Apples and Oranges: Assessing the Stringency of EPA's Clean Power Plan

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Summary

An accurate assessment of the stringency of state emission goals under EPA's proposed Clean Power Plan compares state emission goals to adjusted state emission rates that incorporate known and reasonably foreseeable measures that will affect CO_2 emissions from existing power plants. These adjusted emission rates may include projections of actual generation and emissions, which may differ from the building block assumptions used in EPA's Clean Power Plan. In addition, projections in performance levels can reflect the emission and generation impacts that compliance measures will have on the electricity system. Consideration of these impacts can lead to a more accurate comparison of a state's projected CO_2 performance level to its final emission goal under the Clean Power Plan and result in state plans that are optimized for the degree of required emission reduction.

I. Introduction

On June 18, 2014, the U.S. Environmental Protection Agency (EPA) proposed the Clean Power Plan[1] to regulate carbon dioxide (CO_2) emissions from existing power plants. The Agency's proposal, made under §111(d) of the Clean Air Act (CAA),[2] generates unique CO_2 emission goals for each state using a formula that includes assumptions about various emission control strategies.

While the proposal provides clear emission goals for each state, understanding the stringency of those goals is less straightforward. The form of state §111(d) emission goals is an emission rate (pounds of CO_2 emissions per megawatt hour (MWh)) that is adjusted to incorporate, among other things, the effects of zero-emission electricity generation and cumulative demand-side energy efficiency. Though tempting, comparison of a state's §111(d) emission goal to the current average emission rate of the state's fleet of fossil fuel-fired power plants is an apples-to-oranges comparison that provides an inaccurate picture of the rule's stringency. A more meaningful comparison would evaluate a state's §111(d) emission goal against a projected adjusted emission rate for the state that reflects transitions in the power sector that are already underway, such as increases in generation from natural gas and renewable energy facilities. Using a more apples-to-apples comparison can better estimate the degree of improvement in power plant performance levels that the Clean Power Plan requires and equip a state to identify compliance strategies that achieve low-cost emission reductions. This Article offers a framework for assessing the stringency of the Clean Power Plan and identifies key concepts useful for generating an apples-to-apples comparison.

II. The Clean Power Plan's Building Blocks and State Emission Goals

A. *The Building Blocks*

The CAA requires that §111(d) performance standards "reflect the degree of emission limitation achievable through the application of the best system of emission reduction [BSER] which . . . the Administrator determines has been adequately demonstrated."[3] EPA developed an interim and final emission goal for each state using what the Agency considers the BSER for CO_2 emissions

1. Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 34830 (June 18, 2014) [hereinafter Proposed Clean Power Plan].
2. Clean Air Act (CAA), 42 U.S.C. §§7401-7671q, ELR Stat. CAA §§101-618.
3. 42 U.S.C. §7411(a)(1) (2012).

from existing power plants.[4] EPA determined the BSER to include four categories, or "building blocks," of carbon emission-reduction measures[5]:

- Building Block 1: Efficiency improvements at individual coal-fired units;
- Building Block 2: Increased use of existing natural gas combined cycle (NGCC) units in place of higher emitting coal (as well as oil and natural gas) steam-generating units;
- Building Block 3: Power generation from zero-carbon units, such as renewable energy or nuclear facilities; and
- Building Block 4: Demand-side energy-efficiency measures.

EPA developed assumptions for each building block that serve as the basis for calculating the state-specific emissions goals, as discussed below. The Agency justified inclusion of Building Blocks 2-4 as part of the BSER by reasoning that they are technically feasible, can be implemented at reasonable cost, and will result in greater CO_2 reductions than can be achieved through heat-rate improvements alone.[6] Further, EPA reasoned that states already use these measures to reduce carbon emissions and that the BSER determination ensures reliability of the electricity system.[7]

B. *Application of the Building Blocks to Each State*

EPA calculated an interim and final goal for each state, which are output-weighted average emission rates (adjusted emission rates) that result from application of the four building blocks. To develop each state's interim and final goals, EPA began with each state's 2012 average emission rate—pounds of CO_2 per MWh net generation—from affected fossil fuel-fired units. The Agency then adjusted that 2012 average emission rate by applying what it considered "reasonable"[8] assumptions about each building block through a formula that adjusts emissions in the numerator and generation in the denominator. Figure 1 visually represents in a very general sense how the building blocks operate to adjust the 2012 emissions rate of fossil units subject to the Clean Power Plan. Assumptions from Building Blocks 1 and 2 decrease the amount of carbon emissions in the numerator. Assumptions about generation and energy savings from Building Blocks 3 and 4 increase the denominator. The overall effect is an adjusted emission rate fraction that is smaller than the 2012 average emission rate of fossil units.

