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Energy & Climate

EPA's New Standards for Power Plants

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The Environmental Protection Agency (EPA) recently finalized the latest chapter in the long saga of regulating greenhouse gases from electric power plants. The new rules are complex, but at a high level, they require existing coal plants to meet an emissions threshold aligned with 90% carbon capture by 2032 in order to continue running after 2038. New natural gas plants must also meet a 90% capture standard starting in 2035 or run below a 40% capacity factor. Already, lawsuits challenging the new regulations abound, and it's likely the rules will ultimately make their way to the Supreme Court.

In this note, we consider what the new rules mean for electric power GHG and conventional pollutant emissions into the next decade. The rules represent the largest EPA climate regulation to date in the electric power sector, cutting CO_2 emissions by 155 to 241 million metric tons (MMT) compared to no new regulations in 2035. This represents a 28-48% reduction in electric power sector emissions in that year, compared to no new regulations. These reductions are largely achieved through the retirement of coal plants and replacing that generation with a mix of renewables, nuclear, and existing gas. 2-7% of the remaining fossil capacity in 2035 is equipped with carbon capture. The rules also further accelerate declines in conventional pollutant emissions levels, leading to a 93-94% reduction in SO_2 emissions and a 75-85% reduction in NOx emissions compared to 2022 levels. These reductions occur in both overburdened fence-line communities and beyond, improving public health outcomes. But existing natural gas plants are not covered by the rules that EPA finalized, and EPA will need to figure out how to reduce the associated GHG emissions as well as conventional pollutant emissions that continue to disproportionately affect fence-line communities.

New rules in a long game

In April, EPA finalized its guidelines to states for regulating existing coal power plants and its new source performance standards for new natural gas-fired power plants. These rules are the cornerstone of a suite of actions regulating GHGs, conventional pollutants, wastewater, and coal ash. The existing coal rule builds on rules already in place for new coal plants, which require stringent GHG emission rates based on carbon capture technology.

The existing coal rule was promulgated under section 111(d) of the Clean Air Act, which directs EPA to establish a best system of emission reductions (BSER) to set a target for GHG emissions, but which provides flexibility in how states could meet that target. EPA established 90% carbon capture as the BSER for most existing coal plants, though plants that retire before 2040 could use 40% natural gas blending as the BSER instead. States are required to demonstrate that their coal fleets have emissions rates below these BSER levels beginning in 2032. The rule doesn't mandate installation of the BSER technology, just that plants meet the emissions rate standards in whatever way they can. States also have the flexibility to opt certain facilities out of the rule based on age or grid reliability constraints, and they can opt to average emissions across multiple coal plants. The rule is effectively the final chapter for uncontrolled coal plants in the US, which have already been in decline for years.

Meanwhile, rules on new gas plants come under section 111(b) of the Clean Air Act. Under the final rules, all new gas plants that commenced construction after May 2023 must achieve a 90% capture-based emissions standard starting in 2035 or run below a "base load" capacity factor threshold of less than 40%. EPA proposed regulations on existing gas plants as well, but they punted on finalizing those rules. They're in the early stages of figuring out where to go next on regulatory actions for this portion of the gas fleet.

The new rules have been a long time coming. The Obama-era EPA first attempted to regulate existing fossil plants through its Clean Power Plan (CPP) more than a decade ago. Those rules were stayed and, ultimately, struck down by the Supreme Court in its 2022 *West Virginia v. EPA* decision. The court found that EPA could not consider "generation shifting" as part of a BSER since the law had previously only been applied based on pollution controls for individual sources. The CPP took a broader approach, counting new renewable investment as a method of reducing emissions at fossil plants, drawing the ire of the court. The new rules follow the *West Virginia* guidance and require plants to meet emission rates established through 90% capture of carbon dioxide. In the interim, a lower court struck down the Trump-era EPA's attempt at rules in part because they didn't require any pollution reductions.

