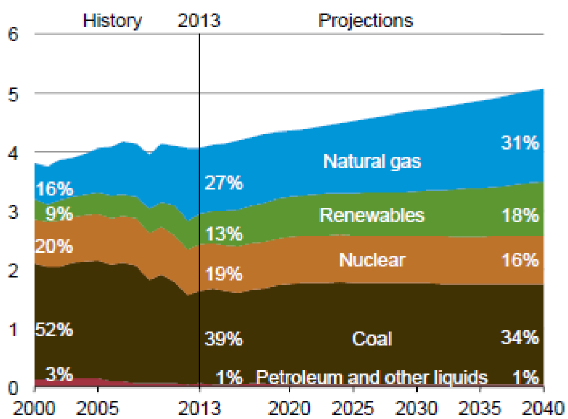
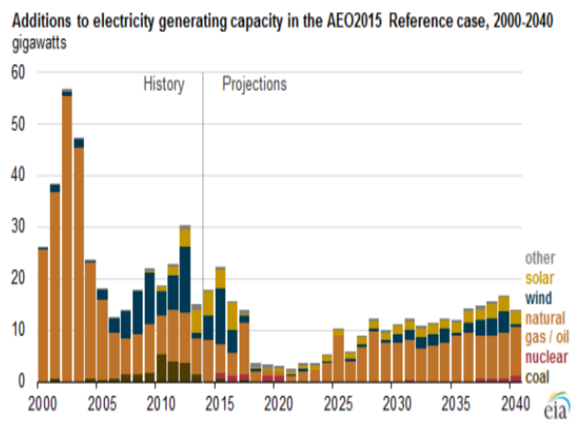
The New Building Block 3 and the Final Rule

EPA's significantly increased renewable energy assumptions drive more stringent standards





Source: EIA, AEO2015

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Executive Summary

- ***EPA scaled back on carbon dioxide reductions from coal plant improvements and energy efficiency in its Final Rule under the Clean Power Plan, but nevertheless increased its carbon reduction mandate from 30 percent to 32 percent by 2030.*** EPA did so through its use of "potential renewables" as the variable driving eventual state carbon budgets. EPA now forecasts that incremental renewable energy electric generation (Building Block 3) will more than double, from 335,370 gigawatt hours in the Proposed Rule to 706,030 GWh in the Final Rule.

- ***EPA uses a complicated and unprecedented methodology to achieve its new renewable energy forecast for the years 2024 through 2030.*** Looking to historic renewable capacity additions during 2010-2014, EPA selects the *maximum* change in capacity for each renewable resource type that occurred in any year over the five-year period, and adds this maximum capacity change year-over-year from 2024 through 2030. The maximum capacity addition year selected by EPA for each resource is more than twice as much as the average over 2010 - 2014.

- ***EPA's methodology fails to account for the fact that expiration of the production tax credit, or PTC, drove the development of renewable energy resources during 2012.*** Renewable energy capacity additions fluctuated substantially between 2010 and 2014, especially the largest component of Building Block 3, onshore wind power. EPA uses the anomalous year, 2012, to predict future growth of wind power. In 2012, the wind production tax credit was expected to expire at the end of the year, causing producers to rush to install as much wind capacity as possible. Other renewable resource types also showed non-linear and unpredictable trends during 2010 – 2014.

- ***EPA's renewable energy expectations diverge by an order of magnitude from the EIA's base case renewable energy capacity and generation forecasts over the 2022 – 2030 period.*** Notwithstanding these incongruences with EIA's forecasts, EPA suggests that its forecasted renewable energy additions would occur in the normal course even without the CPP.

- ***EPA assumes that fossil fuel generation could be displaced based on the average capacity factors of renewable energy resource types (e.g., 41.8 percent for onshore wind power).*** However, utilities and restructured market system operators assign a much lower *capacity value* for wind power, in the 10-15 percent range, because wind production is often not available during peak load conditions. To the extent that the EPA's assumed renewable energy displacement of fossil fuel resources does not occur because wind, solar, or other intermittent generation is not available, system capacity will in real terms be lost absent planners assigning a much lower capacity value to the given renewable resource (and in turn adding additional capacity, be it fossil-based or renewable).

I. Introduction

The Environmental Protection Agency (EPA) scaled back on carbon dioxide reductions from coal plant improvements and energy efficiency in its Final Rule under the Clean Power Plan (CPP). Despite these changes to its construction of the Best System of Emission Reduction (BSER) under Clean Air Act Section 111(d), the Final Rule nevertheless *increased* its carbon emission reduction mandate from 30 percent to 32 percent by 2030.