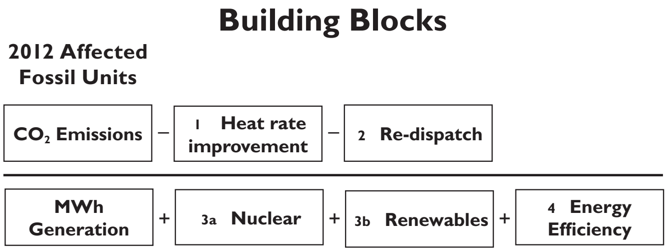
To apply Building Block 1, the Agency reduced the numerator (emissions) of each state's 2012 rate to reflect a 6% heat-rate improvement from coal units operating in 2012.[9] For Building Block 2, EPA shifted dispatch from coal (as well as oil and natural gas) steam-generating units to existing NGCC units by increasing generation up to a 70% capacity factor (utilization) at NGCC units operating in 2012.[10] For NGCC units that were not operating in 2012 but began construction by January 8, 2014, and are covered under the proposal, EPA assumed a 55% capacity factor prior to re-dispatch and increased utilization of these units up to a 70% capacity factor. Application of Building Block 2 increases emissions from NGCC units while simultaneously reducing emissions from existing fossil steam units, which are more carbon-intensive. This dynamic results in an overall decrease in the adjusted emissions rate.[11]

Next, EPA applied Building Blocks 3 and 4 to adjust the denominator (MWhs of generation) of each state's performance goal. EPA began with 2012 generation from affected units and added generation from renewables, nuclear, and energy efficiency based on generalized assumptions about those resources. Building Block 3 consists of zero-emitting generation, including non-hydro renewables and nuclear power. Total renewable energy under Building Block 3 results from growing each state's renewable generation from 2012 levels using an annual growth factor that is based on the year 2020 average renewable portfolio standard of states in the same region.[12] Nuclear estimates reflect the amount of capacity under construction (if any) in each state and approximately 5.8% of a state's 2012 nuclear capacity (to reflect existing capacity at risk of retirement), operated at a 90% utilization rate.[13] Finally, to apply Building Block 4 (demand-side energy efficiency), EPA estimates the cumulative energy savings (avoided MWh of generation) each year that would be achieved by annual incremental savings of up to 1.5%.[14]

4. Proposed Clean Power Plan, *supra* note 1, 79 Fed. Reg. at 34856.
5. *Id.*
6. *Id.* at 34877.
7. *Id.* at 34836.
8. *Id.*
9. *Id.* at 34859-61. Building Block 1 does not not assume any dispatch changes as a result of increased effriciency at coal units.
10. A unit's capacity factor reflects the amount of electricity generated relative to the unit's maximum potential output when running at full power over the same period of time. U.S. Energy Information Administration, Frequently Asked Questions, http://www.eia.gov/tools/faqs/faq.cfm?id=187&t=3.
11. Proposed Clean Power Plan, *supra* note 1, at 34896. For natural gas combined cycle (NGCC) units that began construction by January 8, 2014, but did not operate in 2012, EPA adds the generation and emissions at 55% capacity factor to the emissions rate equation without adjusting emissions or dispatch from other affected units. Because NGCC units are more carbon-efficient than fossil steam units, this reduces the adjusted emissions rate in states with NGCC units under construction. *Id.*
12. *Id.* at 34866-69. EPA determines a renewable energy percentage of total generation for different regions of the country based on average renewable portfolio standards (RPS) in each region among states with RPS and calculates a growth rate to meet the regional target based on 2012 regional renewable generation (growth rate is calculated from 2017 to 2029). *Id.*
13. *Id.* at 34870-71.
14. *Id.* at 34872-73. For states that are net importers of electricity, EPA adjusted the energy savings downward to reflect the fact that some of the generation and emissions reductions associated with in-state energy-efficiency programs would reduce out-of-state emissions. U.S. EPA, Technical Support Document (TSD) for the CAA Section 111(d) Emission Guidelines for Existing Power Plants: Goal Computation Technical Support Document p. 17, note 22 (June 2014), http://www2.epa.gov/sites/production/

EPA performed these computations separately for each year in the 2020-2029 period. A state's interim goal is the average of annual adjusted emissions rates computed for each year during that 10-year period, and the final state goal is the rate computed for year 2029.[15] The Clean Power Plan allows states to comply by achieving either the rate-based emission goals or mass-based equivalents.[16]

Figure 1: Visual Representation of the Clean Power Plan's Building-Block Formula[17]



Note that in Figure 1, Building Block 3 (zero-carbon generation) is broken into two categories: nuclear and renewable energy.

