WHAT'S IN A TARGET?

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HOW THE FINAL CLEAN POWER PLAN USES UNREASONABLE RENEWABLE ENERGY ASSUMPTIONS TO INCREASE THE STRINGENCY OF STATE EMISSIONS REQUIREMENTS

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Highlights and Key Takeaways

1. The design of and justification for state carbon emissions reduction requirements in the Environmental Protection Agency's (EPA) Clean Power Plan (CPP) Final Rule bear little resemblance to the Proposed Rule. Because these dramatic changes were not contemplated in the Proposed Rule, states and stakeholders had no opportunity to review and comment on the accuracy, achievability, or fairness of EPA's requirements and underlying assumptions.

2. Unlike the Proposed Rule, the Final Rule bases state requirements on "source-specific performance rates" that purport to apply directly to coal- and gas-fired plants, and thus no longer expect third parties to undertake compliance measures, shifting responsibility instead to power plant owners.

3. In reality, however, EPA's "source specific performance rates" are not performance rates at all. They have almost nothing to do with what EPA purports to be regulating (fossil-fueled electric generating units) and instead are based primarily on EPA assumptions that power plant owners replace coal- and gas-fired generation with massive amounts of new renewable energy.

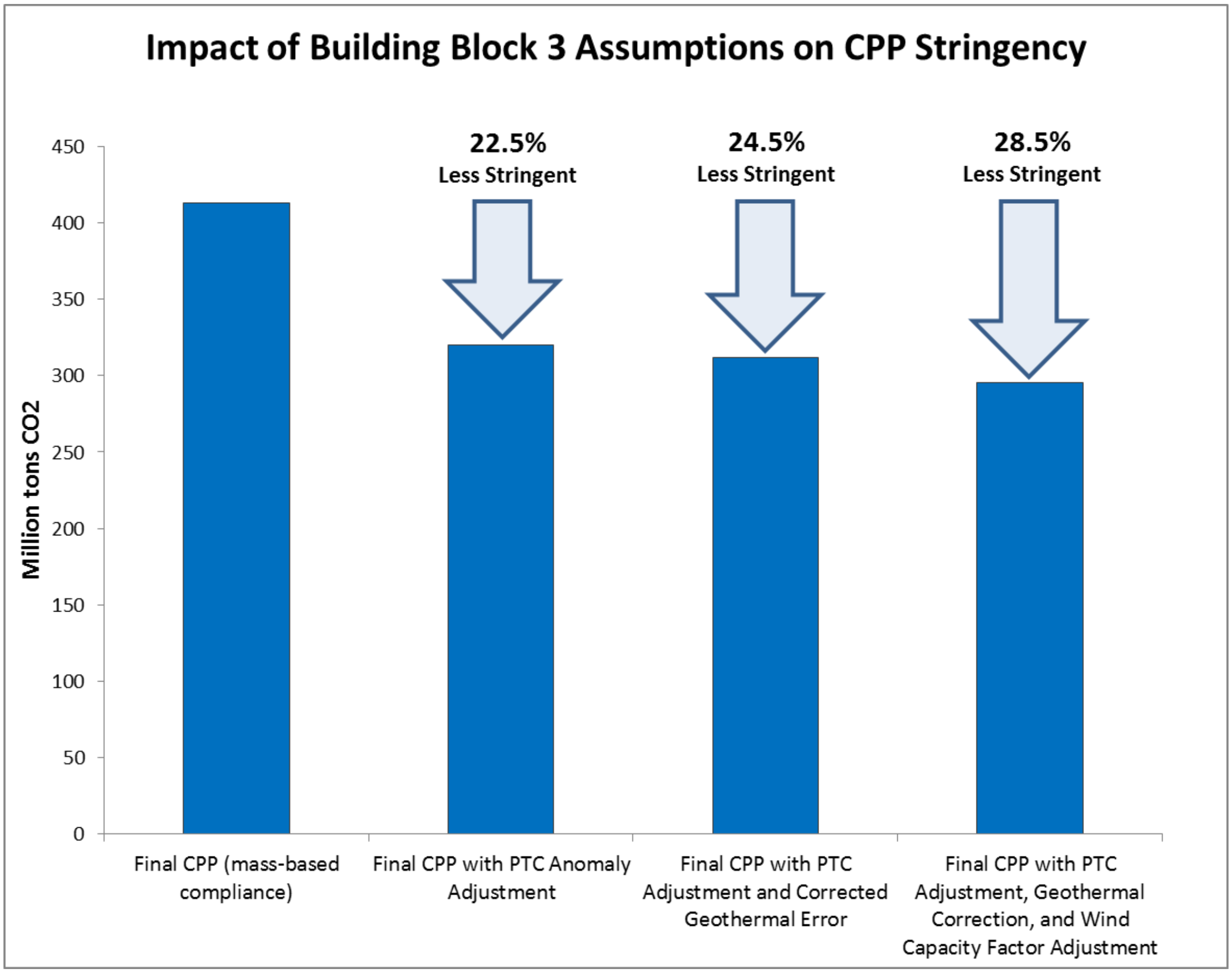
4. Specifically, the Final Rule bases state requirements on an assumption that renewables can grow a whopping 61% more than they were projected to increase in the Proposed Rule, and nearly 250% above 2012 generation levels. As a result, EPA's revised renewable energy projections form the basis of more than half of all carbon reductions mandated by entire CPP.

