presents climate opportunity costs, especially when alternative uses might include long-lived wood products: "Higher levels of bioenergy consumption are likely to involve trade-offs with mitigation in other sectors, notably in construction (i.e., wood for material and structural products) and [the land use sector] (carbon stocks and future carbon sequestration), as well as trade-offs with sustainability and feasibility concerns."[29] This could have cascading impacts, as the report explains: "Increased demand for biomass can increase the pressure on forest and conservation areas and poses a heightened risk for biodiversity, livelihoods, and intertemporal carbon balances."[30]

Finally, treatment of forest biomass as categorically carbon neutral has also been rejected by the EPA's Science Advisory Board ("SAB").[31] The SAB established that carbon impacts to the atmosphere vary widely among different types of forest biomass feedstocks from differing forest management regimes. In its charge, the EPA asked the SAB to review the validity of a categorical exclusion (i.e., presumptive carbon neutrality), which would treat emissions as zero. The SAB's response was to reject *a priori* assumptions of carbon neutrality. The SAB instead affirmed the need for the specific assessment of carbon impacts of individual feedstocks.[32]

III. EPA's exclusion of forest biomass co-firing as BSER is appropriate.

In the proposed rule, EPA did not identify forest biomass co-firing as a best system of emission reduction ("BSER") for any subcategory of EGUs. As explained above, burning forest biomass generates CO_2 emissions at the time and place of combustion. Potential net carbon benefits rely on accounting for external biogenic mitigation that in the case of forests could take years or decades to occur and depend on feedstock management. This inherent delay, combined with the uncertainties associated with the forecast regrowth and/or decay rates resulting from

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[27] M. Pathak et al., Technical Summary *in* IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change, Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla et al, (eds.)], Cambridge University Press at 85 (2022), doi: 10.1017/9781009157926.002.
[28] L. Clarke et al., Energy Systems *in* IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla et al., (eds.)], Cambridge University Press at 646 (2022), doi: 10.1017/9781009157926.008.
[29] *Id.* at 341.
[30] *Id.* at 529.
[31] EPA's subsequent statement addressing this issue did not alter the validity of the SAB's prior determination, as the statement itself explicitly noted that it "is not a scientific determination and does not revise or amend any scientific determinations EPA has previously made." EPA's Treatment of Biogenic Carbon Dioxide (CO_2) Emissions from Stationary Sources that Use Forest Biomass for Energy Production (2018). Moreover, the 2018 statement is a general statement of agency policy that is not binding on the agency. *See AMREP Corp. v. FTC*, 768 F.2d 1171, 1178 (10th Cir. 1985) (stating that general statements of agency policy "have no more binding effect than press releases"); *Sierra Club v. EPA*, 873 F.3d 946, 951–52 (D.C. Cir. 2017); *see also* Jared P. Cole & Todd Garvey, Cong. Rsch. Serv. R44468, *General Policy Statements: Legal Overview* at PDF p. 2 (updated Apr. 14, 2016) ("General statements of policy are not legally binding . . . .").
[32] SAB (2012), *supra* note 8.

exogenous events unique to biogenic processes (such as wildfire and insect infestation), make forest biomass co-firing distinct from the other potential systems of emission reduction considered by EPA. Furthermore, co-firing forest biomass can only achieve a limited degree of emission reduction, even under optimistic accounting, due to inefficiencies and cost. It also causes other health and environmental impacts. Therefore, EPA was correct to not identify forest biomass co-firing as BSER.

a. Legal Background

The proposed rule implements Section 111 of the CAA, which requires EPA to set a "standard of performance" for certain categories of new and existing sources. A "standard of performance" must "reflect[] the degree of emission limitation achievable through the application of the best system of emission reduction," including consideration of "the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements."[33]

As explained by the Supreme Court, EPA "retains the primary regulatory role in Section 111(d)" and "decides the amount of pollution reduction that must ultimately be achieved."[34] In this process,

