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New Sources and the Clean Power Plan: Considerations for Mass-Based Plans

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Introduction

On August 3, 2015, the U.S. Environmental Protection Agency (EPA) finalized the first national greenhouse gas regulations for fossil fuel-fired power plants under the Clean Air Act.[1] The regulations comprise separate rules for new and existing sources. The rule for existing sources, called the Clean Power Plan, requires states to develop plans and implement performance standards that reflect rate-based (pounds of CO_2 per megawatt hour of generation) or mass-based (total tons of CO_2 from covered sources) emissions guidelines established by the EPA. For states considering mass-based plans, whether to cover emissions from *new* units that are also subject to the new source standards is a threshold question. For any state that elects to cover new sources, the EPA provides a presumptively approvable additional emissions budget—or "new source complement."

This policy brief explores the implications of including or excluding new sources in mass-based state plans. It considers factors such as expected load growth, whether the choice to include or exclude new units affects the generation mix between new and existing units, and the corresponding requirement to address the risk that emissions could shift from existing sources to new sources—so-called leakage—in a state plan that covers only existing units. The brief concludes that states may face a tradeoff in their decision to include or exclude new sources—a finding based on three factors:

- Covering new sources may make it harder or easier to comply, depending on assumptions about future electricity demand and the resources that will meet that demand.
- Covering new sources would provide a consistent economic signal to existing and new sources with a similar emissions profile. In contrast, excluding new sources may lead to power market distortions.
- Covering new sources would improve the program's environmental integrity by eliminating the risk of leakage.

Overview of the Clean Power Plan

The Clean Power Plan regulates CO_2 emissions from most *existing* coal-, oil-, and gas-steam electric generating units (EGUs) as well as natural gas combined cycle (NGCC) units.[2] New sources in the same category are subject to new source

[1] "Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units," *Fed. Reg.* 80 (October 23, 2015): 64510–64660 [Hereinafter "New Source Rule"], https://www.federalregister.gov/articles/2015/10/23/2015-22837/standards-of-performance-for-greenhouse-gas-emissions-from-new-modified-and-reconstructed-stationary; "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units," *Fed. Reg.* 80 (October 23, 2015): 64661–65120 [Hereinafter "CPP Rule"], https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating.

[2] CPP Rule, *supra,* note 1. Peaking units such as combustion turbines that generally run only during hours of the year when demand is highest are not covered under the Clean Power Plan.

performance standards.[3] The Clean Power Plan sets national emissions guidelines and requires states to develop plans to implement existing source standards that reflect those guidelines. Any state that chooses not to develop a plan or that develops a plan the EPA deems insufficient will become subject to a federal plan.[4]

To facilitate state plan development, the final rule provides the emissions guidelines in four forms: (1) subcategorized performance rates for steam and NGCC units, (2) state-by-state "blended" rates that would apply to all affected units in a state, (3) a statewide mass-based goal (total tons of CO_2 from affected units), and (4) a statewide mass-based goal with a "new source complement," which would apply to both existing and new EGUs that are also subject to the new source performance standards.[5]

In states that adopt a mass-based goal, affected EGUs would demonstrate compliance on the basis of total tons of CO_2 emitted. In the case of mass-based plans that cover existing units only, the Clean Power Plan requires state plans to address the risk of leakage to new sources as a result of new and existing units facing different regulatory requirements.[6] The EPA's assumptions in developing the mass-based emissions budgets for existing and new sources—described in detail below—are an important factor in the decision whether to include new sources.

All forms of the emissions goals can be met through state plans that incorporate market-based emissions-trading programs.[7] To facilitate trading, the EPA proposed mass- and rate-based model trading rules that states can use as a template for plan development.[8] The model rules will become presumptively approvable once finalized, meaning that any state using all or part of the model rules in its state plan will know ahead of time that those components that are drawn from the model rules—including the provisions to address the risk of leakage in the mass-based model rule, which covers existing sources only—will be approved by the EPA.[9]

States have until September 6, 2016, to submit a plan or make an initial submission requesting an extension.[10] States that receive an extension must then submit an update by September 6, 2017, and a final plan by September 6, 2018.[11] As states move forward with plan development, threshold choices include the form of the standards (rate-based or mass-based), whether and to what extent to allow trading (described below), and for mass-based plans,[12] whether to cover emissions from new sources.

Overview of Mass-Based Emissions Trading Systems

In general, mass-based emissions trading programs establish a total emissions budget for each compliance period and create a number of "allowances" equal to the total budget, with each allowance representing one ton of emissions. Covered sources, sometimes called *affected units* or *compliance entities,* must surrender one allowance for each ton of emissions during a compliance period. The fixed number of allowances maintains total emissions within the budget. Affected unit owners, and in many cases other market participants, can buy and sell allowances, which enables the market to determine the least cost compliance path across all affected units.[13] Key questions in the design of mass-based emissions trading programs include the overall budget and how allowances are initially made available to the market—such as through an auction or free allocation (Box 1).

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[3] New Source Rule *supra*, note 1.

[4] For an overview of the proposed federal plan, see, DeMeester, J. and S. Adair, "The EPA's Clean Power Plan: Understanding and Evaluating the Proposed Federal Plan and Model Rules," NI PB 15-05 (2015), https://nicholasinstitute.duke.edu/sites/default/files/publications/ni_pb_15-05_0.pdf.