Accelerating electric power decarbonization

To quantify the impact of the new EPA rules on GHG and conventional pollutant emissions, we start with our baseline scenarios from Taking Stock 2023, which include policies on the books through May 2023, labeled "Without 111" in the charts below. This includes all key components of the Inflation Reduction Act, such as the tech-neutral tax credits, which we recently found play a large role in driving electric power decarbonization on their own. We then layer on the finalized 111 regulations to assess their impacts, labeled "With 111" in the charts below. In both policy scenarios, we use RHG-NEMS, our integrated energy

system model, to assess future emissions and energy systems outcomes under low, mid, and high emissions pathways, capturing sensitivities in macroeconomic growth, clean technology cost, and oil and gas price uncertainty. Further detail on how the pathways are constructed is available in Taking Stock 2023.

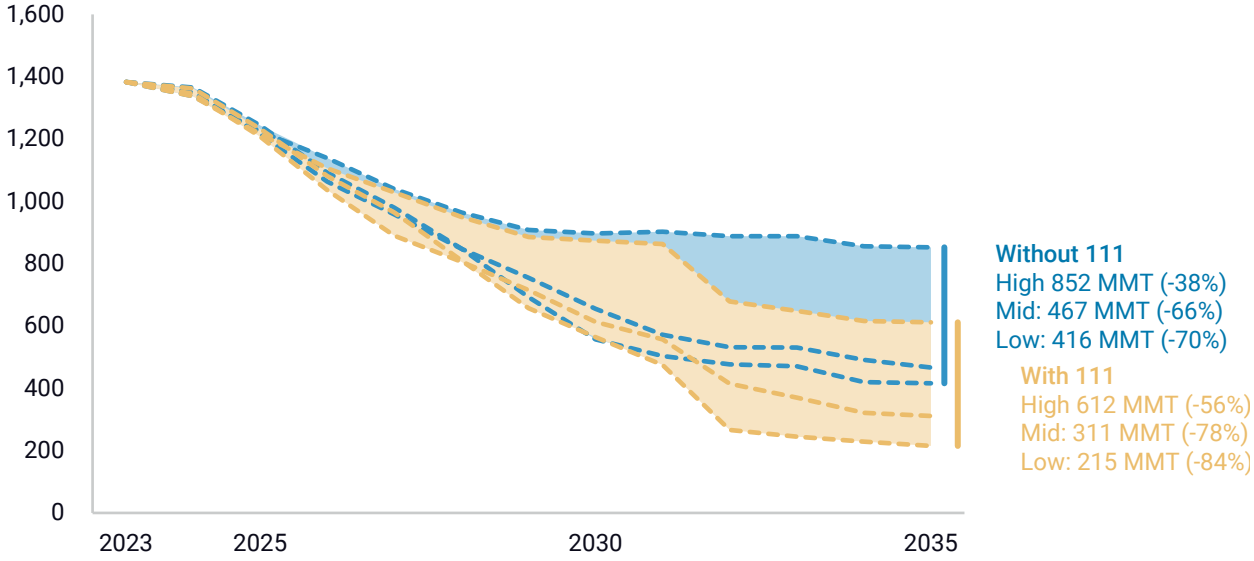
To isolate the impacts of the 111 regulations, the only thing that changes between the "without" and "with" 111 runs is inclusion of the regulations themselves. EPA has finalized a raft of other rules, including limits on vehicle tailpipe emissions and methane from oil and gas operations, but an assessment of those rules is beyond the scope of this note. There has also been growing attention paid to increasing levels of power sector demand growth, particularly from data centers and new manufacturing capacity, which may be regionally significant. Other factors that we don't consider here can also influence the magnitude of our estimates. As we discuss below, RHG-NEMS is limited in its ability to represent some headwinds facing clean energy deployment, like permitting and siting constraints, supply chain limitations, and transmission capacity. We will dive much more into new rules and new demand growth, and also aim to provide directional insight on some of these supply-side constraints, in our Taking Stock 2024 report due out in July.

We find that the new EPA rules cut electric power CO_2 emissions by 155-241 million metric tons in 2035 across our three emissions scenarios (Figure 1), a 28-48% reduction in electric power sector emissions in that year compared to no new regulations. Most of this decline comes from lower emissions levels from the coal fleet, which rapidly shrinks after the 2032 deadline for coal plants to meet emissions levels associated with 90% carbon capture comes into force. As such, these reductions don't contribute substantially to meeting the US 2030 climate target of 50-52% below 2005 levels, but they still deliver meaningful decarbonization progress early in the 2030s.