> the statute directs EPA to (1) 'determine[],' taking into account various factors, the 'best system of emission reduction which . . . has been adequately demonstrated,' (2) ascertain the 'degree of emission limitation achievable through the application' of that system, and (3) impose an emissions limit on new stationary sources that 'reflects' that amount.[35]

In determining what constitutes a "best system of emission reduction," EPA first "identifies 'systems of emission reduction' that have been 'adequately demonstrated' for a particular source category and [then] determines the 'best' of these systems" in light of the relevant statutory considerations.[36] To determine what system is "best," EPA must take into account statutory factors, such as cost, non-air quality health and environmental impacts, and energy requirements.[37] According to the U.S. Court of Appeals for the D.C. Circuit, EPA "must exercise its discretion to choose an achievable emission level which represents the best balance of economic, environmental, and energy considerations."[38] Under this analysis, "the amount of air pollution [is] a relevant factor to be weighed when determining the optimal standard."[39]

After EPA sets a standard of performance, states then may submit plans to EPA detailing how they will comply with the standard. State "plans contain[] the emissions restrictions that they intend to adopt and enforce in order not to exceed the permissible level of pollution

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[33] 42 U.S.C. § 7411(a)(1).
[34] *West Virginia v. EPA*, 142 S. Ct. 2587, 2601–02 (2022).
[35] *Id.* at 2601 (quoting 42 U.S.C. § 7411(a)(1)).
[36] 88 Fed. Reg. 33272.
[37] 42 U.S.C. § 7411(a)(1).
[38] *Sierra Club v. Costle*, 657 F.2d 298, 330 (D.C. Cir. 1981).
[39] *Id.* at 326.

established by EPA."[40] EPA reviews these plans to determine if they are "satisfactory."[41] EPA's longstanding regulations and proposed revisions to those regulations both require the Agency to make that determination based on whether the plan contains "emission standards . . . no less stringent than the corresponding emission guidelines."[42] The proposed rule would also require state plans to demonstrate that the proposed emission standards are "quantifiable, verifiable, non-duplicative, permanent, and enforceable."[43]

These statutory and regulatory requirements provide the framework for EPA's determination of the best system of emission reductions and evaluation of state plans to meet a standard of performance.

b. Forest biomass co-firing increases stack emissions, introduces a carbon debt period, and relies on uncertain future mitigation.

EPA's first step in determining BSER is to identify relevant emission reduction systems. While EPA's proposal evaluates certain types of fuel switching as systems of emission reduction, the proposed rule did not identify forest biomass co-firing as a potential fuel-switching system that would reduce emissions. EPA was justified in not identifying co-firing forest biomass as a system of emission reduction because the practice does not, in fact, limit or reduce emissions. Instead, forest biomass co-firing increases stack emissions, and any net decrease in carbon emissions attributed to biogenic mitigation is actually an offset following a carbon debt period that relies on non-contemporaneous, unsecured, uncertain, and practically unverifiable carbon sequestration elsewhere.

i. Forest biomass co-firing increases emissions at the stack.

Co-firing forest biomass at a coal- or gas-fired power plant results in an emission increase at the stack. The established science demonstrates that power stations that burn forest biomass—or a mix of forest biomass and coal or gas—emit more CO_2 per kilowatt hour (kWh)-generated than otherwise identical power stations that burn only coal or only gas.[44] As shown in Figure 2 below, the CO_2 emissions rate from combustion of forest biomass at a utility-scale power station exceeds the CO_2 emissions rate from a coal-fired power station or a natural gas-fired power station.

[40] *West Virginia*, 142 S. Ct. at 2602.
[41] 42 U.S.C. § 7411(d)(2)(a).
[42] 88 Fed. Reg. at 33338 (quoting 40 C.F.R. § 60.24(c)).
[43] Draft Regulatory Text for 40 C.F.R. § 60.5775b(a).
[44] *See supra*, Section II.