[5] Although single-cycle combustion turbines are subject to the new source performance standard, states would likely have discretion on their inclusion under the new source complement. The new source complement increases the total emissions budget.

[6] CPP Rule, *supra,* note 1 at 64949, to be codified at 40 CFR 60.5790(b)(5).

[7] CPP Rule, *supra,* note 1 at 64834.

[8] "Federal Plan Requirements for Greenhouse Gas Emissions From Electric Utility Generating Units Constructed On or Before January 8, 2014; Model Trading Rules; Amendments to Framework Regulations," *Fed. Reg.* 80(205): 64966–65116, [Hereinafter "Proposed Federal Plan & Model Rules"], http://www.gpo.gov/fdsys/pkg/FR-2015-10-23/html/2015-22848.htm.

[9] *Id.* at 64969.

[10] CPP Rule, *supra*, note 1 at 64946. To be codified at 40 CFR §60.5760.

[11] *Id.* at 64946-7. To be codified at 40 CFR §60.5760-5.

[12] The Clean Power Plan prohibits sources subject to the new source standards from participating in rate-based state plans. Specifically, such units cannot generate "emission rate credits" that are used to adjust the CO_2 emissions rates of affected units to demonstrate compliance. CPP Rule, *supra,* note 1 at 64950. To be codified at 40 CFR §60.5800(c)(1).

[13] In a mass-based emissions trading system, sources will reduce their emissions (subject to operational constraints) if the cost of doing so is below the market price of an allowance. Sources with emissions reduction costs that are higher than the market price of an allowance will buy allowances to comply with the mass cap, minimizing cost for both individual affected units and the system as a whole.

Box 1. Tradable Allowances and Electricity Market Outcomes

Tradable allowances in a mass-based trading plan have value and affect electricity markets and unit dispatch. Tradable allowances, regardless of how they are acquired (e.g., through free allocation, purchases, or auction) have a market value because their owners can sell them at the market price. Thus, whenever a power plant uses an allowance for compliance, it is forgoing the opportunity to sell the allowance, thereby creating what economists refer to as an opportunity cost. This opportunity cost—the cost to the owner of using the allowance—is reflected in bids into competitive electricity markets and should affect dispatch decisions. Because of this opportunity cost, emitting units covered by the mass-based trading program bear the cost of allowances, in proportion to their emissions, in competitive bid and dispatch decisions, raising their cost relative to any non-emitting unit or unit outside the emissions budget. Generally, these costs are passed onto ratepayers unless the units are traditionally regulated and receive allowances for free.

How allowances are allocated can also affect bids into competitive markets and dispatch decisions. For example, in updating output-based allocation, eligible units earn allowances on the basis of their generation. A unit earning allowances through operation is creating value—that is, gaining allowances that can be used or sold—through operation, and that value is also reflected in market bids and dispatch decisions. Thus, updating output-based allocation lowers the bid price of units earning allowances through operation and increases their dispatch.

Considerations for State Plans That Cover New Sources

As noted above, states may face a tradeoff in their decision to include or exclude new sources. Mass-based compliance plans that cover new units would limit emissions from covered existing units as well as new units in the same categories—most likely new NGCC units.[14] Including new units creates a uniform market signal for new and existing sources, which maintains a level playing field and strengthens the environmental integrity of the policy. It also sets limits on most fossil generation, potentially limiting a state's ability to meet load growth with fossil generation.

Expectations about future load growth—and what resources would be used to meet that growth—are therefore a key consideration in the choice of whether to cover new sources. Depending on how a state's assumptions about future load growth and the resources needed to meet that growth compare with the EPA's assumptions in calculating the mass-based budgets, including new sources could make it harder or easier to comply. For example, if no new NGCCs units are built in a state, the new source complement provides additional allowances that would reduce the stringency of the regulation. For states that participate in interstate trading, affected units in the state could end up with additional allowances to sell or needing to purchase additional allowances.[15] Some states or stakeholders may perceive that covering new sources imposes risk by limiting total future emissions, but doing so will likely increase electricity markets' efficiency, states' flexibility in allowance allocation, and emissions integrity, and it may increase the supply of allowances for existing sources.

Evaluating Mass-Based Emissions Budgets, Load Growth, and Emissions Trajectory

For the reasons stated above, expectations about future load growth and the resources that will be used to meet that growth (e.g., natural gas, renewables, nuclear, energy efficiency) are likely to be central to a state's decision to include or exclude new sources in a mass-based state plan. Therefore, considering a range of plausible future scenarios—and how those scenarios compare to the EPA's mass budgets—is critical to evaluating the likely effects of covering new sources.

[14] To meet the new source performance standard for coal (1,400 pounds per MWh), new units would likely require carbon capture and storage but may be able to comply with co-firing. See, e.g., Electric Power Research Institute, "Clean Power Plan: A Quick Comparison of What Changed" (August 4, 2015), http://www.epri.com/About-Us/Documents/Summer_Seminar_2015/Clean-Power-Plan-Comparison.pdf. Conversely, the new source standard for NGCC units (1,030 pounds per MWh-net), is essentially non-binding, because most existing NGCC units already operate below this standard. (New Source Rule, *supra* at note 1.) Even without the new source standards, the U.S. EIA's *Annual Energy Outlook 2015* projects very few new coal plants. See U.S. EIA, *Annual Energy Outlook 2015: Electricity Generation* (April 14, 2015), http://www.eia.gov/forecasts/aeo/section_elecgeneration.cfm.