It is important to note three things about the BSER construction in the Final Rule: (1) Building Block 1 (coal unit heat rate improvements) became less ambitious; (2) Building Block 2 (increased gas utilization) did not change in a significant way; and (3) Building Block 4 (energy efficiency) went away entirely. Accordingly, Building Block 3 and its "potential renewables" standard is the driver of state carbon budgets and the primary avenue through which the Final Rule increased its overall stringency, despite making Building Block 1 less stringent and eliminating Building Block 4 altogether. In the Final Rule, EPA doubles down on renewable energy, forecasting that incremental renewable energy electric generation will increase from 335,370 gigawatt hours (GWh) in the Proposed Rule to 706,030 GWh in the Final Rule,[1] while displacing generation from affected fossil units on an average capacity *pro rata* basis.

Because EPA ultimately determined the carbon emission limits of each state based on its renewable energy expectations, it is crucial to understand how EPA derived the goals, and whether its assumptions are reasonable.[2] As detailed below, EPA's methodology is fanciful, at best, and amounts to solving for the end goal, at worst. Regardless, EPA's new BSER contemplates an energy future with enormous continuing additions of renewable energy to replace coal-fired generation, while holding natural gas use flat.

II. The Evolution of the Proposed Rule

To compute each state's carbon budget, the Proposed Rule (released in June 2014) relied on four Building Blocks. The Proposed Rule imposed somewhat lesser reduction standards on heavily coal-dependent states, and higher standards on states with a significant amount of natural gas combined cycle (NGCC) capacity. Building Block 1, the heat rate improvement for coal-fired electric generating units (EGUs), was set at 6 percent. For Building Block 2, dispatch to existing natural gas combined cycle (NGCC) was set at 70 percent. In addition, EPA relied on renewable energy and nuclear deployment as Building Block 3 and a significant implementation of energy efficiency measures as Building Block 4.

In the Final Rule, EPA reworks its assumptions considerably. Building Block 4 is eliminated as a factor in determining state carbon reduction goals.[3] Building Block 1 is revised and coal-fired EGU heat rate improvements are reduced based on a regional approach (4.2% for the Eastern Interconnection, 2.1% for the Western Interconnection, and 2.3% for the Texas Interconnection). The Final Rule also converts an assumption of 70 percent natural gas combined cycle operation utilization to 75 percent of the net summer capacity rating of the NGCC unit. However, under the Final Rule natural gas use is expected to be flat or decline because the credit is based on replacing coal with natural gas, as opposed to building new NGCC units. To that end, EPA estimates that NGCC construction decreases from between 39 percent to 68 percent from the base case by 2030.[4]

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[1] *See* Environmental Protection Agency, *Technical Support Document: Greenhouse Gas Mitigation Measures*, Docket ID No. EPA-HQ-OAR-2013-0602 (Aug. 3, 2015), *available at* http://epa.gov/airquality/cpp/tsd-cpp-ghg-mitigation-measures.pdf (TSD).

[2] EPA took a different approach in the Final Rule as compared to the Proposed Rule by establishing subcategory emission performance rates for coal-fired EGUs and NGCC facilities in three regions broken down by interconnection. Because the methodology yielded extremely low emission rates in the Western Interconnection and Texas Interconnection, EPA eliminated these rates for the Western Interconnection and Texas Interconnection and established uniform rates for two subcategories of sources (fossil-fuel fired electric steam generating units and stationary combustion turbines) using the Eastern Interconnection figures. Accordingly, the performance rate is 1305 lbs/CO_2 MWh for the latter and 771 lbs/CO_2 MWh for the former. These subcategory emission performance rates provide the basis for the state specific rate-based goals and mass-based goals.

[3] This is likely for prudent legal reasons from EPA's perspective.

[4] *See* EPA, *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, at 3-32 (Aug. 3, 2015) ("Under the rate-based illustrative scenario, new natural gas combined cycle capacity is projected to decrease by 8 GW in 2025 and 30 GW in 2030 (52 percent and 68 percent decrease relative to the base case). … Under the mass-based illustrative scenario, new natural gas combined cycle capacity is projected to decrease by 1 GW in 2025 and decrease by 17 GW in 2030 (a 9 percent and 38 percent decrease relative to the base case)"), *available at* http://www.epa.gov/airquality/cpp/cpp-final-rule-ria.pdf/(Regulatory Impact Analysis).

In order to solve for the 30% by 2030 end goal, Building Block 3 had to compensate for the emission reduction losses from a less stringent Building Block 1, revised Building Block 2, and eliminated Building Block 4. Indeed, the new Building Block 3 more than compensates for these carbon emission losses because the final standard increased from an overall carbon emission reduction of 30% to 32% by 2030.