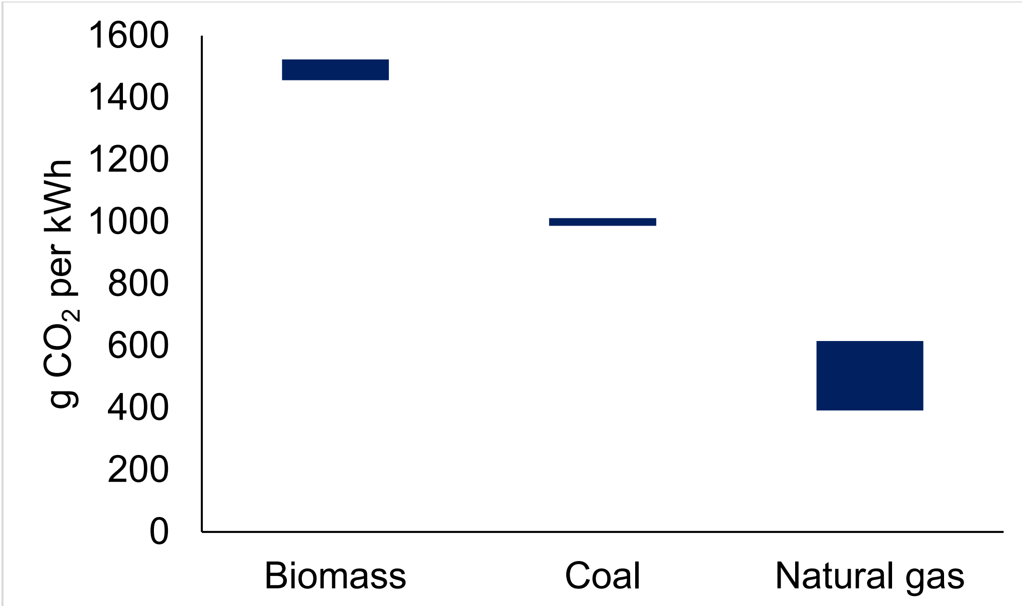

Figure 2: CO_2 emissions for biomass (1456–1523 g CO_2/kWh), coal (987– 012 g CO_2/kWh), and natural gas (392–616 g CO_2/kWh)[45]

Accordingly, fuel switching to forest biomass co-firing at a coal- or gas-fired power station does not automatically reduce or limit the amount of CO_2 emitted from the source—rather it increases the source's direct CO_2 emissions. Co-firing forest biomass neither reduces emissions nor improves the emission or pollution performance for an EGU.

ii. Offsetting through biogenic mitigation is uncertain and practically unverifiable.

Any purported decrease in emissions attributed to forest biomass co-firing occur as the result of future, uncertain and practically unverifiable biogenic mitigation happening elsewhere.[46] As discussed in Section II, the potential reductions depend on an assessment of *net* emissions, in which CO_2 stack emissions from the existing source are adjusted to account for subsequent CO_2 removals attributed to carbon sequestration from forest regrowth or avoided decay. To claim that a net CO_2 emission reduction occurred, the owner/operator of the forest biomass-fueled power station must be able to take credit for biogenic mitigation that happens in the forest stand. However, any such claim is highly uncertain.

Section 111 and the proposed rule do leave open the possibility of offsite activities qualifying as systems of emission reductions. However, in the case of forest biomass, any biogenic mitigation that is anticipated to occur on lands offsite may not materialize because of exogenous ecosystem events such as wildfire or pest infestation, land-use changes under existing

[45] Longwen Ou & Hao Cai, Energy Systems Div., Argonne Nat'l Lab'y, *Update of Emission Factors of Greenhouse Gases and Criteria Air Pollutants, and Generation Efficiencies of the U.S. Electricity Generation Sector* (2020) (Attachment 24).