[15] If the state plan does not allow interstate trading of allowances, covering new sources would cause the in-state allowance price to rise or fall to reflect any increase or decrease in the program's stringency.

The EPA's Mass-based Emissions Budgets

A key initial consideration for whether to include new sources is the EPA's methodology for developing the state-by-state mass-based goals for existing sources only and new source complements. Most of the accommodation for load growth in the EPA's calculation of mass-based goals is included in the existing sources-only budgets. Therefore, the new source complement adds a small percentage to the overall mass budgets (Table 1), but the most relevant comparison is the expected emissions trajectory with the combined existing source budget and new source complement.

Table 1. Percent increase in national emissions budget with all state new source complements

	Cumulative Interim Goal Budget	Final Goal Budget
National increase in emissions budget with new source complements	1.8%	2.5%

The mass-based *existing* source budgets for each state are intended to allow growth in emissions from existing sources equivalent to that possible under a subcategorized rate-based compliance approach.[16] The EPA set the national subcategorized rate-based standards on the basis of the least stringent regional (interconnect-wide) standards resulting from its analysis of the best system of emission reduction (BSER) (see Box 2). Therefore, some of the assumed BSER potential is not reflected in the subcategory-specific standards of performance (i.e., in the regions that did not set the national standards). Therefore, the EPA concludes there is "unutilized" BSER potential—namely renewable energy potential—that could facilitate additional generation and emissions from affected sources under a rate-based approach.

Box 2. The EPA's Analysis of the Best System of Emission Reduction

The EPA calculates the emissions guidelines for existing sources on the basis of its determination that the best system of emission reduction (BSER) comprises three building blocks: (1) improved efficiency of existing coal plants (heat rate improvements), (2) shifting generation from existing steam units to existing NGCC units up to 75% of net summer capacity, and (3) increasing deployment of renewable energy. The EPA analyzes the building blocks' potential to reduce emissions on an interconnection-wide basis (Eastern Interconnect, Western Interconnect, and Electric Reliability Council of Texas Interconnect). It then chooses the least stringent standard for steam units and NGCC units, respectively, in each time period, and applies it nationally.

Additional renewable energy generation could generate emissions rate credits (ERCs) in a rate-based system beyond those needed for baseline (2012) fossil generation to meet the standards, and existing sources could use those additional credits to increase their emissions while remaining in compliance. Thus the mass-based budgets are adjusted upward to reflect this possibility and maintain equivalence to the rate-based approach. This approach is incorporated into the EPA's calculation of existing-source-only mass-based goals through the addition of the potential emissions growth if the unutilized renewable energy was added to the grid (Box 3).[17]

[16] U.S. EPA, "CO_2 Emission Performance Rate and Goal Computation Technical Support Document for CPP Final Rule," (August 2015) at 21, http://www3.epa.gov/airquality/cpp/tsd-cpp-emission-performance-rate-goal-computation.pdf.

[17] In a rate-based approach, renewable energy and other low- or zero-emitting resources create "emissions reduction credits" representing 1 MWh of emissions-free generation. These credits can be acquired by affected units and added to the denominator of a unit's emissions rate to adjust the rate downward and demonstrate compliance. Additional credits in the system can therefore be acquired by existing sources and used to demonstrate compliance while increasing total emissions.

Box 3. Rate-to-Mass Conversion Formula for Existing Source Only Budget

State Existing Source Mass Budget =

(State Blended Rate x 2012 Adjusted Affected Generation) +

(Unutilized Renewable Energy x 2 x State Portion of Total Affected 2012 Generation x State Blended Rate)

Note: Under-construction units are included in the rate-to-mass conversion for existing units through the 2012-adjusted affected-unit fossil generation calculations. (See U.S. EPA, *supra,* note 16 at 12-13.) Unutilized renewable energy is multiplied by 2 because each MWh of zero-emitting generation allows another MWh of fossil generation operating at twice the emissions rate (blended or subcategorized) in rate-based compliance.

The new source complements are intended to capture expected emissions growth beyond that built into the existing-source-only budgets.[18] To calculate the new source complement for each state, the EPA began by calculating generation growth rates for each interconnect on the basis of the U.S. Energy Information Administration's Annual Energy Outlook (AEO) 2015 Reference Case. Next, the EPA calculated the portion of these growth rates met by under-construction units and unutilized renewable energy potential already included in the rate-to-mass conversion for existing units. Then, the EPA apportioned the remaining growth to states on a pro-rata basis at the emissions rate allowable for new NGCC units—1,030 lbs/MWh-net—under the new source standards, which implicitly assumes the additional growth is met with new NGCC units.[19] AEO 2015 annual generation growth rates range from 0.7% per year in the Eastern Interconnect and Western Interconnect to 0.9% in the Electric Reliability Council of Texas (ERCOT).[20]

If desired, states can project their own new source complement subject to EPA approval. Any state creating its own new source complement would need to demonstrate that existing affected EGUs would meet the mass limits for *existing* units. However, the EPA will measure compliance with a state-developed new source performance standard on the basis of whether affected EGUs in the state meet the state's mass goal for *existing* EGUs.[21] The requirement that existing units in a state-developed new source complement meet the state's mass-based goals for existing units could mean that the state must adopt measures that would effectively create separate markets for existing source and new source allowances.