The result from the increased renewable assumption leads to substantial increases in carbon emission reduction goals for Indiana, Kentucky, Missouri, Montana, Nebraska, North Dakota, Ohio, West Virginia, Utah, and Wyoming, among others. Many other states saw their carbon reduction goals stay largely the same but still must reduce their rate-based carbon emissions by almost 40 percent or greater, *e.g.*, Colorado, Illinois, Iowa, Michigan, Tennessee, and Wisconsin. This paper examines the renewable energy assumptions EPA uses to get to its carbon reduction budget.

III. EPA's Assumes Significant Increases to Renewable Energy Capacity for Each Year from 2022 through 2030

The chart below is directly from EPA's Technical Support Document: GHG Mitigation Measures (TSD) for the Final Rule (with additional highlighting for explanatory purposes in this analysis).[5] It illustrates how EPA managed to double its renewable energy capacity addition assumptions.

Table 4-1: Annual Capacity Change by RE Technology (MW)

RE Tech-nology	2010	2011	2012	2013	2014	Average	Maxi-mum
Solar PV	267	784	1803	2847	3934	1927	3934
CSP	78	0	0	410	767	251	767
Onshore Wind	5112	6816	13131	1087	4854	6200	13131
Geo-thermal	15	138	147	407	4	142	407
Hydro-power	294	-10	47	216	158	141	294

Under the Final Rule, EPA's interim goal and associated step-downs run from 2022 to 2030 (the interim goal began in 2020 under the Proposed Rule). In determining how much renewable energy capacity is expected nationwide by 2022, EPA began by "[e]stablishing an initial level of incremental generation from the building block 3 RE [renewable energy] technologies that could be expected by 2022 even in the absence of the rule …."[6] This incremental generation number consists of existing renewable energy that came online in 2013 or later as well as "projects that are not currently operating but are firmly anticipated to be operational in the future … and capacity that is projected to be deployed as an economic resource to meet load."[7] For 2022 and 2023, EPA then imputes the "historical average change in capacity"[8] between 2010 and 2014 (numbers in blue above, second column from right) and added it to this initial production level.

For 2024 through 2030, however, EPA used only the "historical *maximum* change in capacity"[9] (column in green above, far right) by selecting the highest capacity addition for each generation type and adding it year over year. The yellow highlighted megawatt (MW) numbers (the historical maximum capacity addition year over the 2010-2014 time period) were chosen by EPA to represent what can be expected in future years; specifically, each year from 2024 through 2030. As the table shows, the historical maximum capacity addition year for each resource was more than twice as much as the average over the five year period.

The result is shown in EPA's Table 4-4 in the TSD[10] and reveals substantial jumps in renewable energy Megawatt-hours (MWh), starting from 2023 to 2024 and repeating every year thereafter. The ultimate result yields an incremental increase of renewable energy of over 706 Terawatt-hours (TWh) by 2030 (see table on following page).

[5] TSD, at 4-2.

[6] TSD, at 4-2.

[7] TSD, at 4-4.

[8] TSD, at 4-5.

[9] TSD, at 4-5 (emphasis added).

[10] TSD, at 4-6.

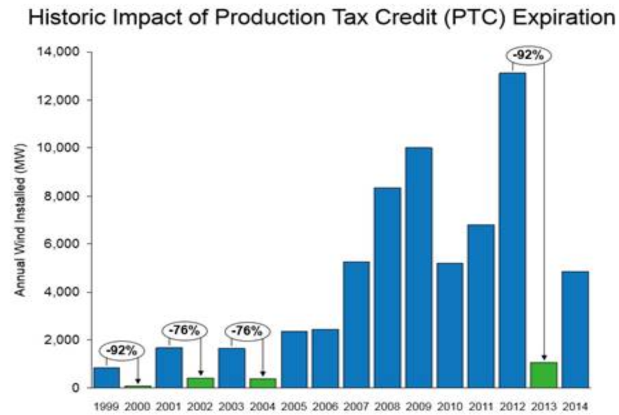
Table 4-4: National Building Block 3 Generation Totals (MWh)

Year	Building Block 3
2022	241,880,347
2023	270,676,570
2024	332,869,933
2025	395,063,296
2026	457,256,659
2027	519,450,023
2028	581,643,386
2029	643,836,749
2030	706,030,112

EPA assumes that the *maximum* historical capacity addition will repeat itself year-over-year from 2024 through 2030. This is so notwithstanding that the period 2010 through 2014 data relied on by EPA shows large swings in MW capacity changes from year to year. In the TSD, EPA defends this approach by offering that cost and production performance of renewable energy should improve over time.[11]

However, there are likely reasons other than cost and production performance that cause these swings in capacity additions. Only one of the five renewable energy technology types (Solar PV) in Table 4-1 shows a linear or progressive increase over the five years; the remainder show substantial increases or decreases, with no predictive trend emerging. The largest renewable energy technology type (by MW) relied on by EPA for Building Block 3 is onshore wind, representing 72% of the historical average capacity addition (and 71% of the historical maximum capacity addition) MWs in Table 4-1. Moreover, EPA's capacity addition expectation for wind in 2024 through 2030 relies on one highly anomalous year: 2012.