III. Assessing the Stringency of State Goals

As states and stakeholders evaluate the Clean Power Plan, many seek to understand the level of additional emission reduction that the interim and final emission goals require beyond a state's current performance levels. To calculate the emission goals' stringency, some may compare the §111(d) state goals to the average emissions rate of in-state fossil units today or in a prior year. For example, if a state had a 2012 average fossil emission rate of 2,000 lbs./MWh and a final goal under the Clean Power Plan of 1,500 lbs./MWh, one might conclude that the proposal requires a 25% improvement in performance. This, however, is an apples-to-oranges comparison. A state's final emission goal is an output-weighted average emission rate (apples), while the average fossil emission rate is unadjusted (oranges), meaning it does not account for rate adjustments to reflect zero-emitting generation and demand-side energy efficiency.

A more accurate method for evaluating the stringency of a state's final goal is to compare it to an adjusted emission rate that reflects foreseeable future circumstances. To develop such a rate, a state could, for example, begin with its average fossil emission rate for affected units and then adjust that rate using known or anticipated changes in the power sector. The state's average fossil emission rate could be adjusted to reflect any improvement in emission rates at coal units since 2012 and any scheduled or completed retirements. Further adjustments could include anticipated generation from renewable facilities, under-construction nuclear units once completed, and uprated nuclear units.[18] In addition, states could project generation and CO_2-emission impacts on affected units based on state legal requirements, such as renewable portfolio standards (RPS) or energy-efficiency resource standards, as well as on electric utility-integrated resources plans. States also might consider trends such as load growth and state economic incentives for renewable energy and demand-side management programs.[19]

When adjusting the state's average fossil emission rate using known and projected values, states also should be mindful that under the proposed Clean Power Plan the BSER rules for adjusting a state's average emissions rate to develop state goals differ from the rules on adjusting a rate to determine compliance. EPA's calculation of state-specific performance goals using the building blocks are based on specific assumptions that do not predict actual MWh of generation or CO_2 emissions from various energy resources. When demonstrating compliance, however, a state would include in its adjusted emissions rate total generation and emissions from all affected fossil units, including, for example, existing NGCC generation above a 70% capacity factor. Similarly, total generation from an under-construction nuclear unit would be included in the calculation, even if the unit runs at a capacity factor higher than the standard assumption in Building Block 3 of a 90% utilization rate. In addition, the building block formula does not account for broader emission reduction impacts (extended impacts) that the building block measures would have on the power system. When using these same emission-reduction measures for compliance, states incorporate a fuller range of impacts (discussed below) into the adjusted rate. The development of an adjusted emission rate for comparison to emission goals should incorporate these dynamics that are unique to a compliance calculation.

files/2014-06/documents/20140602tsd-goal-computation.pdf [hereinafter Goal Computation TSD].

15. For a more detailed description of the Clean Power Plan, see Jeremy M. Tarr & Sarah K. Adair, The EPA's Proposed Guidelines for Regulating Carbon Dioxide Emissions From Existing Power Plants (2014), http://nicholasinstitute.duke.edu/climate/publications/epa%E2%80%99s-proposed-guidelines-regulating-carbon-dioxide-emissions-existing-power-plants#.VEA8QYeSM3s. For a detailed video explanation of the building block formula, see David Hoppock & Jeremy M. Tarr, Webinar: EPA's Proposed Clean Power Plan, YouTube (2014), http://youtu.be/lejjD3CtliA?list=PLs7HlaDdvJH_BRD-fg526r2mTjtu0RfDq.
16. Proposed Clean Power Plan, *supra* note 1, at 34897. Mass-based goals limit total tons of CO_2 emissions, while rate-based goals govern emission rates.
17. EPA uses the following formula to express the operation of the building block assumptions for calculating annual adjusted emission rates: [(Coal gen. × Coal emission rate) + (OG gen. × OG emission rate) + (NGCC gen. × NGCC emission rate) + "Other" emissions]/[Coal gen. + OG gen. + NGCC gen. + "Other" gen. + Nuclear gen. + RE gen. + EE gen.]. *Id.* at 34986, n.265.
18. *Id.* at 34923.
19. EPA provides a partially adjusted 2012 emission rate for each state that incorporates affected fossil, renewable, and at-risk nuclear generation. The Agency appears to calculate this adjusted rate to provide states a better comparison point for assessing the stringency of their emission goals. This adjusted 2012 rate, however, is of limited value because it does not account for many of the dynamics identified in this Article, including future projections of fossil, renewable, and nuclear generation; demand-side energy-efficiency impacts; and extended impacts that measures will have in displacing fossil generation. Goal Computation TSD, *supra* note 14, at 26-28.