[46] Alice Favero et al., *Economic Factors Influence Net Carbon Emissions of Forest Bioenergy Expansion*, 4 Commc'ns Earth & Env't (2023) (Attachment 25).

ownerships, weather/climate–induced impacts on projected forest growth rates, or ownership transfer, among other factors. Similarly, reliance on offsite biogenic mitigation as an actual emission reduction would bring all the challenges of additionality, durability, risk, double-counting, and verification that have plagued the voluntary carbon market, thus making the approach impracticable.[47]

iii. Offsetting through biogenic mitigation is not contemporaneous with a source's emissions and only occurs following a carbon debt period.

The emission benefits attributed to forest biomass-burning power stations do not occur for years, decades, or even centuries after the station burns forest biomass to make energy—if they materialize at all.[48] There is a delay between the time at which the combustion of forest biomass produces CO_2 emissions from the station's smokestacks, and the time—if ever—at which any emission reductions are achieved eventually through biogenic mitigation.[49] For example, if standing trees are harvested and burned in a power station, it takes several decades to centuries for forest regrowth and the associated carbon sequestration to fully offset the stack emissions and lost CO_2 sequestration associated with forest biomass harvest and combustion. If genuine forestry residues, such as limbs and treetops, are burned in a power station instead, the payback period is shorter because it is tied to the decomposition rate of that material but is still typically decades.[50] Even in the case of thinnings from managed forests, the carbon payback period can continue for over 40 years.[51] If EPA were to rely on a calculation of "net" emissions that factors anticipated biogenic mitigation in forests, these net outcomes are, by definition, delayed and therefore not contemporaneous.

Unlike the precombustion cleaning and treatment activities referenced in Section 111 and the proposed rule, which reduce emissions at the source through activities taken *before* the emissions occur,[52] mitigation associated with forest biomass co-firing takes place in the future, during which time a "carbon debt" persists in the atmosphere that can last for decades to centuries.

Furthermore, interpreting "emission reduction" to include delayed biogenic mitigation of emissions would frustrate the purpose of Section 111(d) and the proposed rule. The additional CO_2 molecules emitted into the atmosphere by forest biomass-fueled power stations are hardly inert during the years or decades that it takes for a harvested forest to fully grow back. Instead,

[47] *See*, *e.g.*, Ben Elgin, *This Timber Company Sold Millions of Dollars of Useless Carbon Offsets*, Bloomberg (Mar. 17, 2022) (Attachment 26); Ben Elgin, *A Top U.S. Seller of Carbon Offsets Starts Investigating Its Own Projects*, Bloomberg (Apr. 5, 2021) (Attachment 27); Patrick Greenfield, *Carbon Offsets Used by Major Airlines Based on Flawed System, Warn Experts*, The Guardian (May 4, 2021) (Attachment 28); Lisa Song, *An Even More Inconvenient Truth: Why Carbon Credits for Forest Preservation May Be Worse than Nothing*, ProPublica (May 22, 2019) (Attachment 29); Patrick Greenfield, *Revealed: More than 90% of Rainforest Carbon Offsets by Biggest Certifier are Worthless, Analysis Shows*, The Guardian (Jan. 18, 2023) (Attachment 30).
[48] *See supra*, Section II.
[49] Favero, *supra* note 46.
[50] *See* Booth, *supra* note 18.
[51] *See* Buchholz (2021), *supra* note 16.
[52] *See, e.g.*, 88 Fed. Reg. 33272; *see also* 42 U.S.C. § 7411(a)(7)(B) (identifying precombustion cleaning or treatment of fuels as a "technological system of continuous emission reduction").

they spend that time trapping heat radiated from the earth and contributing to global warming in precisely the same way that CO_2 molecules emitted from coal-fired power stations do. Similarly, the multi-year or multi-decade net increase in atmospheric CO_2 concentrations resulting from a shift to forest biomass co-firing negatively impacts the climate even assuming the near-term CO_2 emissions from forest biomass combustion may eventually be netted out by future growth and carbon absorption. An actual emission reduction would prevent a percentage of near-term warming effects that forest biomass co-firing would leave unchecked.