In 2012, the wind production tax credit (PTC) (wind generators receive a $23 per MWh post-tax tax credit over the first 10 years of a project's lifespan) was in danger of expiration. The PTC has existed since 1992, but the credit has faced several renewal battles in Congress and lapsed on multiple occasions. The American Wind Energy Association (AWEA) stresses the importance of the PTC on its website: "If wind energy is to be a part of America's energy mix, Congress must extend the PTC/ITC."[12] The AWEA graph[13] reproduced below shows the dramatic swings in wind development that occur whenever the PTC has historically expired.



As shown in the graph, 2012 was an unusual year because, as explained by AWEA, "it was uncertain whether the PTC would expire at the end of the year, or be extended."[14] For that reason, utilities and independent power producers rushed to install wind capacity by the end of 2012. Despite this clear rationale for the abnormal level of wind development in 2012, EPA chose that single year as representative of what can be expected for *each and every year* from 2024 through 2030. The EPA could have chosen 2010, 2011, or 2014 – all years in which the PTC was in effect – as more representative, but that would have been roughly half or less than the capacity in 2012, making it impossible to get to the 32% carbon reduction goal by 2030. If nothing else, EPA's assumption that the PTC will continue in perpetuity is questionable given its expiration in 2000, 2002, 2004, and 2013.

The same is true of the Investment Tax Credit (ITC), a 30 percent federal tax credit for commercial and residential solar energy systems. Solar PV represents the second highest total MW capacity additions (at 22% for average capacity and 21% for maximum capacity MWs) used by EPA in Table 4-1 above. The Solar Energy Industries Association (SEIA) website states that the solar ITC "is the cornerstone of continued growth of solar energy in the

[11] TSD, at 4-12 to 4-18.

[12] AWEA Advocacy PTC Home Page, *available at* http://www.awea.org/Advocacy/Content.aspx?ItemNumber=797.

[13] *Id.*

[14] *Id.*

United States."[15] In 2008, Congress provided an eight-year extension of the commercial and residential solar ITC, but the residential ITC expires completely (and the commercial ITC drops to 10 percent) at the end of 2016 absent further Congressional action.[16] EPA assumes the solar ITC will be extended past 2016 and continue all the way through 2030, notwithstanding that it was in danger of lapsing in 2007 and 2008.

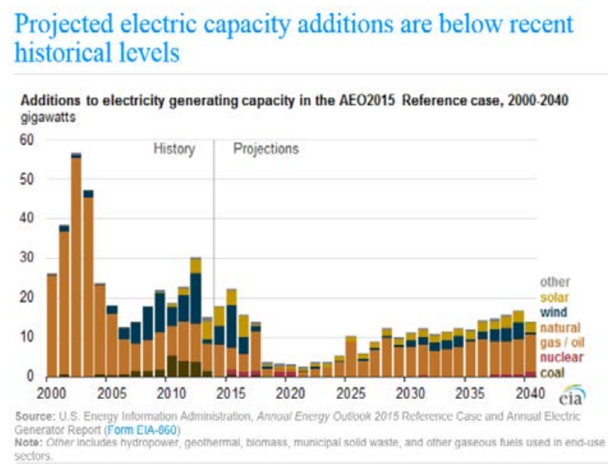
EPA's Onshore Wind and Solar PV categories make up 94% of the average (and 92% of the maximum) MW capacity additions used by EPA in forecasting capacity additions in future years. The remaining resource types — Geothermal, Hydropower and Concentrating Solar Power (CSP) — also show wide swings in production in Table 4-1. Over a three-year period, geothermal power shifts from 147 to 407 and back to 4 MW; and hydropower goes from 294 to *negative* 10 to 47 MW. While CSP shows growth from 2013 to 2014, its MW capacity growth in both 2011 and 2012 was zero. EPA nonetheless selects the highest capacity growth single-year figure for each resource type and adds that figure each year from 2024 through 2030 to obtain the final renewable assumption in Table 4-4. It is an understatement to call this a highly ambitious forecasting methodology.

The maximum change in capacity year historical data certainly inflates the amount of renewable generation that may be "potential" in the 2024 to 2030 period. In turn, this assumption drives the more ambitious carbon reduction targets imposed on the states. To be sure, it gets EPA to its end goal, but only as a conclusion needing a rationale, as opposed to a rationale leading to a conclusion.

