Enabling Mass-Based Compliance Approaches In the Context of the Environmental Protection Agency's Most Recent Clean Air Act Section 111 Proposal

The U.S. Environmental Protection Agency (Agency or EPA) has proposed regulations under Clean Air Act (CAA) section 111 to address greenhouse gas (GHG) emissions (primarily carbon dioxide (CO_2) emissions) from fossil-based electric generating units (EGUs or units).[1] Electric companies' comments to EPA, among other things, were aimed at ensuring that final standards included key compliance flexibilities to support the ongoing industry investment in an affordable, reliable clean energy transition. Consistent with these comments and their aim, electric companies continue to believe that mass-based approaches have potential both to provide compliance pathways that promote reliability and to enable significant, quantifiable emissions reductions. This paper outlines how mass-based compliance approaches could work in the context of EPA's more recent proposal, with a particular focus on existing sources and that states that will regulate them under the CAA 111 framework.

The Edison Electric Institute (EEI) is the association that represents all U.S. investor-owned electric companies. EEI members provide electricity for nearly 250 million Americans and operate in all 50 states and the District of Columbia. As a whole, the electric power industry supports more than seven million jobs in communities across the United States. EEI member companies invest more than $130 billion annually to make the energy grid smarter, cleaner, more dynamic, more flexible, and more secure in order to provide affordable and reliable electricity to customers. EEI's members are committed to getting the energy they provide as clean as they can as fast as they can, keeping affordability and reliability front and center.

EEI members are in the middle of a profound, long-term transformation in how electricity is generated, transmitted, and used. This transformation is being driven by a wide range of factors, including relatively lower prices for natural gas, particularly as compared to historic high prices; increased deployment of renewable energy resources, energy efficiency, and demand-side management; technological improvements; changing customer and investor expectations, federal and state regulations and policies, and the increasing use of distributed energy resources. EEI members are well-positioned to continue to lead the nation's clean energy transformation. Across the industry, companies are investing in a broad range of affordable, carbon-free technologies and approaches with the goal of finding the most affordable way to deliver resilient clean energy. As noted in recent reports, this transformation continues, as early estimates from 2023 show that power sector emissions decreased by 8 percent compared to the prior year, significantly outpacing the 1.9 percent decrease in terms of overall U.S. emissions.[2]

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[1] *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 111 Rules). 88 *Fed. Reg.* 33,240 (May 23, 2023).

[2] *See* Ben King, et al., Rhodium Group, Preliminary US Greenhouse Gas Emissions Estimates for 2023 (Jan. 10, 2024), https://rhg.com/research/us-greenhouse-gas-emissions-2023/.

Section 111 and Mass-Based Compliance

The Agency can and should authorize mass-based compliance in the context of the Proposed 111 Rules. While EPA traditionally sets unit-specific emissions rate limitations under CAA section 111, which, in the case of GHG limits been expressed as pounds of CO_2 per megawatt hour (lbs CO_2/MWh), there is no statutory bar on a different approach or converting emissions rate limits into mass-based emissions limits.[3] The ability to convert rate-based standards into mass-based compliance options can provide emissions reductions and important operational flexibility for regulated units that supports the reliability of the larger electric grid. This is especially important when EPA's proposed BSER results in very stringent emissions rates limits or require limited utilization for compliance.[4]

Mass-based approaches to GHG regulations long have been recognized as tools to provide both operational flexibility[5] and environmental integrity.[6] As discussed in more detail in EEI's comments filed on the Proposed 111 Rules, there are several advantages that could be gained from converting rate-based emissions limitations into mass-based tonnage budgets for individual regulated units.[7] The key question is how to make this conversation in ways that provide

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[3] CAA section 111(a)(1) calls for the Administrator to set a "standard of performance" that reflects the degree of emissions limitation that is achievable through the application of the best system of emission reduction (BSER). The term "standard" is not defined and can be read broadly to support both emissions rate limitations as well as mass-based limits on emissions.

[4] Achievable emissions rate limitations also provide operational flexibility. In the case of the Proposed 111 Rules, however, electric companies generally disagree with EPA that the identified BSERs have been adequately demonstrated and that the resulting emissions limits are achievable. The purpose of this paper is not to address EPA's BSERs, but instead to provide pathways that enable achievable, reliable compliance should EPA opt to finalize the BSERs as proposed.

[5] EPA has promulgated numerous mass-based programs for the power sector that have provided operational flexibility, from Title IV of the CAA through the variety of ozone transport-related rulemakings.

[6] All GHG emissions reporting protocols rely on mass-based measurement and reporting. *See, e.g.*, World Resources Institute, the proposed SEC rules, the proposed CEQ/GSA regulations for federal purchasing. It is also worth noting that the EPA itself utilized a mass-based approach under CAA section 111 in the final Clean Power Plan, although that was never implemented.