As EPA correctly recognizes in the proposal, "early emission reductions have value in addressing climate change."[53] An approach that increases emissions and does not provide a net benefit for decades would frustrate efforts under Section 111 to reduce "air pollution which may be reasonably anticipated to endanger public health or welfare."[54] Additionally, as noted above, the biogenic mitigation anticipated to occur offsite may not materialize in the future because of substantial uncertainties associated with exogenous ecosystem events such as wildfire or pest infestation, land-use changes under existing ownerships, or ownership transfer.

The delay of any anticipated carbon benefits from biogenic mitigation combined with uncertainties unique to biogenic processes make forest biomass co-firing distinct from the potential systems of emission reduction considered by EPA. The practice would fail to reduce the actual concentration of carbon emissions in the atmosphere.[55]

c. The degree of emission reduction achievable from forest biomass co-firing is limited by inefficiencies and cost.

Inefficiencies and costs related to co-firing forest biomass limit the degree of emission reduction feasible from the method to levels far below what is reasonably achievable using other technologies or processes.

First, there are limitations on the amount of forest biomass that can be fired with coal or gas, largely due to inefficiencies inherent to the feedstock. Direct co-firing of solid forest biomass with coal is the most common and least expensive option.[56] Indirect co-firing is typically more expensive, using gasification of forest biomass to yield products such as "syngas" or pyrolysis to yield liquid products such as "bio-oil," which can then be co-fired with coal or gas.[57] Parallel combustion of forest biomass and fossil fuels is a third option. Both direct and indirect forest biomass co-firing can increase the risk of corrosion, fouling, and slagging, with potential for impacts on boiler efficiency.[58] The high water content, ash content, and other

[53] 88 Fed. Reg. 33332. EPA makes this point in the proposed rule to distinguish between early emission reductions and "the cumulative impact of the emission reductions" when taking into consideration "the short time-scale over which [] early reductions are occurring" when determining different compliance deadlines. *Id.*
[54] 42 U.S.C. § 7411(b)(1)(A).
[55] 42 U.S.C. § 7401(c).
[56] Ezinwa Agbor et al., *A Review of Biomass Co-firing in North America*, 40 Renewable & Sustainable Energy Rev. 930–43 (2014) (Attachment 31).
[57] *Id.*
[58] I. Andrić et al., *Environmental Performance Assessment of Retrofitting Existing Coal Fired Power Plants to Co-Firing with Biomass: Carbon Footprint and Energy Approach*, 103 J. Cleaner Prod. 13–27 (2015) (Attachment

properties of forest biomass—which can vary greatly between feedstocks—may reduce thermal efficiencies, while higher alkali levels in forest biomass fuels can increase corrosion.[59]

Second, forest biomass co-firing could require the operator to incur significant costs, depending on co-firing method, facility modifications, and other factors.[60] The cost of forest biomass fuels, including transportation, preparation, treatment, storage, and handling; reduced thermal efficiency; and variable impacts on boiler equipment mean that forest biomass is generally not cost-effective. Despite the "availability" of forest biomass described in various analyses, the costs of collecting and transporting forest biomass from remote areas often can be prohibitive. Indirect co-firing may allow for higher percentages of forest biomass but is typically more expensive and less technologically mature. For these reasons, forest biomass energy generating units are typically better suited to combined heat-and-power applications, which are significantly more energy efficient.

Together, these factors mean that the share by energy content of forest biomass directly co-fired with coal typically hovers around 10 to 20 percent because any larger share of forest biomass can lead to prohibitive increases in cost and increases the risk of fouling and other contamination issues.[61] Even using optimistic analyses that assume biogenic emissions to be negligible or zero, which EPA has contested,[62] any potential percentage reductions from forest biomass co-firing would be roughly comparable to the percentage of forest biomass co-fired.[63] Under those optimistic analyses, forest biomass co-firing could result in little more than 10 to 20 percent reductions in carbon emissions for a source category.[64] Furthermore, evaluating the net impact of forest biomass utilization in power generation remains fraught. Estimates of changes in emissions from dedicated forest biomass generation and co-firing compared to coal range from more than 80 percent reductions to more than 70 percent increases.[65] These limited and uncertain emission reductions would pale in comparison to those achievable through systems of emission reduction identified and considered in the proposed rule.