IV. EPA's Assumptions Diverge from EIA Modeling

EPA might have explained its overly-optimistic renewable energy projections as requiring a Herculean effort from utilities, IPPs and other renewable energy developers that diverges far from the base case, but nevertheless is justified because of the importance of its carbon reduction goals in the CPP. To be sure, that is *not* EPA's rationale in the Final Rule, and EPA instead states that the higher Building Block 3 levels "are based on historical additions that have actually been achieved."[17] Furthermore, EPA asserts that the feasibility of these generation levels "is further confirmed by the results of other industry projections of RE, as well as many industry studies of the technical feasibility of even higher levels of RE penetration," concluding that such levels are "well within the range of industry expectations."[18] The overall picture painted by EPA in the TSD is that the renewable energy capacity additions would largely occur in the normal course even without the CPP.

The federal government's main forecaster of electric generation, the Energy Information Administration (EIA), tells a different story. The EIA graphic related to its Annual Energy Outlook (AEO2015),[19] set forth below, shows the considerable growth of renewable energy capacity during the same 2010-2014 historic period relied on by EPA for its future renewable energy capacity expectations.



However, the renewable energy capacity additions over the 2022-2030 period are consistent with its title: "Projected electric capacity additions are below recent

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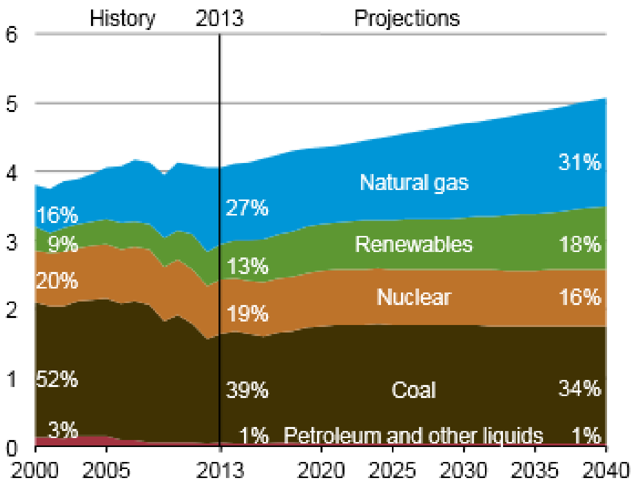
[15] SEIA Solar Investment Tax Credit Home Page, *available at* http://www.seia.org/policy/finance-tax/solar-investment-tax-credit.
[16] *Id.*

[17] TSD at 4-20.
[18] TSD at 4-20 to 4-21.
[19] U.S. Energy Information Administration, *Projected electric capacity additions are below recent historical levels* (May 11, 2015) *available at* http://www.eia.gov/todayinenergy/detail.cfm?id=21172. EIA notes that its forecasted capacity additions do not assume the continuation of tax credits for certain renewable energy technologies that are scheduled to expire under current law, and these tax credits can have a significant effect on projected capacity additions and retirements. The authors of this white paper agree that such tax credits have a substantial effect on whether renewable energy projects are cost-effective and get installed.

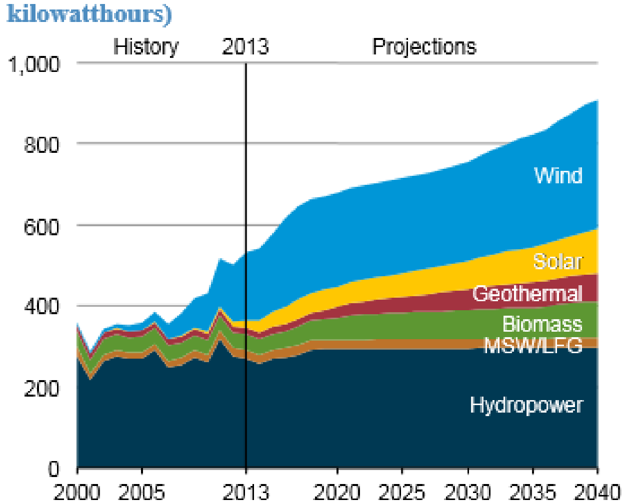
historical levels." This moderate renewable energy growth is also shown in Figure 31 of AEO2015.[20]

Figure 31. Electricity generation by fuel in the Reference case, 2000-2040 (trillion kilowatthours)



Contrary to EPA's 464 TWh renewable energy generation growth assumption from 2022 to 2030 (see Table 4-4 of the TSD above), EIA expects roughly 50 TWh of growth from all renewable sources combined (including biomass and other generation sources not considered by EPA), as reflected in Figure 34 of AEO2015.[21]

Figure 34. Renewable electricity generation by fuel type in the Reference case, 2000-2040 (billion kilowatthours)