Projecting Load Growth and Emissions Trajectory

Evaluating the stringency of a state's existing source budget plus new source complement requires projections about future demand and the resources that would meet that demand. Therefore, assumptions and projections about load growth and emissions will likely play a major role in many states' determination to include or exclude new units under mass-based compliance.

Accurately projecting load growth is difficult, and actual load growth in the United States has been low for about a decade and consistently below official projections. The new source complements reflect the AEO 2015 Reference Case projections of 0.7% annualized generation growth in the Eastern Interconnect and Western Interconnect and 0.9% in ERCOT.[22] These projections are in line with other recent AEO projections (2010–2015), which have put annualized generation growth at 0.7–0.8%.[23] However, actual annualized growth was 0.3% per year from 2004 to 2014 for national

[18] U.S. EPA, "New Source Complements to Mass Goals Technical Support Document for CPP Final Rule," (August 2015), http://www3.epa.gov/airquality/cpp/tsd-cpp-new-source-complements.pdf.

[19] *Id.*

[20] Calculated from 2012 to 2030. See U.S. EIA, "Annual Energy Outlook 2015," (April 14, 2015).[Hereinafter "AEO 2015"], http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf.

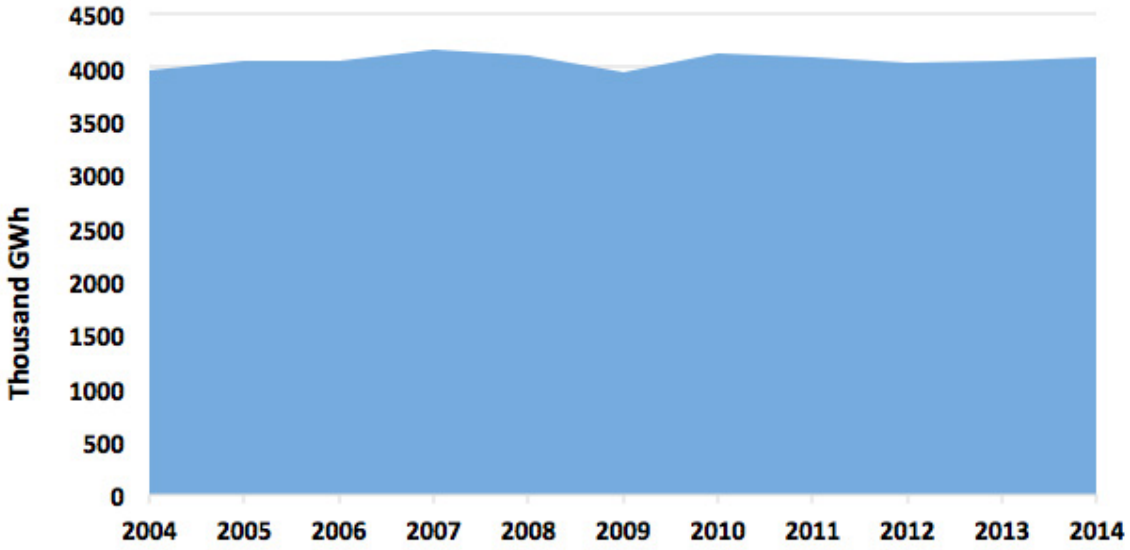
[21] The state's projection method must take into account the EPA's rate-to-mass conversion method, including load growth embedded in the mass-based goals for existing units. Any state-developed new source complement must be consistent with the BSER and must be sufficient to cover projected new sources. See CPP Rule, *supra,* note 1 at 64887-9.

[22] U.S. EPA, "Data File: New Source Complements Appendix," (August 2015), http://www2.epa.gov/cleanpowerplan/clean-power-plan-final-rule-technical-documents.

[23] U.S. EIA, "Total Energy Supply, Disposition, and Price Summary Table: Reference Case," (2015), http://www.eia.gov/beta/aeo//.

electricity generation from all sectors (Figure 1).[24] Over the same time period, total retail electricity sales fell in multiple states, including Connecticut, Maine, Massachusetts, Rhode Island, Vermont, New Jersey, Michigan, Ohio, Delaware, Maryland, and Kentucky.[25]

Figure 1. Net U.S. generation: Electricity plants, all sectors, 2004–2014



Source: U.S. EIA.

Going forward, load growth can be met by a wide variety of resources, including new and existing fossil sources but also non-emitting sources such as nuclear units, renewable generation, and demand-side energy efficiency. Hence, a mass-based goal that includes new sources does not limit load growth. It limits emissions from affected sources (most existing coal, oil, and natural gas generation other than peaking units) and new sources in the same categories, which are, in all likelihood, new NGCC units. Thus load growth can be accommodated if it is met by less emissions-intensive units.