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32); María V. Gil & Fernando Rubiera, *Coal and Biomass Cofiring: Fundamentals and Future Trends in I. Suárez-Ruiz et al., (Eds.) New Trends in Coal Conversion* 117–40 (2019), Woodhead Publishing (Attachment 33); Paula Teixeira et al., *Evaluation of Slagging and Fouling Tendency During Biomass Co-Firing with Coal in a Fluidized Bed*, 39 Biomass & Bioenergy 192–203 (2020) (Attachment 34).

[59] M. Sami et al., *Co-Firing of Coal and Biomass Fuel Blends*, 27 Progress Energy & Combustion Sci. 171–214 (2001) (Attachment 35).

[60] U.S. EIA, *Levelized Costs of New Generation Resources in Annual Energy Outlook 2022* at Table 1(b) (Mar. 2022), https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf.

[61] IEA-ETSAP and IRENA, *Biomass Co-firing: Technology Brief* (2013) (Attachment 36); Agbor, *supra* note 56.

[62] *See* SAB (2019 and 2012), *supra* note 8.

[63] *See, e.g.*, Andrić, *supra*, note 58 (finding that 20 percent co-firing of various types of biomass reduced CO_2 emissions 11–25 percent in power plants in Poland); Brandon Morrison & Jay S. Golden, *Life Cycle Assessment of Co-Firing Coal and Wood Pellets in the Southeastern United States*, 150 J. Cleaner Prod. 188–96 (2017) (finding that 10 percent co-firing of roundwood biomass reduced global warming impact by 9.39 percent, with similar reductions for 10 percent co-firing of sawmill residues in the Southeast) (Attachment 37).

[64] "Assuming a carbon-neutral biomass resource, CO_2 emissions will decline linearly in proportion to the amount of coal offset by biomass." Environmental and Energy Study Institute ("EESI"), *Issue Brief, Biomass Cofiring: A Transition to a Low-Carbon Future* at 2 (Mar. 2009) (Attachment 38).

[65] Mirjam Röder et al., *How Certain are Greenhouse Gas Reductions from Bioenergy? Life Cycle Assessment and Uncertainty Analysis of Wood Pellet-to-Electricity Supply Chains from Forest Residues*, 79 Biomass & Bioenergy 50–63 (2015) (Attachment 39).

d. Co-firing forest biomass causes other health and environmental impacts.

The use of forest biomass co-firing can also include increases in other types of emissions and cause health and environmental impacts.[66] Compared to coal, biomass contains lower amounts of nitrogen and sulfur and could thus reduce sulfur dioxide (SO_2) and nitrogen oxide (NOx) emissions.[67] Still, biomass combustion can release NOx, particulate matter, and other air pollutants, at rates influenced by chemical composition of the feedstock, conditions during energy recovery, reactions during combustion, and co-firing practices.[68] The impacts of co-firing on facility efficiency may also influence net air pollutant emissions. For instance, one recent analysis of potential impacts from forest biomass co-firing at retrofitted coal power plants in the eastern United States found that forest biomass co-firing could lead to increases in NOx emissions per million metric British thermal units (MMBtu) as the result of decreases in generation efficiency.[69]

The health and environmental justice impacts of co-firing forest biomass cannot be ignored. Research suggests that the combustion of forest biomass is a leading contributor to fine particulate matter ($PM_{2.5}$) concentrations.[70] $PM_{2.5}$ increases adverse health effects including morbidity and mortality risks, especially in vulnerable populations.[71] Increased PM burdens have also been associated with increased risk of mortality for COVID-19, potentially worsening existing racial disparities in the burden of this disease.[72] Additionally, air pollution produced from forest biomass combustion has been linked to increased asthma attacks, heart attacks, and other health risks.[73] The American Lung Association opposes the combustion of biomass for electricity production due to the air pollution it creates.[74] Moreover, industrial-scale wood pellet

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[66] *See* 42 U.S.C. § 7411(a)(1) (requiring consideration of other environmental impacts); *Essex Chem. Corp. v. Ruckelshaus*, 486 F.2d 427, 438–39 (ruling EPA must consider "counter-productive environmental effects" when determining BSER).