IV. Extended Impacts of Emission-Reduction Measures

Key to assessing the stringency of state emission goals is understanding not only the difference between an adjusted and unadjusted emission rate and between the rules for calculating emission goals and compliance, but also the extended impacts of strategies for reducing CO_2 emissions under the Clean Power Plan. A basic understanding of electricity dispatch is important for assessing the variety of potential extended impacts. Electricity demand varies throughout the day based on factors such as the weather, day of the week, and economic activity. Electricity supply meets this demand precisely and in real time by varying the amount of power supplied to the electric grid. Electric utilities and grid operators operate, or dispatch, the lowest operating cost (marginal cost) generation resources first and increase generation based on minimizing operating costs, subject to technical and regulatory constraints.

This means that the highest operating cost units, typically oil-fired generation, only operate on very high demand days, whereas low operating cost generation, such as nuclear power plants and renewable generation with zero fuel costs, such as solar and wind, tend to operate whenever they are available.[20] Adding new generation or retiring existing generation therefore shifts the dispatch of other existing units in the system. For instance, adding wind generation, which has a negligible operating cost, may decrease dispatch of some higher cost existing units, depending on load growth and other factors. Given the dynamic nature of electricity dispatch, emission-reduction measures can impact the generation of affected units. Inclusion of these extended impacts, discussed below, can help a state develop a more apples-to-apples comparison.

A. Heat-Rate Improvements at Existing Coal Plants

Heat-rate improvements at existing coal units, which reduce fuel use per MWh of generation and therefore marginal operating costs, will potentially cause them to dispatch more frequently. However, the ability to increase the dispatch of more-efficient coal plants is limited to some extent by the rule itself. This is because even after efficiency improvements, the average emission rates of existing coal units are higher than states' interim and final emissions goals.[21] States that choose to achieve a limit on total tons of CO_2 emissions rather than a rate-based goal would have a similar incentive to limit relatively carbon-intensive coal generation in order to temper the emissions from affected units.

B. Increased Dispatch of Existing NGCC Units

Increasing the dispatch of NGCC units that were operating in 2012 should reduce emissions from fossil fuel-fired steam-generating units roughly as projected by EPA, provided that a level of re-dispatch is similar to that in EPA's Building Block 2 assumptions. There may be added emissions savings if the re-dispatched NGCC units have lower emission rates than the 2012 average NGCC emission rate.[22] Similarly, emission savings beyond those in Building Block 2 assumptions can occur if the units experiencing reduced dispatch have higher emission rates than the applicable average emission rate in 2012 of steam-generating units.

C. Under-Construction NGCC Units

For NGCC units that were not operating in 2012 but began construction by January 8, 2014 (under-construction NGCC units), EPA assumed in Building Block 2 operation at a 55% capacity factor, but made no assumptions about how they will affect the dispatch of other covered sources. It is likely that these NGCC units will displace generation and emissions from covered sources, even without any additional re-dispatch to aid compliance with state emission goals. Furthermore, though Building Block 2 assumes that later model NGCC units will perform at the average 2012 NGCC emission rate nationally (907 lbs./MWh), newer NGCC units tend to have lower emissions rates (824 lbs./MWh).[23] Assuming that under-construction NGCC units displace generation of covered sources, a lower emission rate likely would reduce further emissions from covered sources.[24]

D. New NGCC Units

Generation and emissions from new NGCC units may not count toward a state's emission goal.[25] The proposal explains that compliance in a mass-based approach will depend upon emission from affected sources, not new sources. But the Agency seeks comment on the role of emissions and generation from new NGCC units in compli-