The AEO2015 "Renewable Energy by Fuel" (Table 58) spreadsheet provides more specific figures for EIA's renewable capacity and generation growth assumptions. For the electric power sector, EIA expects renewable generation from all sources (again, including biomass and other generation sources not considered by EPA) to increase from 642 TWh in 2022 to 686 TWh in 2030, an increase of 44 TWh – less than 10 percent of EPA's 464 TWh assumption.[22]

An even greater divergence occurs regarding expected renewable energy *capacity* additions. EIA's AEO2015 Table 58 spreadsheet shows expected capacity additions for all sources of renewable energy in the electric power sector increasing from approximately 191 Gigawatts (GW) in 2024 to 198 GW in 2030, an increase of 7 GW.[23] Referencing EPA's Table 4-1 (above) and applying its expected capacity increases every year from 2024 through 2030, EPA expects renewable capacity additions of 130 GW. This is shown by resource type in the table below.[24]

RE Type	Hydro-power (MW)	Geother-mal (MW)	Solar Ther-mal (MW)	Solar PV (MW)	Onshore Wind (MW)
2024	100	250	0	100	320
2025	60	220	0	70	90
2026	0	260	0	130	350
2027	0	340	0	190	500
2028	70	450	0	140	450
2029	0	350	0	230	510
2030	60	300	0	360	1,500
EIA Avg	41.4	310	0	174.3	531.4
CPP	294	407	767 (CSP)	3,934	13,131
Cum. Diff. Over 7 Years	2058 -290 1,768	2849 -2170 679	5369 -0 5,369	27538 -1220 26,317	91917 -3720 88,197

The cumulative difference over the 2024-2030 period as between EIA and EPA is 122,330 MW, or

[20] U.S. Energy Information Administration, *Annual Energy Outlook 2015*, at 24 (2015) *available at* http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf (AEO2015).
[21] *Id.* at 25.

[22] If end-use generation (includes non-regulated end use commercial and industrial heat and power plants, and small on-site generating systems) is also considered, EIA's AEO2015 Table 58 spreadsheet shows renewable generation from all sectors increasing from 698 TWh in in 2022 to 756 TWh in 2030, an increase of 58 TWh. This figure represents less than 13 percent of EPA's TWh growth assumption over the same period.
[23] If end-use generation is also considered, renewable capacity from all sectors increases from approximately 213 GW in 2024 to 231 GW in 2030, an increase of 18 GW. This is less than 14 percent of EPA's 130 GW expectation. The difference of 112 GW represents a 622% increase over EIA's 18 GW forecast. *See* AEO2015, at Table 58 (standalone spreadsheet).
[24] Please note that this table was compiled by the authors for presentation purposes in this paper.

122 GW. This represents a more than tenfold (1,743%) increase from EIA's incremental renewable capacity expectation of 7 GW.

EPA's own estimate of renewable energy capacity growth as a result of the CPP is somewhat lower than the methodology it used to determine carbon reduction expectations for the states.[25] EPA's Integrated Planning Model (IPM) run shows an increase of renewable energy capacity of approximately 54 GW (rate-based plan) to 55 GW (mass-based plan) from 2020 to 2030.[26] EPA claims that this is only an 18-20 GW incremental addition of renewable energy capacity over the base case, which EPA assumes to be a 35 GW increase.[27] However, the base case assumption of a 35 GW increase is four times that of the EIA base case projection – roughly 9 GW of growth from 2020 through 2030.[28] And the 54 GW projected increase of renewable capacity in EPA's IPM modeling is a six-fold increase over the EIA base case.

The EIA makes clear that its AEO2015 reference case (*i.e.*, base case) projections do not include the effects of the CPP.[29] As such, it provides a relevant comparison of the base case without the CPP against EPA's Building Block 3 assumptions. This comparison reveals a wide divergence between EPA's renewable energy capacity and generation growth assumptions and the base case from the federal government's main electric generation forecaster.[30]

In sum, EPA assumes in its BSER that the maximum capacity addition year for each type of renewable energy resource in the 2010 to 2014 period can be expected to be replicated every year from 2024 through 2030. This translates to an expectation that states can increase renewable energy capacity and generation from 6 to 17 times that of EIA's base case. States that cannot do so or blanch at the expense of such a significant turnover in the generation mix will need to look elsewhere for the equivalent carbon reductions assumed in Building Block 3.

V. EPA Uses Average Capacity Factor Instead of Capacity Credit for Each Type of Renewable Energy

In determining how much renewable energy may be relied upon, it is important to look at the capacity factor of each type of resource. Capacity value measures the actual use of a resource over the period of a year. For example, if a NGCC facility runs 45 percent of the time during the total hours of one year, then its average capacity is 45 percent. Renewable resources have the same ratings, but with the added layer of intermittency. As the old saying has it, the wind doesn't always blow and the sun doesn't always shine; accordingly, wind and solar average capacity are generally below other types of resources.