There are numerous circumstances in which total generation can increase while fossil emissions remain constant or decrease. For example, in states with new nuclear capacity, total generation can increase while displacing significant fossil generation and reducing emissions. Similarly, in states that displace coal generation with efficient NGCC units—which emit CO_2 at approximately one-third the rate of existing coal units—fossil generation can grow while emissions decrease relative to a 2012 baseline. For example, CO_2 emissions in North Carolina fell almost 20% from 2005 to 2014 as NGCC generation replaced coal generation (Figure 2). At the national level, coal capacity declines to 255 gigawatts (GW) in 2022 in the AEO 2015 Reference Case from 300 GW in 2012.[26] In the AEO 2015 Reference Case, total generation increases annually at 0.7% while electricity sector CO_2 emissions increase at 0.2% per year, indicating declining emissions per unit of generation.[27]

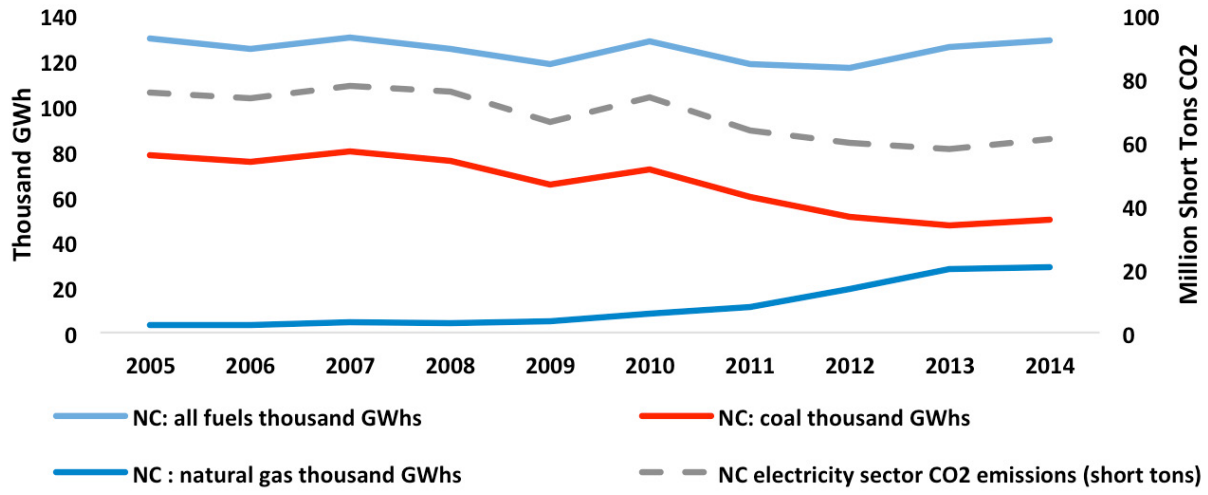
[24] U.S. EIA, "Electricity Data Browser: Net Generation from Electricity Plants for All Sectors, Monthly" (Accessed November 4, 2015), http://www.eia.gov/electricity/data/browser/.

[25] Total retail sales includes sales to the industrial, commercial, residential, transportation, and other sectors. U.S. EIA, "Electricity Data Browser, Retail Sales of Electricity, Annual" (Accessed November 23, 2015), http://www.eia.gov/electricity/data/browser/#/topic/5?agg=0,1&geo=vvvvvvvvvvvvo&endsec=vg&linechart=ELEC.SALES.US-ALL.A&columnchart=ELEC.SALES.US-ALL.A&map=ELEC.SALES.US-ALL.A&freq=A&ctype=linechart&ltype=pin&maptype=0&rse=0&pin=.

[26] Electricity-sector coal capacity. See, AEO 2015, *supra*, note 23.

[27] *Id.*

Figure 2. North Carolina generation and CO_2 emissions 2005-2014



Note: For generation data, see U.S. EIA, "Electricity Data Browser," *supra,* note 28. For emissions data, see U.S. EPA, "Air Markets Program Data" (Accessed November 4, 2015), http://ampd.epa.gov/ampd/.

Finally, although meeting load growth with lower-emitting sources could be technically feasible, cost implications are another important factor. As part of the AEO 2015, the EIA released an analysis of the levelized cost of new generation resources coming online in 2020 (Table 2). In this analysis, the levelized cost of new wind generation is approximately equal to or below the cost of new NGCC generation without federal subsidies for new wind generation.[28] However, costs are sensitive to assumptions.

For example, the expected cost of new NGCC generation is dependent on expectations about its capacity factor and about future fuel prices (Table 3).

Table 2. AEO 2015 regional variation in levelized cost of electricity for new generation online in 2020

	Minimum	Average	High
NGCC	70.4	75.2	85.5
Advanced NGCC	68.6	72.6	81.7
Advanced nuclear[b]	91.8	95.2	101
Wind	65.6	73.6	81.6
Solar PV[a]	89.3	114.3	175.8

[a] Includes permanent 10% investment tax credit.
[b] Assumed to be online in 2022.

[28] U.S. EIA, "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2015" (June 3, 2015), http://www.eia.gov/forecasts/aeo/electricity_generation.cfm. Note that levelized cost estimates for new nuclear, wind, and solar generation are highly sensitive to capital cost assumptions. Other analyses, such as a recent Lazard study, assume lower capital costs for new wind and solar photovoltaic generation, resulting in lower levelized costs of electricity. See Lazard, "Lazard's Levelized Cost of Energy Analysis Version 8.0," (September 2014), https://www.lazard.com/media/1777/levelized_cost_of_energy_-_version_80.pdf.