20. U.S. EPA, Technical Support Document (TSD) for the CAA Section 111(d) Emission Guidelines for Existing Power Plants: GHG Abatement Measures, at 3-2 to 3-3 (June 2014) [hereinafter GHG Abatement Measures TSD], http://www2.epa.gov/sites/production/files/2014-06/documents/20140602tsd-ghg-abatement-measures.pdf.
21. This assumes a 6% heat rate improvements. U.S. EPA, Clean Power Plan Proposed Rule, Data File: Goal Computation—Appendix 1 (xls), http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule-technical-documents (showing that the adjusted coal rates (Column L) is higher than the interim and final goals for each state (Columns BA and BB, respectively)).
22. Under Building Block 2, the emission impact of increasing utilization of NGCC units operating in 2012 is based upon the average 2012 emission rate for in-state NGCC units. Goal Computation TSD, *supra* note 14, at 4, 8. Similarly, the emission impacts of dispatching away from steam EGUs depends upon the average emission rates of coal as well as oil and gas steam units in 2012. *Id.*
23. U.S. Energy Info. Admin. (EIA), Annual Energy Outlook 2014, Electricity Market Module Assumptions Report, *available at* http://www.eia.gov/forecasts/aeo/assumptions/pdf/electricity.pdf.
24. This may not be the case if covered sources increase generation due to load growth or other factors.
25. "New units" refers to units that had not begun construction by January 8, 2014, or the date §111(b) standards are finalized. Proposed Clean Power Plan, *supra* note 1, at 34923.

ance calculations under a rate-based plan.[26] New units are likely to displace generation and emissions from covered sources, potentially easing a state's compliance pathway. To the extent new NGCC units displace the least-efficient coal units in a state's fleet, the average emission rate of remaining coal units would improve.

E. Existing Nuclear Power Plants

Generation from existing nuclear plants is unlikely to significantly impact emissions from covered sources unless existing nuclear units had low capacity factors in 2012. However, any incremental nuclear generation from uprates at existing nuclear plants could reduce generation and emissions from covered sources, and all generation from uprates is added to the denominator.[27] The retirement of an existing nuclear plant may increase generation from affected sources, depending on demand and other new generation that has or soon will come online.

F. Under-Construction Nuclear Units

EPA added under-construction nuclear generation to the denominator in the emission goal computation for three states without any re-dispatch of existing units,[28] though nuclear units have low operating costs and will presumably be dispatched to the maximum extent possible. As a result, these units could displace significant amounts of generation and emissions from covered sources. If capacity factors for under-construction nuclear units exceed 90%, the additional zero-carbon generation beyond EPA's assumption would be added to the denominator.

G. Non-Hydro Renewable Energy

In formulating states' emissions goals, EPA included increases in renewable generation to the denominator of states' emission-rate goal equation without adjusting dispatch from existing fossil generation.[29] But generation by renewable capacity added to comply with emission goals may displace covered generation, especially if they track Building Block 3 assumptions. The regional renewable growth rates used in Building Block 3 all exceed expected demand growth. The regional growth rates used by EPA range from 6-17% annually,[30] while the U.S. Energy Information Administration (EIA) projects national electricity demand to increase 0.8% per year, with growth rates as high as 1.3% in the West and around 1% in the South.[31]

The proposal does not require states to generate renewable energy at the levels included in Building Block 3, but current trends in renewable energy-capacity additions suggest continued growth in renewable generation. Solar additions in 2012 totaled 3,369 MW and then increased to 4,751 MW in 2013. Projections for 2014 anticipate even higher rates of installed capacity.[32] In 2012, the country saw 13,131 MW of newly installed wind capacity.[33] While that number dropped to only 1,084 MW in 2013,[34] as of April 2014, approximately 13,000 MW of wind capacity was under construction.[35] In addition, 29 states have passed RPS that mandate generation from renewable resources to meet demand into the future.[36] Both ongoing capacity installations and RPS requirements for additional renewable generation likely will reduce dispatch of covered sources as well as increase the amount of renewable energy generation added to the denominator.[37]

H. Demand-Side Energy Efficiency

In the proposed rule, EPA allows demand-side efficiency measures taken after the release of the proposed rule and that produce savings during the compliance period to count toward compliance.[38] Ongoing energy-efficiency programs in states, accounting for measure life,[39] may reduce dispatch of covered sources as well as the need for increases in generation and capacity. If cumulative demand-side energy-efficiency measures reduce demand at a greater rate than underlying demand growth, dispatch of covered sources should decrease. Annual incre-