5. But EPA's renewable assumptions are fraught with numerous flaws that contribute to aggressive renewable generation projections, ultimately increasing the stringency of the CPP. For example:
    - EPA assumes that the unprecedented deployment rate of wind resources that occurred in 2012 due to the anticipated expiration of the production tax credit (PTC) will not only be repeated, but will be sustained for seven straight years.
    - EPA committed an egregious error in its estimate of potential future geothermal energy generation, misinterpreting Department of Energy data by a factor of four.
    - EPA assumed unrealistically optimistic and unsupported capacity factors for renewable energy generation.

6. Through its complex regulatory formula, EPA then uses these flawed assumptions to impose more stringent requirements on states. We re-ran EPA's calculations using more reasonable assumptions, and found that their influence was substantial. For example:
    - Simply basing wind energy generation projections on the 2nd highest wind deployment year in recent history—as opposed to 2012's highly anomalous deployment that resulted from the pending expiration of the Production Tax Credit—would increase EPA's coal and gas

"performance rates" by 135 pounds per megawatt hour (lbs/MWh) and 25 lbs/MWh, respectively.

- EPA's use of the PTC expiration anomaly increases the average stringency of state targets by 89 lbs/MWh. Under EPA's rate-to-mass translation formula, this increase is equivalent to an additional 93 million tons of annual CO2 emissions that would have been allowed if EPA had not based state requirements on such an unrealistic, policy-driven scenario.
- Similarly, if two additional assumptions are corrected for—the Agency's erroneous geothermal energy generation estimate and unrealistic capacity factor assumption for wind energy—average state target emissions rates would increase by 115 lbs/MWh, and an additional 118 million tons of annual CO2 emissions would be allowed under the rule. These corrections alone would reduce the stringency of the CPP by more than 28% (see graphic).



7. At an average carbon price of $30 per ton, the increased CPP stringency resulting from EPA's assumptions on these three areas alone equate to more than $3.5 billion in compliance costs.

8. Individual state impacts of EPA's erroneous assumptions are presented and are also significant. For example, in Kentucky, basing the state's CPP target on the 2nd highest wind deployment year instead of the 2012 PTC expiration anomaly year would reduce its rate target from 39.4% to 33.2%. Addressing the other questionable assumptions would further reduce its rate reduction target to 31.2%. Translated to mass-based compliance, these adjustments would raise the state's emissions cap by nearly six million tons of CO2, an amount corresponding to $176 million in compliance costs for the state at a $30 per ton carbon price.

9. EPA's formula and underlying assumptions (and our modifications to them) are inherently subjective and open to debate. But the fact that highly questionable assumptions wholly unrelated to fossil-fueled power plants result in billions of dollars in additional compliance costs on states and regulated entities illustrates how far removed EPA's "performance rates" are from anything resembling actual power plant emissions performance.

10. While the U.S. Chamber remains a strong and steadfast supporter of continued efforts to advance renewable technologies to drive down costs and achieve parity with traditional electricity sources, the advancements that we aspire to someday realize should not be relied upon as the present-day basis for sweeping regulations.

11. In addition to these shortcomings, the design of the final CPP disadvantages many states because it bases *state* requirements on *national* renewable projections. For example, nationwide onshore wind generation projections comprise nearly 80% of carbon reductions required by Building Block 3, but are incorporated into state targets evenly, regardless of whether states have the potential to achieve the projected wind generation that is built into their target.

12. As a result, and because of the wide geographic variability of onshore wind generation, 18 state targets assume more wind generation than the technical potential available to them. In effect, the final CPP expects these states to import wind resources from other regions of the country, raising questions of legality and fairness.

Introduction

Last August, President Obama released EPA's Final Clean Power Plan Rule in a high profile ceremony at the White House. The Final Rule clocked in at a little over 3,000 pages of regulatory text and supporting documents, and it achieves the impressive feat of being even more complex and confusing than the Proposed Rule issued by EPA in the summer of 2014.

The sequel is completely different than the original, and there is much left that we still need to digest and understand. But suffice it to say, the regulation has changed so dramatically that states, utilities, and other affected stakeholders have in many ways been forced back to square one in their review and analysis of the rule and its implications.[1] Moreover, because the major changes to the CPP's final design were not contemplated in the Proposed Rule, stakeholders have been left with no opportunity to provide EPA constructive feedback on these implications.