[67] Agbor, *supra* note 56.

[68] "Biomass furnaces exhibit relatively high emissions of NOx and particulates in comparison to furnaces with natural gas or light fuel oil." Thomas Nussbaumer, *Combustion and Co-Combustion of Biomass: Fundamentals, Technologies, and Primary Measures for Emission Reduction*, 17(6) Energy & Fuels 1510, 1511 (2003) (Attachment 40).

[69] *See* Paul Picciano et al., *Environmental and Socio-Economic Implications of Woody Biomass Co-Firing at Coal-Fired Power Plants*, 68 Res. & Energy Econ. 101296 (2022) (Attachment 41).

[70] Jonathan J. Buonocore et al., *A Decade of the U.S. Energy Mix Transitioning Away from Coal: Historical Reconstruction of the Reductions in the Public Health Burden of Energy*, 16 Env't Rsch. Letters 21 (2021) (Attachment 42).

[71] Pablo Orellano et al., *Short-Term Exposure to Particulate Matter (PM_{10} and $PM_{2.5}$), Nitrogen Dioxide (NO_2), and Ozone (O_3) and All-Cause and Cause-Specific Mortality: Systematic Review and Meta-Analysis*, 142 Env't Int'l 105876 (2020) (Attachment 43).

[72] Michael Petroni et al., *Hazardous Air Pollutant Exposure as a Contributing Factor to COVID-19 Mortality in the United States*, 15 Env't Rsch. Letters 0940a9 (2020) (Attachment 44).

[73] Sasha Stashwick, *Health Groups to Congress: Burning Biomass is Bad for Health*, NRDC (Sept. 14, 2016) (Attachment 45); *see Letter to Politicians from Health Organizations about Biomass* (attached to *Biomass Facilities Impact Air Quality In Surrounding Neighborhoods* (2017)) (Attachment 46).

[74] American Lung Ass'n, *Policy Principle on Energy* (June 25, 2021), https://www.lung.org/policy-advocacy/public-policy-positions/public-policy-position-energy.

manufacturing—the industry currently supporting industrial-scale forest biomass combustion overseas—has been identified as raising significant environmental justice concerns.[75]

IV. Conclusion

EPA was right to not identify forest biomass co-firing as the basis for determining the BSER for coal- and gas-fired EGUs. We urge EPA to include a robust description of the scientific foundation for that decision, including the information contained in these comments, in its final rule.

Respectfully Submitted,

Clean Air Task Force
National Wildlife Federation
Natural Resources Defense Council
Southern Environmental Law Center

Enclosures: Attachments 1–48

[75] *See, e.g.*, NAACP, *Resolution in Opposition to Wood Pellets Manufacturing and Use of Wood-Bioenergy,* https://naacp.org/resources/resolution-wood-pellets-opposition (last visited Aug. 7, 2023) (Attachment 47); Stefan Koester & Sam Davis, *Siting of Wood Pellet Production Facilities in Environmental Justice Communities in the Southeastern United States*, 11 Env't Just. 64–70 (Apr. 2018) (Attachment 48); *see also* White House Environmental Justice Advisory Council, *Final Recommendations: Justice40 Climate and Economic Justice Screening Tool & Executive Order 12898 Revisions* at 59 (May 21, 2021), https://www.epa.gov/sites/default/files/2021-05/documents/whiteh2.pdf (including industrial scale bioenergy as an example of a type of project that "will not benefit a community").