FIGURE 1

US electric power sector emissions

Million metric tons (MMT) of CO_2 and percent reduction from 2023 levels

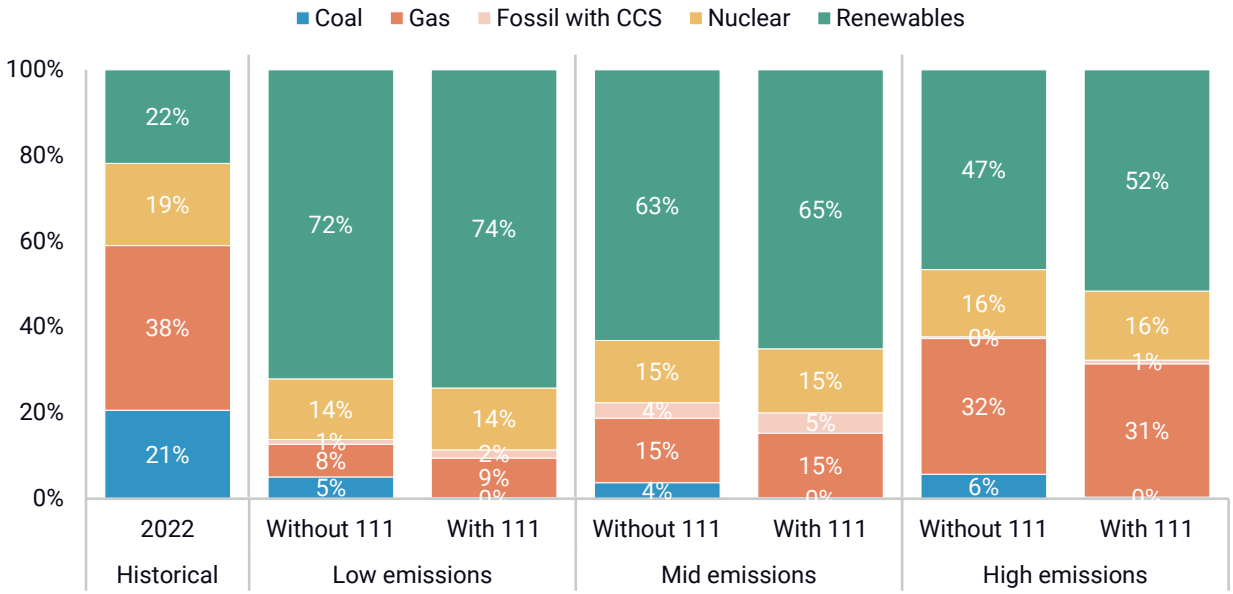


Source: Rhodium Group. The high, mid, and low ranges reflect uncertainty around fossil fuel prices, economic growth, and clean technology costs.

These reductions are achieved primarily by a shift from coal generation to clean generation like solar and (in some scenarios) wind; retaining slightly more of the existing nuclear fleet; and deployment of small amounts of fossil with carbon capture and storage (CCS) (Figure 2). Generation from all fossil sources, including plants with carbon capture, drops from 59% in 2022 to 11-32% in 2035 with 111 in place. Much of this change happens based on a combination of technology cost improvements and support from the IRA, with generation from zero-emitting sources reaching 62-86% in 2035 without 111 regulations. But the regulations drive this transition further, and with them in place the share of zero-emitting generation reaches 68-89% in 2035. We unpack the dynamics of the fossil fleet in more detail below.

The increasing shares of generation from renewables are supported by a couple of important factors. First, battery storage increases by 22-23% in our low and mid emissions cases to enable integration of higher shares of variable renewables (and increases by 2% in the high emissions case). Second, interregional transmission flows increase in our mid and high cases. Though NEMS lacks a fully characterized representation of the bulk transmission system, this outcome provides directional insight into the value of added transmission.

FIGURE 2
Utility-scale generation by resource type in 2035
Percent share



Source: Rhodium Group
Notes: Gas includes a small amount of generation from oil in addition to natural gas. The high, mid, and low ranges reflect uncertainty around fossil fuel prices, economic growth, and clean technology costs.