In a nutshell, EPA has employed an entirely new structure and set of assumptions from which it derives individual state requirements. The end result overall is a more stringent regulation that the Agency blithely claims will be easier and cheaper for states to comply with. To cite just one example, EPA tightened the 2030 carbon dioxide (CO_2) emissions rate reduction requirement for North Dakota from 11% in the Proposed Rule to 45% in the Final Rule, the third steepest rate reduction in the country. With a straight face, the Agency's "Fact Sheet" goes on to describe this new target as such:

> "North Dakota's 2030 goal is 1,305 pounds per megawatt-hour. That's on the high end of this range, meaning **North Dakota has one of the least stringent state goals**, compared to other state goals in the final Clean Power Plan." [Emphasis added.]

Compare this to the description of California's target. EPA loosened the state's CO_2 rate reduction requirement from 23% in the Proposed Rule to 14% in the final, and agency fact sheets project that California will actually be allowed to ***increase*** its emissions rate under the rule (and/or sell emissions credits to other states). Nonetheless, EPA suggests this will be a heavy lift for the Golden State:

> "California's 2030 goal is 828 pounds per megawatt-hour. That's on the low end of this range, meaning **California has one of the more stringent state goals**, compared to other state goals in the final Clean Power Plan." [Emphasis added.]

Welcome to the world of EPA Fuzzy Math, where up is down and down is up. Where do these goals come from, and how did EPA pull this off? Well, it's complicated. But it's based on layer upon layer of shaky assumptions, outright errors, and uneven treatment of states that we hope to explain in this analysis.

[1] A helpful high level summary of these changes is described at: http://www.realclearenergy.org/articles/2015/08/04/whats_actually_in_the_brand_new_clean_power_plan_108652.html.

Our prior analyses to date have focused on the two primary factors that EPA employs to arrive at its magic “more stringent but cheaper and easier to comply” Final Rule: (1) an extremely unrealistic revised baseline; and (2) extremely unrealistic and unfair assumptions regarding deployment of renewable energy in “Building Block 3” of the rule, which calls for replacement of fossil and Natural Gas Combined Cycle (NGCC) generation by increases in renewable energy generation. The first installments of our series on the revised baseline can be found here, here, and here. In this paper, we deconstruct EPA’s complex formula for setting “performance standards” and associated emissions reductions requirements on states.

Anatomy of a State Target

In regulatory technical support documents accompanying the CPP, EPA describes the process and calculations it employs to arrive at state CO_2 emissions reduction requirements, centered on the following eight-step formula:[2]

- Step 1 – Compile state-level baseline emission performance rates for coal, oil & gas steam, and NGCC facilities.
- Step 2 – Aggregate adjusted state baseline data to the regional “interconnection” level.
- Step 3 – Identify category-specific baseline emission rates for fossil steam (coal and oil) and NGCC units.
- Step 4 – Adjust fossil steam baseline emission rates to account for Building Block 1: Heat Rate Improvements.
- Step 5 – Further adjust fossil steam and NGCC emissions to account for Building Block 3.
- Step 6 – Further adjust fossil steam generation to account for Building Block 2: Re-Dispatch from Coal Plants to NGCC, increasing average NGCC capacity factor to 75%.
- Step 7 – Calculate adjusted “source-specific CO_2 emission performance rates” for each interconnection region based on Building Blocks 1 - 3.
- Step 8 – Identify the least stringent fossil and NGCC emission rates for all regions: Fossil steam = 1,305 lbs/MWh; NGCC = 771 lbs/MWh.