However, average capacity is only part of the story. The "capacity credit" of each resource, *i.e.*, the amount of capacity from a resource type that can be counted upon during peak load conditions, must also be analyzed for operating an electric system. In the Final Rule, EPA set its subcategory emission performance rates, and in turn carbon reduction mandate for the states, in part by forecasting how much renewable energy can displace coal units that must be curtailed or shut down to meet the mandate. As described in the EPA forecasting discussion above, EPA first

[25] The main reason for this discrepancy appears to be EPA's IPM assumption that states can achieve a level of demand reduction through implementation of demand-side energy efficiency measures. Specifically, EPA assumed electricity demand reductions for each state by ramping up from a historical basis to a target annual incremental demand reduction rate of 1.0 percent of electricity demand over a period of years starting in 2020, and maintaining that rate throughout the modeling horizon. *See* Regulatory Impact Analysis, at 3-13. The incremental demand reduction rate for each state, for each year, was used by EPA in its IPM to derive cumulative annual electricity demand reductions. *Id.* at 3-13-3-14. (Whether the demand reduction assumption in the IPM is reasonable is beyond the scope of this paper.) This, in turn, reduced EPA's RE assumption necessary to meet load in its IPM modeling. However, because states' carbon reduction mandates are based on EPA's building block assumptions, not the IPM, the reasonableness of EPA's renewable energy assumptions remains a crucial inquiry.
[26] *See* Regulatory Impact Analysis, at 3-33 (Table 3-14).
[27] *Id.*
[28] *See* AEO2015 Table 58 spreadsheet.
[29] AEO2015, at ii ("The AEO2015 projections are based generally on federal, state, and local laws and regulations in effect as of the end of October 2014. The potential impacts of pending or proposed legislation, regulations, and standards (and sections of existing legislation that require implementing regulations or funds that have not been appropriated) are not reflected in the projections (for example, the proposed Clean Power Plan). In certain situations, however, where it is clear that a law or a regulation will take effect shortly after AEO2015 is completed, it may be considered in the projection.") (internal citations omitted)
[30] According to EIA.gov, EIA is the statistical and analytical agency within the U.S. Department of Energy, and "is the nation's premier source of energy information."

determined how much renewable energy capacity (in MWs) can be expected in future years. EPA then multiplied each type of resource's expected capacity value by its *average* capacity factor to determine the expected MWh, which represents how much electric energy the EPA expects to actually be generated by each resource. EPA assumed that these MWhs can replace, on a one-to-one basis, fossil-fuel MWhs.

The fundamental problem is that this is not how the power system actually works. Electric utilities plan their power generation to meet *peak* load plus a reserve margin, *i.e.*, the highest expected MWh demand plus a safety buffer (usually a 15-20 percent margin). Peak loading conditions usually occur on hot summer days in the late afternoon and early evening, when it is hottest and people get home and turn up the air conditioning (3 p.m. to 8 p.m., with some variance across the country). Peak loading can also occur during very cold winter conditions. However, the nation's largest source of intermittent renewable energy, wind power, does not reliably produce power during peak load conditions. Indeed, studies show that wind power production tends to be greater during the night, and is often near zero during peak load periods.[31]

As a result, regulators and utilities use a different measure than simple capacity factor when determining how much renewable energy may be relied upon during peak conditions. For wind power, that figure (called "capacity credit" or "capacity value") is more in the 5-15% range[32] as opposed to the 41.8% assumed by EPA.[33] Given this disparity, the 48 TWh of wind production EPA counts on to replace fossil fuel capacity in peak load conditions is likely a fraction of that figure based on utilities' capacity credit methodologies. This is of significant concern because, again turning to the EIA, the ratio of annual peak-hour electric demand to average hourly demand has risen across the U.S. over the past 20 years.[34]

EPA's BSER calls for over 530 TWh of renewable energy to displace coal and natural gas-fired generation. To the extent that the EPA's assumed renewable energy displacement of fossil fuel resources does not occur because wind, solar, or other intermittent generation is not available, the reliability of the electric system is placed in jeopardy. Rolling brownouts – when utilities turn off power to geographic subsections of their systems on a rolling basis – usually occur during peak load conditions when utilities do not have enough electric production to meet peak demand.

In the Final Rule, the EPA indicates that electric system reliability is the responsibility of each state. EPA also added a "reliability safety valve" (RSV) in the Final Rule, allowing affected EGUs to operate under temporarily modified emission standards under certain circumstances. However, the CPP will result in the closure of significant numbers of coal-fired EGUs. Once these EGUs are decommissioned, the vast majority, if not all, of these plants are permanently eliminated from the system. A RSV does not help where there are no additional generation units to run. If it turns out that EPA's assumptions regarding displacement of coal-fired EGUs with renewable energy was in error, the options available to utilities will be limited, and could include having to build new NGCC peaker plants. This takes time and resources, and may come too late if peak loading conditions are severe.