There's an interesting interaction between these EPA regulations and the tech-neutral power sector tax credits. The IRA instituted an either-or phaseout provision for the tax credits: they expire either in 2032 or once power sector emissions are 75% lower than their 2022 emissions levels. In our recent analysis of tech-neutral tax credits, we found that those credits would not expire before 2035 because electric power emissions don't decline far enough to cross the statutory phase-out threshold of 75% below 2022 levels.

Layering on the new EPA regulations, we find the 75% decline threshold is crossed as early as 2032 in our low emissions scenario and 2034 in our mid emissions scenario. The threshold is not crossed in our high emissions scenario, where clean technologies are relatively expensive and natural gas is cheap. Given the way the phase-out is structured, we wouldn't expect to see impacts within the timeframe we're considering in this note, but a looming expiration of the PTC and ITC could cause a rush to install renewable capacity in the late 2030s—at a point at which we're already installing wind and solar at a breakneck pace.

More generation from existing gas, little carbon capture deployment

The dynamics of the fossil fleet under 111 merit further discussion. Generation from both coal and gas see structural declines from today's levels by 2035 even before the EPA regulations are included. The magnitude of the decline in fossil's role is a function of the emissions scenario context, with our low emissions scenario with cheap clean generation and relatively expensive fossil fuels providing a more favorable environment for economically driven decarbonization. This environment reduces fossil's role on the grid more substantially compared to our high emissions scenario, which includes cheaper fossil fuels and more expensive clean generation. Adding the 111 regulations uniformly reduces fossil's contribution to the grid even further. For instance, with 111 in place, uncontrolled coal generation drops to effectively zero in 2035 across all scenarios—down from 21% of generation in 2022 and 4-6% in 2035 without the 111 regulations. The 6-11 GWs of uncontrolled coal that remain online in 2035 largely retire before 2039 per EPA's 111 rule requirements.

Gas also plays a smaller role in 2035 both without and with 111. In our mid and high emissions scenarios, natural gas's share of generation holds steady or declines with 111 in place, while there's a small increase in gas share in the low emissions case (which has the lowest overall contribution of gas to the grid). The new source standards on gas result in lower overall generation from combined cycle gas plants built after the enactment of the rule. However, slightly more new gas plants get built but run under the 40% baseload capacity factor limitation instead of building or retrofitting with carbon capture. Meanwhile, generation from existing combined cycle gas plants increases by 12 and 24% in the mid and low emissions cases, respectively, and stays flat in the high emissions case, where generation from these facilities was already substantially higher. The amount of installed combined cycle gas capacity is effectively flat in 2035 without and with 111 (Table 1). Likewise, simple cycle peaking gas capacity is also flat between the two policy cases.

Fossil with carbon capture generally plays a small role on the grid in 2035. Carbon capture is a commercially available technology in the early stages of scale-up. In the US, carbon capture enjoys a substantial tax credit of $85 per ton of CO_2 captured and stored, owing to recent policy changes to the 45Q tax credit in the IRA. EPA relied on carbon capture as the best system of emission reduction when setting emission rates standards for existing coal and new natural gas plants in the final rule. In our analysis of the rule, we see almost all coal plants (180-181 GW) retiring in the early 2030s instead of retrofitting with carbon capture. The 7-11 GWs, or 4-6% of all coal plants, that do retrofit with carbon capture end up retiring in the early 2040s when the 12-year payout period for 45Q ends for these

facilities. Only 1-7% of the natural gas combined cycle fleet in 2035 is equipped with carbon capture.

TABLE 1
Fossil generation capacity without and with EPA regulations (in GW)

Plant Type	2022	2035 Without 111	2035 With 111
Coal	198	57-62	6-11
Coal with carbon capture	0	4-9	7-11
Combined cycle natural gas	280	251-312	253-319
Combined cycle gas with carbon capture	0	0-18	2-24
Simple cycle natural gas (peakers)	146	216-330	210-334
All other fossil	75	54-61	71-94
Total	699	524-703	545-759