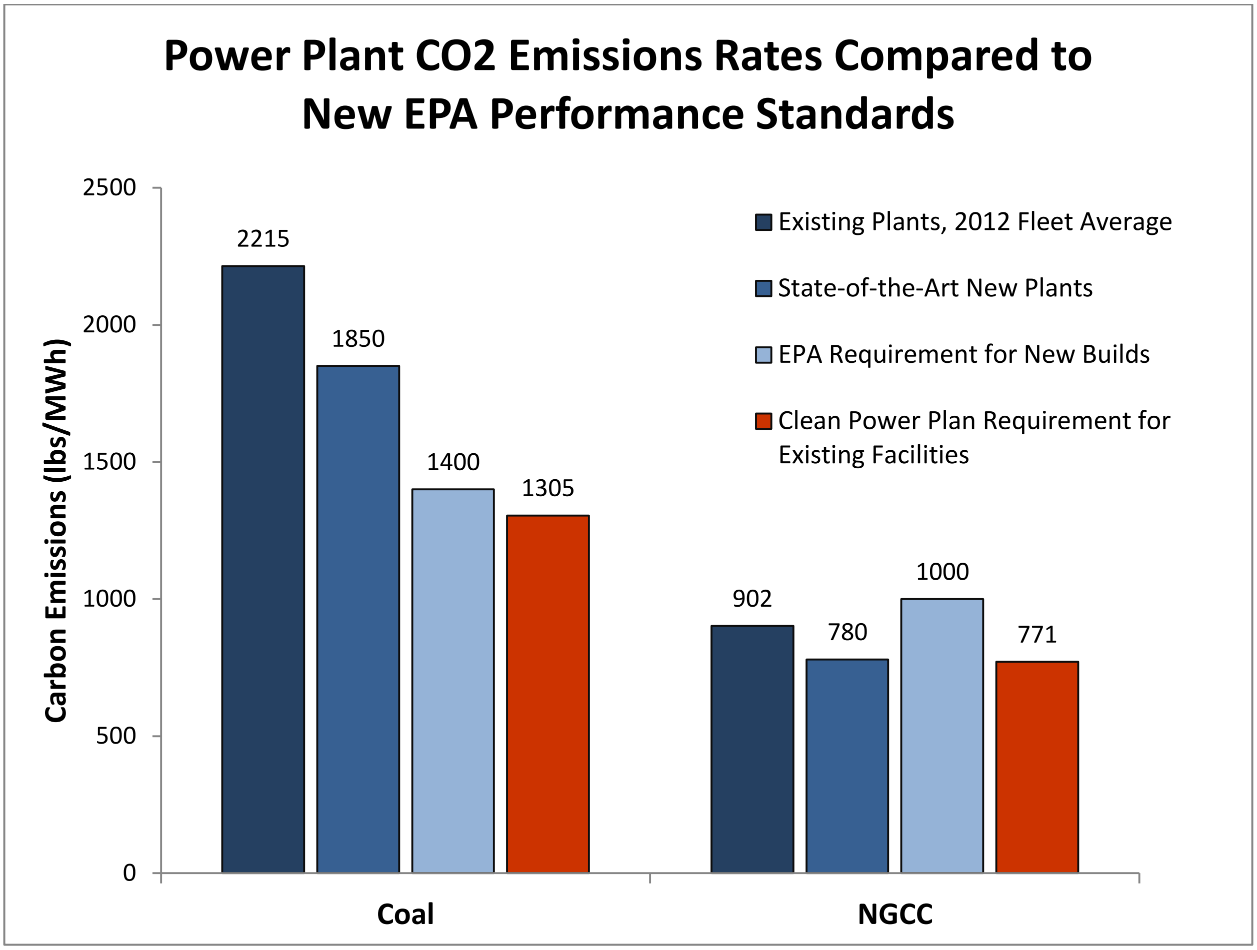
With the revised source-specific performance rates in hand after step 8, EPA then calculates state target rates based on the proportion of fossil steam and NGCC plants in each state. For example, states with all coal and no NGCC receive a 1,305 lbs/MWh target, while states with just NGCC and no coal capacity receive a 771 lbs/MWh target. All other states fall in between. Finally, EPA then translates each state’s target rate into a mass emissions cap using a separate complicated formula. Those state-level mass-based emissions caps add up to President Obama’s national goal to reduce CO2 emissions 32% below 2005 levels by 2030.

Notably, not only are the final coal and NGCC performance rates in the CPP far more stringent than the comparable rates achievable at existing fossil-fueled plants, they also are more stringent than the standards finalized on the same day by EPA for new fossil plants (Figure 1). This marks the

[2] EPA. 2015. *Emission Performance Rate and Goal Computation*. Technical Support Document. Available at http://www3.epa.gov/airquality/cpp/tsd-cpp-emission-performance-rate-goal-computation.pdf.

first time in agency history that EPA has mandated a more stringent standard for older, existing sources than for state-of-the-art new sources.

Figure 1. Power plant carbon dioxide emissions rates compared to EPA performance standards for new and existing facilities.[3]



How does EPA defend these illogical, unprecedented, and clearly unachievable performance standards? Through a complex regulatory design that can only be generously described as a novel interpretation of the Clean Air Act. In short, the Act authorizes EPA to regulate "sources," which the law defines as "any building, structure, facility, or installation which emits or may emit any air pollutant." Unable to achieve desired emissions reductions at the source (i.e. fossil fuel electric generating unit), the CPP asserts that EPA's regulatory authority extends to the *owners* of the source, and that it can therefore base performance standards on beyond-the-source (i.e. outside-the-fence) actions that power plant owners "have the ability" to take.

As such, the "source-specific performance rates" in the CPP are not source-specific rates at all. They have little to do with improving the CO_2 efficiency of coal and gas plant operations, and

[3] Figures for state-of-the-art new plants are approximate. Figures for 2012 fleet average of existing plants taken from CPP Goal Computation technical support document, available at http://www.epa.gov/airquality/cpp/tsd-cpp-emission-performance-rate-goal-computation-appendix-1-5.xlsx.

instead are overwhelmingly focused on two things: (1) forcing coal plants to run less through coal to gas re-dispatch (Building Block 2); and (2) forcing coal and gas plants to run less by replacing them with generation from renewables (Building Block 3). In fact, EPA calculations show that Building Blocks 1, 2, and 3 comprise 9.9%, 38.3%, and 51.8% of total CPP emissions reductions, respectively.[4]

Most striking about these proportions is that the largest contributor to EPA's performance rate calculations—renewable energy generation—is completely unrelated to the coal and natural gas facilities that are the regulated entities under the rule.