Table 3. Variation in levelized cost of NGCC with different capacity factor and fuel cost assumptions

75% Capacity Factor		50% Capacity Factor	
Fuel cost ($/MMBtu)	LCOE ($/MWh)	Fuel cost ($/MMBtu)	LCOE ($/MWh)
7.9	66.36	7.29	74.27
6.00	57.49	6.00	65.40
5.00	50.61	5.00	58.51
4.00	43.71	4.00	51.62
3.00	36.82	3.00	44.74

Source: IECM 9.1, 11-4-15.
[a] All dollars are 2012 $.
[b] Assumes wet cooling tower, two turbines, default financing.

Comparing the EPA Mass-Budgets, Expected Demand, and Emissions

As the above examples illustrate, future load growth, emissions trajectory, and costs are uncertain. A comprehensive comparison of the EPA's mass-based budgets, expected demand, and future emissions would therefore include a range of plausible future scenarios. One way to look at the choice among them is to compare system-wide costs with and without the new source complement in the mass target, likely using modeling.[29] The modeling could include different assumptions about load growth and the resources used to meet that growth (e.g., renewable energy, NGCC units). Assumptions about potential interstate trading partners will also influence total system cost results. Interstate trading of allowances creates access to a supply of allowances to increase emissions beyond the state budget as well as the opportunity to sell allowances outside the state.

Potential Impacts of Including New Sources

Including new units within a mass-based state plan can affect a program's stringency and emissions integrity as well as electricity markets. First, the new source complement increases the supply of allowances available to affected sources, but it also requires additional (new) sources to hold allowances. As explained above, this requirement could increase or decrease the stringency of the program, depending on how a state's actual emissions trajectory compares to its existing-sources-only mass-based budget plus new source complement.

At the same time, the emissions integrity of the program—and the effectiveness of the policy—is likely to be stronger if the state plan includes new units because doing so alleviates the potential for leakage to those new units. Furthermore, state plans that cover new sources need not include additional mechanisms—such as updated output-based allowance allocation (discussed below)—to mitigate this risk. Finally, including new sources maintains a level playing field between existing sources and new sources with similar emissions profiles. These topics as they relate to the alternative of covering only existing sources under a mass-based plan are discussed below.

Considerations for State Plans That Cover Existing Sources Only

Mass-based plans covering existing units only may create different regulatory costs for existing units and new units that are otherwise similar; existing sources would be required to surrender an allowance for each ton of CO_2 emitted, whereas new sources would not. This option may appeal to states that expect to install significant new NGCC capacity, as noted above.[30] However, the disparate requirements placed on existing and new units may create an incentive to shift generation and emissions from existing sources to new sources, leading to adverse market outcomes and reduced environmental

[29] In traditional utility regulation, in which all prudent costs are passed on to ratepayers, minimizing total system costs under the policy would minimize costs for ratepayers. In a competitive restructured market, in which retail prices are linked to wholesale electricity market prices, minimizing market-clearing prices in wholesale power markets would minimize costs for ratepayers.
[30] However, the Clean Air Act directs the EPA to review and, if appropriate, revise the performance standards for *new* sources at least every eight years (42 USC § b)(1)(B)). If the EPA were to revise the new source performance standards for fossil fuel-fired power plants, new sources built prior to the revision could subsequently become existing sources and therefore subject to the existing source program.

integrity. Recognizing these potential issues, the Clean Power Plan requires states that take this approach to address the risk of leakage to new sources. Ultimately, the implications for market and emissions outcomes depend on the efficacy of the (EPA-approved) state plan approach to addressing this risk.

Leakage and Load Growth Under an Existing-Units-Only Approach

The Clean Power Plan requires all states using a mass-based emissions goal to demonstrate that their plan addresses the risk of leakage to new units and gives states three options for doing so: (1) cover new sources, as discussed above; (2) use an allowance allocation approach that neutralizes the incentive to shift generation and emissions to new sources outside the program; and (3) demonstrate the circumstances in the state or state plan that sufficiently address this risk.[31]

Allowance Allocation to Address Leakage

Generally, allowance set-asides use a portion of a state's allowance budget to accomplish specific goals. Regulators can use allowances to accomplish specific goals because of their value—allowances can be sold or used for compliance—and their allocation can incentivize different actions. As noted above, the proposed mass-based model rule includes an allocation approach that, when finalized, will provide a presumptively approvable option for addressing potential leakage to new sources. As currently proposed, the mass-based model rule allocation method includes two set-asides of allowances to address leakage: one for updating output-based allocation to existing NGCC units and one for qualifying renewable energy. States would have flexibility to distribute the remainder of the allowances through a method of their choice.