VI. The Practical Effect of EPA's Assumptions – a National Renewable Portfolio Standard (RPS)?

EPA's extremely optimistic renewable energy adoption assumptions have a significant practical effect by creating a shadow national RPS. A common counterargument to this position is that states have

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[31] *See, e.g.*, Lawrence Livermore National Laboratory, *Power generation is blowing in the wind* (Jan. 17, 2012) (citing a study co-authored with the University of Colorado at Boulder and NREL: "The team found that wind speed and power production varied by season as well as from night to day. Wind speeds were higher at night (more power) than during the day (less power) and higher during the warm season (more power) than in the cool season (less power). For example, average power production was 43 percent of maximum generation capacity on summer days and peaked at 67 percent on summer nights"), *available at* https://www.llnl.gov/news/power-generation-blowing-wind.

[32] For example, the MISO system-wide wind capacity credit is 14.7 percent; PacifiCorp's 2015 IRP includes a 14.5 percent capacity credit for wind; ERCOT non-coastal Texas wind is valued at 14.2 percent; PJM has a default unforced capacity value for wind of 13 percent; Public Service Company of Colorado's capacity credit for wind is 12.5 percent; Tri-State Generation and Transmission Association's is 5 percent; Public Service Company of New Mexico's is 5 percent.

[33] TSD, at 4-3 (Table 4-2 showing a "Capacity Factor" of 41.8% for the "Onshore Wind" category).

[34] U.S. Energy Information Administration, *Peak-to-average electricity demand ratio rising in New England and many other U.S. regions* (Feb. 18, 2014), *available at* http://www.eia.gov/todayinenergy/detail.cfm?id=15051.

"flexibility" to meet the emission standards in the rule and can avail themselves of one of three compliance pathways: (1) each coal-fired EGU and NGCC unit in a state can meet the applicable subcategory emission performance rate (1305 lbs/CO_2 MWh for coal-fired EGUs and 771 lbs/CO_2 MWh for NGCC units); (2) the state can meet its rate-based goal under the Final Rule; or (3) the state can meet its mass-based goal under the Final Rule.[35] However, this position ignores the fact that the renewable energy assumptions discussed in this paper are baked into all three of these standards.[36] The subcategory emission performance rates provide the basis for the rate-based state goals and mass-based state goals, and the renewable energy assumptions are a key driver of the subcategory emission performance rates.

This means that the practical effect of the BSER is that each state has a presumed level of renewable energy adoption, and a significant one at that, overlaid on its electric resource planning through 2030 and beyond. This consequence has all of the hallmarks of a RPS – albeit a RPS without retail rate caps, reliability considerations or other consumer protection measures adopted by many state legislatures. It also skips a step common to other state RPSs (save New York and Arizona), namely the passage of state legislation authorizing and implementing the RPS. Rather, the RPS has been established through an esoteric modeling process by a federal administrative agency charged with protecting human health and the environment, not regulating the electric grid.

To be sure, states do not have to acquire the levels of renewable energy assumed by EPA; however, if they do not, they will need to find carbon emissions from another area to satisfy any shortfall from its failure to acquire the full assumed level of renewable energy. Accordingly, if and when a state achieves compliance with the subcategory emission rates, rate-based goal, or mass-based goal, it has the same consequence from a carbon emissions standpoint as acquiring the full amount of assumed renewable generation. For this reason, while the Final Rule is not a national RPS on its face, it certainly is in spirit when one views the result of any CPP compliance path.

VII. Conclusion

Setting aside enforceability, the President gave EPA a goal in his Climate Action Plan: achieve a 30% carbon emission reduction by 2030. EPA proceeded to solve for that goal with a capacious construction of the BSER under the Clean Air Act. While gas "won" in the near-term under the Proposed Rule, in the end renewable energy resources assume a Brobdingnagian role in determining the level of carbon emission reductions that are purportedly possible under the BSER. EPA's Final Rule constructs a method that solves for a conclusion, instead of having a method that yields a conclusion. Of even greater concern, EPA's use of renewable average capacity factors instead of capacity credit exacerbates reliability risks to the electric system during peak load conditions. The end result may be unknown, but the method of getting there is highly questionable at best.

[35] Environmental Protection Agency, 40 CFR Part 60, Docket No. [EPA-HQ-OAR-2013-0602; FRL-XXXX-XX-OAR], Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Generating Units, at 28-29 (Aug. 3, 2015).

[36] *See id.* ("As we did at proposal, for each state, we are also promulgating rate- based CO_2 goals that are the weighted aggregate of the emission performance rates for the state's EGUs.")

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