So how does EPA explain its decision to base fossil-fuel performance rates on an assumption that they will simply be displaced by renewables? It does so by arguing that the "source" really refers not to a "building, structure, facility…" etc. as defined by the Clean Air Act, but rather that it refers to the owners of fossil-fuel facilities. By asserting that its regulatory reach applies to facility owners instead of facilities, EPA asserts that it can require such owners to make investments in the electricity sources of its choosing. The Final Rule makes its case for EPA's authority this way:

> "Also supporting the determination that building block 3 is adequately demonstrated as a 'system of emission reduction' is the fact that owners of affected EGUs **have the ability to invest in** RE [renewable] generation as a way of reducing emissions. As with building block 2, this can be accomplished in several ways. For example, the owner of an affected EGU could invest in new RE generating capacity and operate that capacity in order to obtain ERCs. Alternatively, the affected EGU could purchase ERCs created based on the operation of an unaffiliated RE generating facility, effectively investing in the actions at another site that allow CO2 emission reductions to occur." [Emphasis added.]

This claim will no doubt be a focus in forthcoming litigation. We'll let the lawyers sort out the legality of this, but one can easily imagine this already extreme concept extending to even further tightening of performance standards. If having "the ability to invest in" something can be the basis of a performance standard, EPA could get even more creative, requiring regulated entities to make countless investments related to electricity. This could include anything from appliance rebate programs for employees or even consumers, to smart meters for all residential customers, to demand-side management programs that pay industrial users to reduce electricity use.

Changes to Building Block Three

Given that EPA's Building Block 3 renewable energy generation projections underlie the majority of state emissions reduction requirements in the Final Rule, it is useful to further unpack these projections to understand their reasonableness, achievability, and ultimate impacts on state targets. The remainder of this report focuses on these issues, specifically: (1) quantifying the

[4] Calculations derived from Appendix 4 of EPA Goal Computation Technical Support Document. Because EPA's formula projects that the Western and ERCOT Interconnections do not have enough fossil generation capacity to redispatch to NGCC all the way to a 75% NGCC capacity factor, total emissions resulting from EPA's rate calculation formula are far lower than amounts allowable under mass-based compliance scenarios. This is a key aspect of EPA's "headroom" concept, but the proportionate contributions of each building block to the overall target remains the same after the headroom adjustment to state targets.

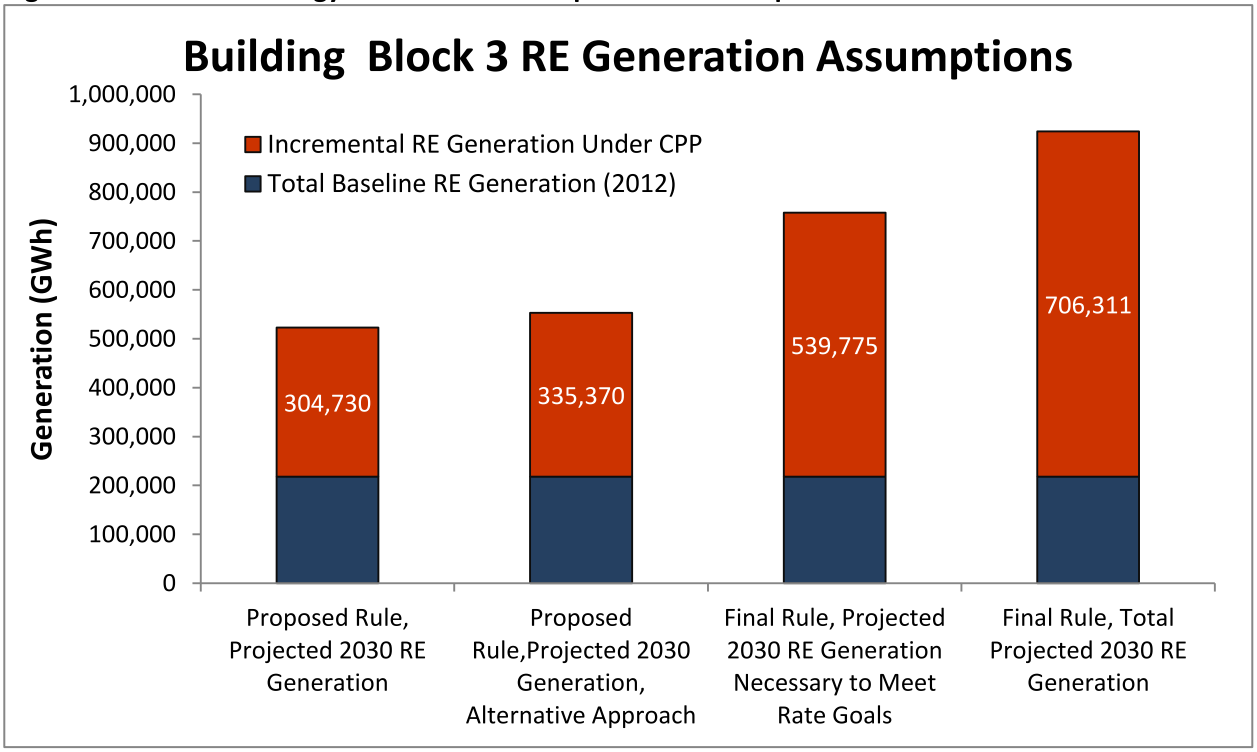
influence of certain renewable assumptions on state requirements; and (2) examining how a significant number of state goals assume the buildout of renewable resources (wind in particular) that those states do not have.