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26. *Id*. at 34923-24.
27. *Id*. at 34923.
28. The five nuclear units considered under construction in the proposal are Watts Bar Unit 2 in Tennessee, Vogtle Units 3 and 4 in Georgia, and VC Summer Units 2 and 3 in South Carolina. *Id*. at 34970.
29. Iowa, Maine, Minnesota, and South Dakota have renewable generation that already exceeds their regional goal. EPA does not add additional renewable energy to the denominator in these states. GHG Abatement Measures TSD, *supra* note 17, at 4-29 to 4-30.
30. In the proposed Clean Power Plan, EPA uses region-specific assumptions to develop annual renewable energy growth factors to calculate reasonable renewable energy assumptions. The regional growth factors are as follows: Alaska 11%, East Central 17%, Hawaii 9%, North Central 6%, Northeast 13%, South Central 8%, Southeast 13%, West 6%. *Id*. at 4-18.
31. U.S. EIA, AEO Table Browser, Electric Power Projections by Electricity Market Module Region, United States, Reference case, http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014&subject=6-AEO2014&table=62-AEO2014&region=3-22&cases=ref2014-d102413a [hereinafter AEO 2014 Table] (select publication as "Annual Energy Outlook 2014," subject filter as "Electric Power Sector," table as "Electric Power Projections by Electricity Market Module," and region as desired. Then reference cell at the intersection of row titled "Total Sales" under section "Electricity Sales" and column titled "Growth Rate (2012-2040)).
32. Solar Energy Indus. Ass'n, Solar Market Insight Report 2013 Year in Review, http://www.seia.org/research-resources/solar-market-insight-report-2013-year-review (last visited Oct. 28, 2014).
33. American Wind Energy Ass'n, AWEA U.S. Wind Industry Fourth Quarter 2013 Market Report 3 (2014), http://awea.files.cms-plus.com/FileDownloads/pdfs/AWEA%204Q2013%20Wind%20Energy%20Industry%20Market%20Report_Public%20Version.pdf.
34. *Id.*
35. American Wind Energy Ass'n, U.S. Wind Industry First Quarter 2014 Market Report 3 (2014), http://awea.files.cms-plus.com/FileDownloads/pdfs/1Q2014%20AWEA%20Public%20Report.pdf.
36. U.S. Dep't of Energy & N.C. Clean Energy Technology Center, Database of State Incentives for Renewables & Efficiency (DSIRE), http://www.dsireusa.org/documents/summarymaps/RPS_map.pptx.
37. Note that renewable capacity additions in 2012 are not fully accounted for in the 2012 generation totals that EPA used to determine state emissions goals, as this capacity only operated in part of 2012.
38. Proposed Clean Power Plan, *supra* note 1, at 34918.
39. "Measure life" is the estimated time period an end-use efficiency measure will achieve energy savings. Building Block 4 assumes an average measure life of 10 years, distributed from one to 20 years. GHG Abatement Measures TSD, *supra* note 17, at 5-35 to 5-36.

mental efficiency savings of 1.5%, the Building Block 4 assumption, exceed EIA projections for U.S. demand growth of 0.8%.[40]

I. *Projected and Planned Coal Unit Retirements*

Approximately 50,000 MW of coal units that were available to operate in 2012 are projected to retire by 2020,[41] with the bulk of the retirements occurring as the Mercury and Air Toxics Standards rule comes into force in 2015 and 2016.[42] The generation and emissions from these units are included in EPA's 2012 baseline for setting the states' emissions rate goals, but the units will not be operating during the compliance period. The effect of coal and other covered source retirements[43] on a state's future emissions rate will largely depend on what replaces the generation from these retiring sources. Generation and emissions shifted to other covered sources, such as remaining coal plants, would be included in a state's adjusted emissions rate, whereas generation from new NGCC units may not.[44] States with forthcoming coal retirements thus will need to determine what types of units will replace them and how their emissions and generation will fit into the §111(d) compliance framework.