The updating output-based allocation set-aside is intended to incentivize increased generation from existing NGCC units to counteract the incentive to shift generation from existing to new NGCC units that operate outside the allowance-trading program (see Box 4).[32] The EPA has proposed the size of the set-aside for each state, equal to 10% of the adjusted baseline natural gas capacity multiplied by the hours in a year and the emissions rate standard for *new* NGCC units. Nationally, this amounts to approximately 6% of allowances in the final compliance period. The EPA further proposes a lagged accounting method for this set-aside such that an existing NGCC unit would begin earning these allowances in one compliance period (e.g., the first compliance period), but that unit would not be awarded the allowances until the next compliance period (e.g., the second compliance period), after it can confirm its total generation. If the total number of eligible allowances exceeds the state's set-aside, the allowances would be distributed on a pro-rata basis. Any unused allowances in the set-aside would be returned to the primary pool of allowances.[33]

Box 4. Proposed Updating Output-based Allocation Formula for Allocating Allowances to Existing NGCC Units

Allowances to existing EGU unit = Net generation over 50% Capacity Factor * 1030 lbs/MWh-net

The concept of using updating output-based allocation to address leakage to emissions sources outside a regulation has theoretical support in academic literature, but it has not been rigorously tested in existing mass-based emissions regulatory mechanisms in the electricity sector.[34] Therefore, it is unknown whether the EPA's proposed updating output-based allocation set-asides are sufficient to address the leakage incentive.

The second set-aside intended to address the risk of leakage to new units would allocate allowances to renewable energy generators.[35] As proposed, the size of the renewable energy set-aside would be 5% of a state's allowance budget in every compliance period. Unlike the lagged accounting for the output-based allocation set-aside, approved renewable energy

[31] CPP Rule, *supra note 1,* at 64949, to be codified at 40 CFR 60.5790(b)(5).
[32] Proposed Federal Plan and Model Rules, *supra,* note 8 at 65020-22.
[33] *Id.*
[34] See, e.g., D. Burtraw, et al. "A Proximate Mirror: Greenhouse Gas Rules and Strategic Behavior under the US Clean Air Act," (March 2015), http://www.rff.org/research/publications/proximate-mirror-greenhouse-gas-rules-and-strategic-behavior-under-us-clean; C. Fischer, "Combining Rate-Based and Cap-and-Trade Emissions Policies," (May 2003), http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-03-32.pdf; and C. Fischer, "Output-Based Allocation of Environmental Policy Revenues," (January 2003), http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-02-60.pdf.
[35] Proposed Federal Plan and Model Rules, *supra*, note 8 at 65022-25.

generators would receive allowances prior to each year in the compliance period. Participating renewable generators would need to project annual expected generation, and any shortfall in generation, relative to the submitted projection, would be subtracted from future allocation to the renewable generator with the shortfall.[36]

State-Proposed Methods to Address Leakage

Alternatively, states may propose their own method of neutralizing the incentive to shift generation and emissions to new sources outside the program, subject to EPA approval.[37] To gain EPA approval, the state plan must demonstrate that circumstances in the state or in the state's plan sufficiently address the risk of leakage to new sources.[38] To that end, the state must provide "credible analysis" that demonstrates leakage is unlikely to occur because of state characteristics or state plan design elements that mitigate the potential for leakage.[39]

Tradeoffs between Options to Address Leakage

Among the choices to address leakage that do not involve covering new sources—adopt the allowance set-asides in the mass-based model rule or demonstrate to the EPA that the state plan or circumstances ensure that leakage is not an issue—states face a tradeoff between the certainty of the presumptively approvable approach in the model rule and flexibility with regard to allowance allocation. Allowance allocation has important distributional consequences and therefore represents a major public policy decision that the state gives up some flexibility to determine. States that opt for the presumptively approvable allowance allocation methodology to address the risk of leakage to new units forgo the choice of how those allowances are distributed. As proposed, the set-asides to address leakage range from 5% to 31% of a state's total budget of allowances, depending on the adjust baseline NGCC capacity. Nationally, the proposed set asides to address leakage would contain approximately 11% of allowances in the final compliance period.

The requirement to address the *risk* of leakage to new units under a mass-based existing-source-only approach does not inhibit a state's ability to build new sources (e.g., new NGCC units). Once a state has satisfied the EPA's requirement to address and mitigate the risk of leakage to new sources, the Clean Power Plan does not create a forward-going requirement for that state to demonstrate that leakage is not occurring. However, even if a state has satisfied the leakage demonstration for the purposes of EPA approval of its state plan, the efficacy of that state's leakage provisions may have important implications for electricity markets and environmental outcomes.

Potential Impacts of Excluding New Sources

Like the decision to include new sources, the decision to exclude new sources from a mass-based state plan may affect the stringency and emissions integrity of the program as well as electricity market outcomes. First, as noted above, a state that excludes new sources may increase new NGCC generation without limit and face a potentially less stringent policy, depending on projected conditions in the state. Historically, natural gas prices have exhibited significant volatility as well as large price variability relative to coal.[40] Currently, natural gas prices are low, less than $2.50/MMBtu, and future contracts for natural gas are below $3.50/MMBtu through 2019.[41] If states and utilities believe natural gas prices will remain low

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[36] *Id.*

[37] CPP Rule, *supra,* note 1 at 64949, to be codified at 40 CFR § 60.5790(b)(5).

[38] Although what might be an approvable state-proposed method is uncertain, potential ideas that the authors have heard floated in various contexts include (1) a larger updating output-based allocation set-aside for existing NGCC units or allocation of all allowances through an updating output-based approach, (2) allocation-based incentives for energy efficiency or renewable energy that reduce demand for fossil generation (e.g., dedication of auction revenue or updating allocations), and (3) contingent updating allocations to NGCC units (i.e., a set-aside that is only applied if leakage occurs).