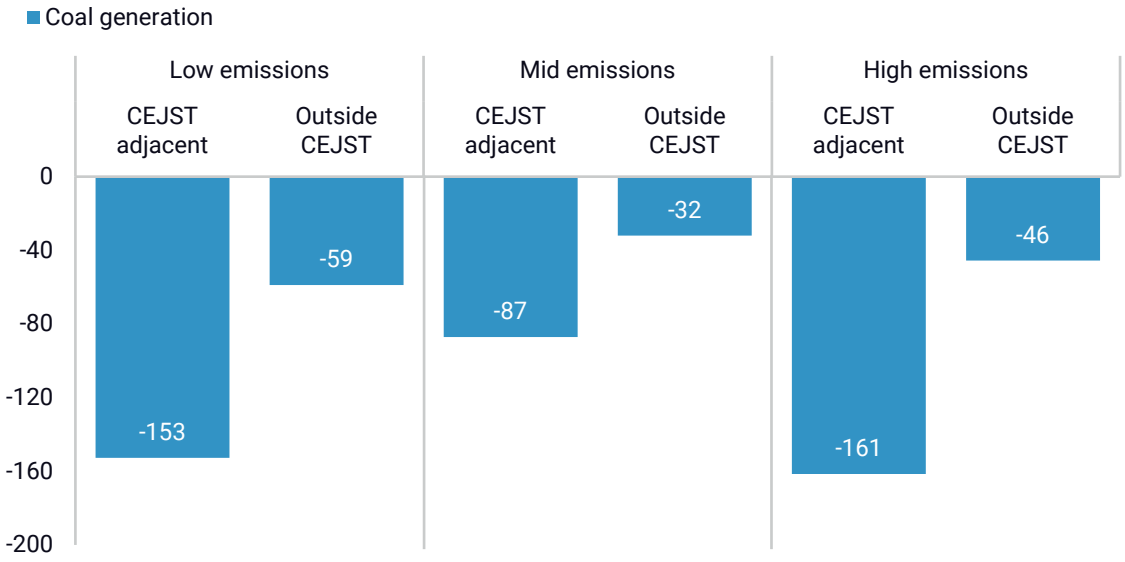
Communities breathe easier

One closely watched aspect of the new GHG rules is whether and how the carbon capture-based standards will impact communities that have dealt with pollution from fossil fuel power plants for decades. Full-scale air quality modeling is beyond the scope of this note, but we aim to provide some insights with a geographic analysis of the emissions of two major air pollutants, NOx and SO_2, which both contribute to acute and chronic cardiovascular and respiratory health problems. We estimate emissions levels of these two pollutants from *existing* coal and gas plants with and without 111 regulations in place.[1] We then identify whether these plants are located within three kilometers of a census tract that has been identified as overburdened and underserved by the Climate and Economic Justice Screening Tool (CEJST). We aggregate plants into two categories: CEJST tract-adjacent and outside CEJST tracts.[2]

[1] Because we do not know precisely where *new* gas plants would be sited, we cannot determine whether they would fall into a three km radius of a CEJST tract. However, as discussed above, the new source component of the rule leads to lower generation from new gas plants, so this approach likely slightly understates the conventional pollutant benefits.

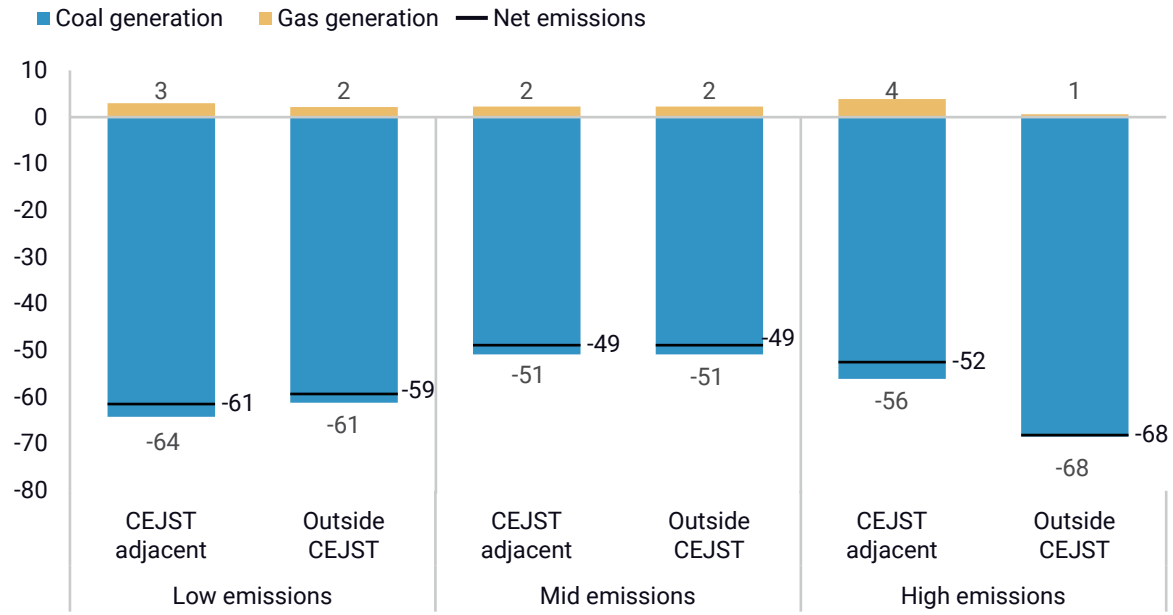
[2] There are multiple ways to define fence-line and overburdened communities. We use CEJST because it encompasses a wide range of burdens and it's the tool used by the federal government to track investment under the Justice40 initiative. Three kilometers is a commonly used radius in environmental justice literature.