First, let's review the evolution of Building Block 3 over the last 18 months. EPA's Proposed Rule in 2014 assumed a rapid buildout of renewable energy as a key element of the nationwide carbon dioxide regulations. At that time, EPA based proposed CPP requirements on an assumption that nationwide renewable generation could increase more than 335 million MWh by 2030. The emissions reductions Building Block 3 sought to achieve were widely and justly criticized as well beyond EPA's authority, and at least 20 states commented to EPA that the proposed targets were too aggressive and not achievable.

Rather than heed the concerns of these states—and remember, the EPA Administrator promised the regulatory development process would be "an absolute collaboration between the federal and state government…a partnership if there ever was one"—EPA rejected their concerns and dramatically *increased* renewable generation targets in the final CPP.

The Final Rule assigns state CO_2 reduction requirements based on a projection of 540 million MWh of renewable generation in 2030—a whopping 61% increase above the already ambitious increase of 335 million MWh projected in the Proposed Rule, and nearly 250% above 2012 generation levels (Figure 2).[5]

Figure 2. Renewable Energy Generation Assumptions in the Proposed and Final CPP.[6]



[5] EPA. 2015. *GHG Mitigation Measures.* Technical Support Document. Available at: http://epa.gov/airquality/cpp/tsd-cpp-ghg-mitigation-measures.pdf.

[6] In the Final Rule, EPA introduces the concept of "headroom," in which performance rates resulting from its formula for ERCOT and the Western Interconnection are far lower than rates in the East. Because ERCOT and the West are

How did EPA get here from there? As with most everything else in the CPP, it's complicated.

Under the Proposed Rule, EPA set renewable energy generation targets based on the circumstances in each state or its surrounding region, assuming that states could reach their targets by: (1) deploying renewables at a rate eventually achieving the average renewable portfolio standard in the region; or (2) deploying renewables based on the technical potential of renewable resources residing within each state.

But the formula used in the Final Rule takes recent historical *nationwide* renewable deployment records and proceeds to assume that they can be repeated and sustained throughout the CPP compliance period to arrive at EPA's 61% increase in projected renewable generation compared to its original proposal. EPA then contends that this massive national growth in renewables can displace fossil generation on a virtually one-to-one basis, evenly across each state, regardless of grid circumstances or renewable resource potential in each state.

These changes are essential to understanding the key factors driving revised state renewable requirements. Despite their importance—or maybe because of it—they are largely hidden in each state's rate-based target and they are not mentioned in agency fact sheets outlining key revisions. Equally frustrating, fair observers on both sides of the issue have acknowledged that EPA's Building Block 3 changes are not driven by new economic projections or an improved understanding of renewable energy resources, but rather by the need to make up for "lost" emissions reductions originally anticipated from energy efficiency (Building Block 4 in the Proposed Rule) but removed in the Final Rule due to serious concerns about the legality of Building Block 4.

We'll give EPA points for creativity, but a close look shows this new construct is even less achievable and less fair than the widely-criticized original proposal. The central drivers behind EPA's new renewable projections are found in two Tables buried in the rule's "Greenhouse Gas Mitigation Measures" technical support document (Tables 4-1 and 4-3, below).

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

RE Technology	2010	2011	2012	2013	2014	Average	Maximum
Solar PV[4]	267	784	1,803	2,847	3,934	1,927	3,934
CSP	78	0	0	410	767	251	767
Onshore Wind	5,112	6,816	13,131	1,087	4,854	6,200	13,131
Geothermal	15	138	147	407	4	142	407
Hydropower	294	-10	47	216	158	141	294

Note: All values are rounded to the nearest MW.

assigned the less stringent rates of the East, RE generation necessary to meet goals is lower than in EPA's overall projected generation.