[39] CPP Rule, *supra*, note 8 at 64890.

[40] See F. Graves and S. Levine, "Managing Natural Gas Price Volatility: Principles and Practices Across the Industry," Brattle Group, November 2010, for historical volatility data. For historical electricity-sector coal prices, see http://www.eia.gov/beta/coal/data/browser/#/topic/45?agg=1,0&geo=vvvvvvvvvvvo&rank=g&linechart=COAL.SHIP_PLANT_PRICE.US-TOT.Q&columnchart=COAL.SHIP_PLANT_PRICE.US-TOT.Q&map=COAL.SHIP_PLANT_PRICE.US-TOT.Q&freq=Q&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=. For historical electricity-sector natural gas prices, see http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm.

[41] For spot prices, see Bloomberg, "Energy & Oil Prices: Natural Gas, Gasoline, and Crude Oil," (Accessed November 10, 2015), http://www.bloomberg.com/energy. For futures prices, see CME Group, "Henry Hub Natural Gas Futures Quotes," (Accessed November 10, 2015), http://www.cmegroup.com/trading/energy/natural-gas/natural-gas.html. Since 2010, spot prices for natural gas have been as high as $6.55/MMBtu and, since 2008, as high as $12.89/MMBtu. See http://www.eia.gov/dnav/ng/hist/rngwhhdw.htm for historical Henry Hub spot prices.

over the life of new NGCC units, those units become very cost competitive against other investment options such as end-use efficiency, renewable energy, and nuclear generation.

However, to the extent that a state's mechanism to address the risk of leakage is ineffective, the choice to treat existing sources and new sources differently may lead to power market distortions and lower emissions integrity. If the allowance allocation or alternative state approach to address the risk of leakage is ineffective (or only partially effective), the state plan could create a significant difference in regulatory cost for existing NGCC units and new NGCC units that compete in wholesale markets. This inconsistency could lead to undesirable market outcomes and place existing NGCC owners at a disadvantage relative to new NGCC developers, despite the similar emissions profiles of new and existing units.[42]

For example, if the state plan does not fully address the disparate regulatory costs for existing and new NGCC units through updating output-based allocation to existing NGCC units, the wholesale market-clearing price may not fully reflect the cost of the policy because new (unregulated) NGCC units may set the price, creating financial stress for owners of existing units. These distortions could create situations in which the overall costs to the system of delivering power to the market are higher than they would be absent the differentiated regulatory burden. These higher costs would reflect some incentive on the margin to switch from lower-cost existing generation to higher-cost new generation directly as a result of the different allowance cost requirements.

If the difference in regulatory cost of existing NGCC units and new NGCC units is sufficiently large, it could create distributional inequities within the system. Developers might build new NGCC capacity that is otherwise not needed, and existing NGCC owners could face stranded asset costs if their units fail to clear in wholesale markets or if new units outside the mass limit depress their revenues. This potential dynamic is a larger concern for states with active wholesale markets and multiple plant owners (e.g., states with restructured electricity markets and states with dispatch by a regional transmission organization or independent system operator). In states with large integrated utilities that own the vast majority of generation or where the wholesale market is not active and must receive regulatory approval prior to building new generation, unequal competition between existing NGCC units and new NGCC units may be less of a concern, especially if the units have the same owner.

Lastly, to the extent that a state plan approach does not fully address the risk of leakage to new units, emissions may shift from covered (existing) sources to uncovered (new) sources, lowering the environmental benefit of the program. Modeling of the proposed Clean Power Plan rule shows lower emissions in scenarios covering both existing and new sources relative to scenarios covering existing sources only.[43] Because the required leakage demonstration occurs at the time of plan submittal, and is therefore not based on observed outcomes, it carries some degree of risk that the whole system underperforms or may need future adjustment.

Conclusion

Whether to include new sources is a threshold-level question for mass-based state plans to implement the Clean Power Plan, and states may face tradeoffs when weighing the potential consequences for stringency, electricity market outcomes, and environmental integrity. First, including new sources may make a state program more or less stringent, depending on assumptions about future electricity demand and the resources that will meet it. Second, including new sources would provide a consistent economic signal to existing and new sources with a similar emissions profile. In contrast, excluding new sources may lead to power market distortions to the extent that a state's mechanism to address the risk of leakage—a requirement for plans that do not cover new units—is ineffective. Finally, covering new sources would increase the environmental integrity of the program by removing the risk of leakage to new units.

[42] Most existing NGCC units already meet the new source performance standard of 1,030lbs/MWh-net.

[43] See e.g., M. Ross, B. Murray, and D. Hoppock, "The Clean Power Plan: Implications of Three Compliance Decisions for U.S. States," (May 2015), NI WP 15-02, https://nicholasinstitute.duke.edu/climate/publications/clean-power-plan-implications-three-compliance-decisions-us-states, and M. Ross, B. Murray, and D. Hoppock, "Assessing Impacts of the Clean Power Plan on Southeast States," (May 2015), NI WP 15-03, https://nicholasinstitute.duke.edu/climate/publications/assessing-impacts-clean-power-plan-southeast-states.

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