[7] See Appendix A, which excerpt the relevant part of EEI's August 8, 2023, comments. It is important to note that sources do not necessarily need to participate in a trading program in order to realize the operational benefits of a mass-based approach. Individual unit budgets—annual or lifetime—and other alternatives are effective in a mass-based system without trading. This paper does not propose or ask EPA to develop any trading system or regime, but a mass-based approach could enable states to use existing trading programs or develop new ones, if desired,

operational flexibility and preserve (or enhance) environmental performance. EPA's Proposed 111 Rules provide an answer to this question through the explicit recognition of the relationship between limiting operations and reduced emissions, because decreases in (or limits on) a unit's capacity factor have a direct impact on its CO_2 emissions profile.[8] However, capacity factor limitations (especially when paired with inflexible compliance averaging requirements) create significant operational challenges, particularly when units are called on to provide power in response to the needs of the broader energy grid. The appropriate approach to mass-based limits helps to solve these challenges.

A mass-based approach also is consistent with the proposed subcategories that rely on the reduced utilization of certain existing affected units under CAA section 111(d). This can be effective since decreases in the capacity factor will have a direct impact on the CO_2 mass emissions of each unit.

Accordingly, this paper discusses potential approaches for deploying and utilizing mass-based compliance approaches for units that will be subject to emissions limits under CAA section 111(b) and (d). In particular, these approaches, if included in a final rule, could be used by states in their compliance plans, both as a way to define the emissions limits applicable to affected units and to measure their compliance with those standards. This paper demonstrates that mass-based approaches both provide units significant operational flexibility and environmental integrity.

Baseline Considerations

As a preliminary matter, in the Proposed 111 Rules, EPA itself made certain assumptions regarding emissions baselines for determining how to calculate the emissions rate for an individual unit. This proposed approach to setting baselines uses a three-year look back.[9] The proposed methodologies both account for historic unit-specific operations—on the assumption that past performance is indicative of future performance—and EPA's proposed BSER for the relevant subcategory.

EPA proposes that a state will use the CO_2 mass emissions and corresponding electricity generation data for a given affected unit from any continuous eight-quarter period, within the five years immediately prior to the date the final rule is published in the Federal Register. EPA expects states to utilize the most representative eight-quarter period of data from those five years. *See* 88 *Fed. Reg.* at 33,375. For example, a state establishing baseline emissions performance in

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through their own state plans under the authority given them by CAA section 111(d). These state plans would of course need to be reviewed and approved by EPA.

[8] E.g., the more a unit runs the more efficient its operations become, leading to lower emissions rates but potentially higher mass emissions.

[9] Specifically, in Section XII(D)(1)(a) of the preamble to the Proposed 111 Rules, EPA describes its proposed method for states to determine the baseline emissions performance, which is a critical step in determining the presumptive standards for existing EGUs. *See* 88 *Fed. Reg.* 33,240, 33,375 (May 23, 2023).

the year 2023 would start by evaluating the CO_2 emissions and electricity generation data from 2018 through 2023 for each of the affected EGUs. The state would choose a continuous eight-quarter period that it deems to be the best representation of the operation for each affected EGU. *See id*. Using these eight quarters of data, the state would then divide the total CO_2 emissions (in the form of pounds) from that continuous time period by the total gross electricity generation (in the form of MWh) over that same time period. This result is baseline CO_2 emission performance in lb CO_2 per MWh. *See id*.

It should be noted that, therefore, that prior to converting the CO_2 tonnage emissions into a rate in the final step described above, EPA's baseline can be used as a mass-based budget for unit. Therefore, EPA has already created the framework for calculating a mass-based budget for any individual unit. The multi-year averaging component of EPA's baseline calculation—intended to capture a range of operating scenarios across a representative number of baseline years—provides a defensible and accurate characterization of unit operations and emissions. Accordingly, such an approach could be used by states to set a unit-specific budget for an existing unit or by EPA to set a budget for a new unit.

One concern raised by some stakeholders is that a mass-based conversion could lead to an "overestimation" of the budget for any individual existing unit because of the use of the historic baseline, which might not capture reductions in use unrelated to the GHG emissions limits but from the changing generation mix. These concerns are, according to some stakeholders, grounded in assumptions that fossil-based units will operate less over time as increasingly variable renewable assets continue to be integrated into the grid. The concern appears to be that an "inflated" budget for these units will either prolonging their operating life or somehow allow them to "doing less" in terms of emissions reductions, with detrimental consequences on investment in clean energy development and overall emissions reductions.

To assume the validity of these concerns, it is important to first recognize that, even in these hypothetical scenarios, many of the existing units in question would be reducing emissions through an eventual retirement, and would also be obligated to remain below their calculated budgets which would reflect the BSER, and therefore complying with EPA's rulemaking through a limitation on the number of tons emitted. In addition, there are other program design elements that states could utilize to address potential concerns. It is also worth noting that the validity of these concerns could certainly—and perhaps likely—be rendered moot by the future operations of the power sector or could only be realized only through success on the part of the power sector to continue to significantly reduce emissions in line with these proposed rules.