Table 4-3: Annual Generation Change Associated with Average and Maximum RE Capacity Changes

	Average Capacity Change (MW)	Capacity Factor	Generation (MWh, Average Capacity Change)	Maximum Capacity Change (MW)	Capacity Factor	Generation (MWh, Maximum Capacity Change)
Solar PV[7]	1,927	20.7%	3,494,268	3,934	20.7%	7,133,601
CSP	251	34.3%	754,175	767	34.3%	2,304,590
Onshore Wind	6,200	41.8%	22,702,416	13,131	41.8%	48,081,520
Geothermal	142	85.0%	1,057,332	407	85.0%	3,030,522
Hydropower	141	63.8%	788,032	294	63.8%	1,643,131
Total Generation (MWh)			**28,796,222**			**62,193,363**

With these Tables as a foundation, the agency employs the following seven-step formula to quantify its revised renewable generation projections that drive the majority of assumed carbon reductions in the "Best System of Emission Reduction" (BSER) and result in significantly more stringent state requirements:[7]

1. Identify historical maximum capacity change and average capacity change from year to year over the past five years (2010 – 2014) for utility-scale solar photovoltaic (PV), concentrating solar power (CSP), onshore wind, hydropower, and geothermal technologies.
2. Assign each renewable technology an annual capacity factor that represents expected generation from each megawatt of capacity installed in the future.
3. Use the data from steps 1 and 2 to produce the annual generation change associated with the historical average and maximum renewable capacity changes for each technology.
4. Establish an initial level of incremental generation from the Building Block 3 renewable technologies that could be expected by 2022 even in the absence of the rule, using EPA's IPM Base Case.
5. Add the generation associated with the historical *average* capacity change to the initial level to obtain the Building Block 3 generation level for 2022. To that 2022 level, add the generation associated with the historical average capacity change to obtain the Building Block 3 generation level for 2023.
6. For each subsequent year, add the generation associated with the historical *maximum* capacity change to the Building Block 3 generation level calculated for the preceding year to obtain the Building Block 3 generation level for each year from 2024 through 2030.

[7] This formula is described in further detail in EPA's *GHG Mitigation Measures* and *Goal Computation Technical Support Documents* available at: http://www3.epa.gov/airquality/cpp/tsd-cpp-ghg-mitigation-measures.pdf and http://www3.epa.gov/airquality/cpp/tsd-cpp-emission-performance-rate-goal-computation.pdf, respectively.

7. Apportion the national totals calculated in steps 5 and 6 to each of the three interconnections for inclusion in the BSER.

The driving factors in this formula are the selection of historical generation figures (step 1) and projected capacity factors for each renewable resource (step 2). These enormously influential assumptions are, however, highly subjective and warrant little confidence as a reliable indicator of future projections. As this paper demonstrates, seemingly modest variations in the assumptions used in these steps can have an outsized impact on renewable generation projections and the resulting state requirements.

To illustrate this, we examined the impact of the following three questionable assumptions employed by EPA, using the Agency's own formulas for calculation of performance rates, state target rates and mass-based emissions caps: (1) EPA's use of anomalous 2012 wind deployment figures due to the pending expiration of the Production Tax Credit (referred to in Tables as the "PTC Expiration Anomaly"); (2) EPA's misunderstanding of estimated historical geothermal deployment ("Geothermal Error"); and (3) EPA's overestimation of capacity factors for newly installed wind resources ("Wind Capacity Factor Overestimation").

It is important to note that these three concerns are not exhaustive of the EPA's questionable Building Block 3 assumptions, but they help to illustrate the outsized influence of these assumptions on the ultimate stringency of the rule.

Example 1: 2012 PTC Expiration Anomaly

Using EPA's renewable generation projection formula described above, Table 1 shows the comparative contribution of each renewable energy resource type. In short, EPA assumes that renewable resources will be deployed at their average 2010 to 2014 rate in 2022 and 2023, and at their maximum rates from 2023 through 2030. These assumptions result in projected 2022 to 2030 renewable generation increases of nearly 500 MWh. EPA projects 77% of this increased generation to come from onshore wind. While wind is certainly the dominant renewable in terms of current installed capacity and near-term future growth, EPA's decision to base 2012 wind generation capacity increases as an indicator of future sustained growth is highly suspect.

Table 1. Renewable generation assumptions used to set fossil and NGCC performance rates in the CPP.

Renewable Energy Resource Type	CPP Projected Incremental Generation, 2022-2023 (MWh)	CPP Projected Incremental Generation, 2024-2030 (MWh)	Total CPP Projected Incremental Generation (MWh)	Percentage Contribution From Each RE Resource
Solar PV	6,988,536	49,935,206	56,923,742	11.5%
CSP	1,508,350	16,132,127	17,640,477	3.6%
Onshore Wind	45,404,832	336,570,641	381,975,473	77.5%
Hydropower	2,114,664	21,213,654	23,328,318	4.7%
Geothermal	1,576,064	11,501,915	13,077,979	2.7%
Total Generation	57,592,446	435,353,543	492,945,989	N/A

In 2012, record-shattering amounts of new wind capacity were deployed across the country. It is well known that the anticipated expiration of the wind production tax credit (PTC) led to this unusual circumstance, due to a mad rush to bring new wind facilities into service ahead of the credit's expiration. As the New York Times reported on this phenomenon in late December 2012, the race for PTC eligibility made 2012 and 2013 boom and bust years for new wind facilities:[8]