V. Estimating Current and Projected Adjusted State Emissions Rates

Accounting for all of the factors that affect a state's projected adjusted emission rate requires an understanding of electricity demand and dispatch in a state as well as assumptions about future conditions. Some assumptions about the future may be fairly straightforward, such as the minimum generation from renewables because of a renewable portfolio standard. In addition, owners of power plants and economic regulators may have data about projected generation from under-construction nuclear units and anticipated plant retirements because of the Mercury and Air Toxic Standards and other factors. Integrated resource plans may provide an indication of future nuclear uprates, new NGCC units, and growth in renewable energy generation. But other dynamics may be less predictable, such as load growth and relative fuel input prices.

Despite any imprecision in projections, development of a forward-looking adjusted emission rate allows a more accurate assessment of the rule's stringency for a state because it accounts for the dynamic changes underway in the power sector rather than looking backward at a static snapshot of where the state was in 2012 or where it is today. In addition, development of a projected adjusted emission rate allows for a more fair comparison with the state's emission targets under the Clean Power Plan by allowing an apples-to-apples comparison of adjusted emission rates.

Comparing a state's emission goals to where the state is headed anyways (its projected adjusted emission rate) may reveal that the Clean Power Plan's emissions goals are less burdensome than they appear at first blush. The delta between a state's emission goals and projected adjusted emission rate may be less than that between the emission goals and an unadjusted state average fossil rate. Similarly, the relative parity of compliance burdens from state to state may look different when comparing Clean Power Plan goals to each state's projected adjusted emission rate rather than its unadjusted fossil emission rate at a prior year. Identifying the degree of required improvement in performance levels also will enable states to determine the compliance paths that are least-cost and maintain electricity reliability. Further, this approach allows state plans to better align with changes already underway in the power sector[45] and to hedge the risk of additional environmental compliance obligations in the future.[46]

VI. Conclusion

State emission goals under EPA's proposed Clean Power Plan are adjusted emission rates that include zero-emitting generation and energy savings from demand-side energy efficiency. Statewide average fossil emission rates are unadjusted rates. As a result, comparing state emission goals under the Clean Power Plan to average fossil emission rates is an apples-and-oranges comparison that does not provide an accurate assessment of the degree of reduction in CO_2 emission levels that the Clean Power Plan requires of a state. A better estimate of stringency would come from comparing state emission goals to an adjusted state emission rate that incorporates known and reasonably foreseeable measures that will affect CO_2 emissions from existing power plants.

When developing adjusted emission rates, states and stakeholders can consider projections of actual generation and emissions, which may differ from the building block assumptions used in the BSER when calculating state goals. In addition, projections in performance lev-

40. AEO 2014 Table, *supra* note 27 (select publication as "Annual Energy Outlook 2014," subject filter as "Electric Power Sector," table as "Electric Power Projections by Electricity Market Module," and region as "United States." Then reference cell at the intersection of row titled "Total Sales" under heading "Electricity Sales" and column "Growth Rate (2012-2040)).
41. AEO 2014 Table, *supra* note 27 (select publication as "Annual Energy Outlook 2014," subject filter as "Electric Power Sector," table as "Electric Power Projections by Electricity Market Module," and region as "United States." Then reference the cell at the intersection of row "Coal" under heading "Cumulative Retirements" and column "2020").
42. Affected units must comply with Mercury and Air Toxics Standards in 2015, but units can receive a one-year extension each to install technology and to ensure grid reliability. U.S. EPA, Fact Sheet Mercury and Air Toxics Standards for Power Plans 2, http://www.epa.gov/airquality/powerplanttoxics/pdfs/20111221MATSsummaryfs.pdf (last visited Oct. 28, 2014).
43. *Id.* at 1.
44. *See supra* notes 25-26 and accompanying text.
45. Jonas Monast & David Hoppock, Designing CO_2 Performance Standards for a Transitioning Electricity Sector: A Multi-Benefits Framework (2014), http://nicholasinstitute.duke.edu/sites/default/files/publications/ni_r_14-04_final_0.pdf.
46. Jeremy M. Tarr & Jonas Monast, Beyond Carbon Dioxide: Capturing Air Quality Benefits With State 111(d) Plans (2014), http://nicholas-institute.duke.edu/sites/default/files/publications/wp_14-04.pdf.

els can reflect the emission and generation impacts that compliance measures will have on the electricity system. Many of these extended impacts are not included in the building block formula that EPA used to compute proposed state emission goals but count toward compliance. Consideration of these impacts can lead to a more accurate comparison of a state's projected CO_2 performance level to its final emission goal under the Clean Power Plan. Accurate estimates of reduction requirements can enable the development of state plans that are optimized for the degree of required emission reduction and can further other state priorities.