However, there are several potential policy approaches that states could adopt as part of a state plan should they feel compelled to address these perceived concerns. One approach that states could use would be to update baseline calculations between the submission of the state plan to EPA for review and the start of the compliance period in order to assess whether units continue to operate consistent with the original baseline calculations. Under such an approach, to ensure that tonnage limits "reflect the intent" of EPA's guidelines, states could recalculate the original baseline using more recent data—e.g., 2027-2030, or 2031-2034—to capture reduced utilization or other changes in operations in response to a changing generation mix. The updated baseline years could be determined at the time that a state submits its plan to EPA, so that units would

have notice of which future years would be captured in the updated baseline calculations and any necessary budgetary updates.

Updating the baseline calculation would help address the potential concerns raised by stakeholders; it would also provide an ongoing way for EPA's program to reflect the changes in the sector through the end of this decade and into the 2030s and could be accomplished without the need to update state plans to address concerns over individual unit budgets that may have been set more than a decade in the past. EPA should consider allowing states to adopt such an approach. A more detailed explanation, with a numeric example, is below.

It should be noted that updating baselines is not the only possible approach to address concerns about whether the size of a unit's budget is appropriate. EPA and states could allow units to engage in averaging mass emissions across similarly situated units, utilize emissions trading, or other policy tools for addressing these concerns. Many states have already implemented plans using some of these tools and EPA should remain open to all these options as part of a mass-based approach, for existing plans and as states develop or modify plans.

Where states have already required generators to establish baselines and achieve reductions in relation to those baselines, EPA should remain open to such mechanisms and allow for states' incorporation of existing approaches to align existing requirements with CAA 111 compliance plans. Such existing requirements are in accord with, and in some cases in advance of, EPA's 111(d) policy goals. Providing states with the flexibility to shape a mass-based compliance approach as part of their plans acknowledges the successes and emissions reductions already occurring. Additionally, the value of a mass-based approach remains significant, regardless of whether the state opts for a trading mechanism. In its simplest form, a mass-based approach requires that affected EGUs adhere to an absolute emissions reduction similar to that achieved by a rate-based approach to BSER.

EPA should remain open to all these options as part of a mass-based approach and should indicate this openness as part of the final rules.

Mass-Based Compliance Options for Existing Sources

This paper and the examples set forth below are intended to illustrative and not to foreclose other approaches, either mass-based or rate-based, that states may consider as the develop compliance plans for EPA approval, consistent with their statutory authority to regulate existing sources.

For purposes of this paper, a few representative examples show how mass-based conversions can work at a unit-specific level.[10] An illustrative unit and two separate scenarios based on an

[10] For purposes of these hypotheticals, certain assumptions (e.g., capacity factors and emissions rates) have been kept constant for illustrative purposes. Real world operations—with their attendant capacity factor variations and resulting changes in emissions rates—will be more variable and more complex. Any application of these principles as part of a state plan must be the result of a unit-specific inquiry. That said, simplicity in assumptions in this paper is intended to showcase how rate-to-mass conversions can work and be paired with other flexibilities while

entirely hypothetical ten percent reduction in the emissions rate through the application of an unspecified "best system of emission reduction" demonstrates how to convert a rate-based emissions limitation into a mass-based tonnage budget for an individual unit:

Hypothetical Unit – Baseline Case

Unit Size (nameplate capacity):	650 MW
CO_2 Emissions Rate Baseline:	2,075 lbs CO_2/MWh
Capacity Factor:	57%
Generation (MWh):	3,245,580
CO_2 Emissions (tons):	3,367,289

Unit Assumption Scenario 1 – Application of BSER

Unit Size (nameplate capacity):	650MW
CO_2 Emissions Rate Baseline:	2,075 lbs CO_2/MWh
BSER Application:	16% Reduction in Emissions Rate Consistent with Proposed Cofiring BSER (1,743 lbs CO_2/MWh)
Annual Capacity Factor (assumed):	57%
Annual Generation (MWh):	3,245,580
CO_2 Emissions Budget (tons):	2,828,523
Realized Annual Emissions Reductions (tons):	538,766

Unit Assumption Scenario 2 – Updated Baseline, Unit Operates Less in Future

Unit Size (nameplate capacity)	650 MW
CO_2 Emissions Rate Baseline:	2,075 lbs CO_2/MWh
BSER Application:	16% Reduction in Emissions Rate Consistent with Proposed Cofiring BSER (1,743 lbs CO_2/MWh)
Annual Capacity Factor:	28.5%
Annual Generation MWh:	1,622,790
CO_2 Emissions Budget (tons):	1,414,261
Realized Annual Emissions Reductions (tons):	1,953,028
Extra Annual Reduction over Scenario 1 (tons):	1,414,262