FIGURE 3
Change in net SO_2 pollution from 111 regulations at existing fossil generators
Thousand short tons



Source: Rhodium Group

FIGURE 4
Change in net NO_x pollution from 111 regulations at existing fossil generators
Thousand short tons



Source: Rhodium Group
Notes: Gas generation includes a small amount of NOx pollution from oil combustion in addition to natural gas.

The changes to the grid we discuss above result in meaningful reductions in SO2 and NOx emissions at the national level. Even without the 111 regulations, major changes to the generation mix lead to SO_2 and NOx dropping from 2022 levels by 71-81% (0.71-0.81

million short tons) and 64-74% (0.68-0.79 million short tons), respectively, in 2035. With the 111 regulations in place, this increases to a 93-94% (0.93-0.95 million short tons) reduction in SO_2 levels and a 75-85% (0.8-0.91 million short tons) reduction in NOx levels in 2035 from 2022 levels.

At the community level, there are even deeper absolute levels of reductions of SO_2 emissions at power plants within 3 km of a CEJST tract, as those are the areas with the highest levels of SO_2 emissions without the regulations in place (Figure 3). NOx emissions reductions are roughly similar on an aggregate basis for plants that are CEJST adjacent or not, with relatively more reductions coming from CEJST adjacent plants in the low emissions scenario and relatively more reductions coming from plants outside CEJST tracts in the high emissions scenario. (Figure 4).

At a national level, both CEJST-adjacent communities and those further afield are better off with the EPA regulations in place, and the impacts of these regulations come in addition to air quality gains driven by IRA-influenced power sector economics. Despite these gains, there is still critical work to do to reduce the remaining sources of these and other pollutants. As has been the case for decades, the majority of *remaining* pollution from these existing sources comes from plants within 3 km of a CEJST tract. Though the closures of the last uncontrolled coal plants by 2039 largely takes care of remaining SO_2 emissions, existing gas plants remain a large source of NOx pollution. As mentioned above, EPA is trying to figure out where to go on regulating these plants.

The bumpy road ahead

The EPA rules face a bumpy and uncertain road to implementation. If the election yields a change in administration, it is likely the rules get revisited. If that's not the case, the rules will be litigated in court. While the agency appears to have adhered to the guidance of the Supreme Court's *West Virginia* decision, the high court has a track record of skepticism on power plant GHG regulations, and it's not clear how things may shake out. Assuming the rules are upheld, states with existing coal plants will need to submit plans on how they intend to implement the rules by spring 2026, and EPA will need to review and approve them. This is the beginning, not the end, of the process of regulated GHG emissions from power plants.

As for historically overburdened communities, the next opportunity to push for pollution relief is EPA's forthcoming rules of existing natural gas plants—the one subset of the fossil fleet that remains free of GHG constraints. EPA has initiated a process to consider new controls on GHGs and conventional pollutants from these plants. Like the latest final rules, this process could be impacted by the election. Creative approaches on how to address emissions from existing natural gas plants will be important if EPA is going to deliver additional public health and climate gains in the years ahead.

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