Using Unit Assumption Scenario 1, and assuming constant operations at the specific capacity factor, EPA could expect that the application of the BSER would yield a total CO_2 emissions reduction of approximately 5,387,660 tons over the ten years year period from 2030 to 2040, prior to the unit's ultimate retirement and cessation of all emissions. As the unit would have

preserving the significant emissions reductions and environmental certainty that can be associated with mass-based approaches. These examples also focus on existing coal-based units but could be applicable to all fossil-based units, including existing natural gas-based units regulated under CAA section 111(d) guidelines.

ceased operations, these emissions reductions would be permanent. These reductions are significant, certain, and ultimately permanent under a mass-based approach.

States, EPA, and units can also leverage the potential benefits of adjusting baselines to create mass-based approaches on a unit-specific basis.[11] However, looking at Unit Assumption Scenario 2, and assuming an adjusted baseline beginning in 2035 for the entire program period and translating that limitation into a tonnage budget, the total avoided emissions from this approach would instead be approximately 9,765,140 tons of CO_2 while also providing a significant amount of operational flexibility within that compliance tonnage budget.

Instead of expressing these limits in terms of capacity factor, however, EPA, states, and unit owners/operations could also opt to create a total tonnage budget for a unit for some period of time—including for an entire compliance period, if desired. These tonnage budgets would be linked to reduced utilization limitations and would include enforceable budget caps with regular reporting regarding the size of the remaining budget and retirement dates (as applicable), among other requirements. Once a unit had utilized the entirety of its tonnage budget, should it choose such an approach, then the unit would retire. This would allow for enforceability and guarantee environmental performance over the term of the budget and the program.

Interfacing With State Programs

Allowing states to pursue mass-based approaches would allow for state plans to more effectively interface with existing state-based climate programs. This is critical since many existing state programs—like the Regional Greenhouse Gas Initiative (RGGI), California's AB32, Oregon's HB 2021, and others—already utilize a mass-based compliance approach for covered sources. Allowing for sensible inclusion and integration of existing state requirements and policies for compliance is essential and should account for the numerous compliance flexibilities and other innovative approaches already being implemented by states.

This includes the use of existing trading programs, like RGGI, which allows covered units to comply with mass-based allowance trading. It could also include other potential state programs that utilize mass-based elements in their approach, including using a combination of mass- and rate-based elements similar to the NOx budget trading plan. It can also simply interface directly with state programs that just use mass-based budgets for compliance at the unit level. Given that states are already utilizing mass-based approaches and elements in their own plans, EPA should allow for these approaches in state plans in order to leverage the existing success and ongoing reductions these approaches embody.

Mass-Based Approaches Would Also Work With Any Reliability Mechanism

As EEI noted to EPA in comments on EPA's reliability supplemental notice, grid reliability is and will continue to be a top priority for EEI's member companies and their customers. The last few years have seen extreme summer and winter conditions that have challenged the reliability

[11] It also is worth noting that there are a variety of other factors to contemplate in a reduced utilization scenario, including rate structures and operations & maintenance requirements that must be addressed as facilities operate differently moving forward. These should be discussed and addressed during the state plan process on a unit-specific basis.

of the grid, raising concerns about the retirement of dispatchable, 24/7 generation, the speed with which new generating resources can be interconnected, the need to expand the capacity of the grid, the clean energy and energy infrastructure supply chain, and increased demand for electricity as a result of economic growth, domestic manufacturing, and electrification. Regardless of any final EPA regulations addressing GHG emissions from the new and existing fossil generating fleet, the clean energy transition is not going to be easy.

Challenges do not mean that this transition is impossible or that our larger goals for a resilient, equitable, affordable clean energy future should change. What these challenges do mean, however, is that we will need to work with and across a myriad of stakeholders to solve them, be prepared for progress to be bumpy on occasion, and be willing to be flexible. The investor-owned electric companies are committed to working with EPA, state regulators, the Federal Energy Regulatory Commission (FERC), the North American Electric Reliability Corporation (NERC), customers, environmental groups, and others to make the clean energy transition successful.

As EEI noted to the Agency, EPA should finalize reliability tools and mechanism in conjunction with expanded compliance flexibilities for states and units that can help obviate the need to deploy reliability-specific mechanisms while supporting the ability of units to comply with EPA's final guidelines. Crucially, providing the ability to use mass-based compliance approaches will enable units to account more for electric reliability considerations and, in practice, likely limit the need for states and units to utilize the Final 111 Rules' specific reliability mechanisms themselves. EPA should therefore ensure that it finalizes approaches that authorize states to explore additional compliance flexibilities in conjunction with any reliability-specific mechanisms.