> *"All over the country, developers are in a sprint to get new wind farms up and running before Tuesday, when two subsidies will disappear like Cinderella's ball gown. After that, the nation's wind-farm building will be at a virtual standstill.*
>
> *The stakes of meeting the deadline are enormous. Wind turbines that are connected to the grid and in commercial service before midnight on New Year's Eve are entitled to <u>a 2.2 cent tax credit for each kilowatt-hour</u> they generate in their first 10 years, which comes out to about $1 million for a big turbine…*
>
> *…According to the Energy Information Administration, the statistical arm of the Energy Department, wind developers were <u>planning to install 12,000 megawatts</u> of wind capacity this year, but as of Nov. 30, only about 6,000 megawatts had been completed.*
>
> *The remaining 6,000 megawatts works out to more than 3,000 turbines: if they are all operating by late Monday night, the wind industry will have added 12 percent to its capacity in a single month.*

When the dust settled on New Year's Day 2013, a record 13,131 megawatts (MW, or 13.1 gigawatts) had been brought online, over half of it in the month of December. This is more than double the average 6.2 gigawatts of wind capacity deployment each year between 2010 and 2014. The impact of PTC expiration on this construction boom is further evidenced by the fact that it was followed by a construction bust in 2013, during which only 1.1 GW was built—a 92% reduction.

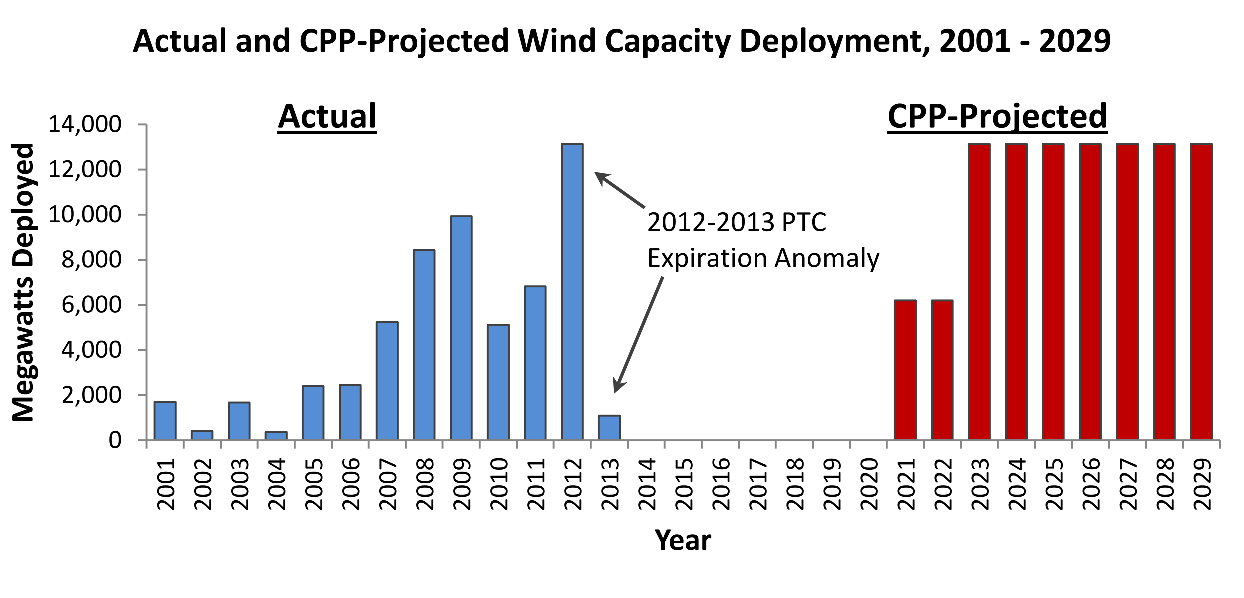
Unfortunately, the renewable energy projections used by EPA to determine state emissions reduction requirements in the CPP not only assume that the 2012 wind deployment anomaly can be repeated; they assume that it will be repeated *<u>each and every year</u>* between 2023 and 2030 (Table 2).

EPA's assumption strains credulity. For starters, in the December 2015 Omnibus spending legislation, Congress instituted a five-year phase-out of the PTC, upon which subsidies gradually reduce until it is permanently expired in 2020. This planning certainty provided by Congress will limit if not eliminate the recurrence of another 2012-like boom year. For example, the National Renewable Energy Laboratory (NREL) estimated wind deployment resulting from a number of PTC expiration and extension scenarios, and concluded that wind deployment would average between 3 and 5 GW per year absent the PTC, and between 3 and 7 GW per year during a multi-year phase-

[8] *Developers of Wind Farms Run a Race Against the Calendar*, December 27, 2012 *New York Times*. Available at http://www.nytimes.com/2012/12/28/science/earth/wind-farm-developers-race-against-end-of-tax-credit.html?_r=0

out of the PTC.[9] The study estimates that a complete, long-term reinstatement of the PTC would result in 8.7 GW annual capacity deployed—still far below EPA's 13.1 GW annual assumption.

Table 2. Actual and CPP-projected wind capacity deployment.



So how influential was EPA's use of the 2012 PTC anomaly to CPP requirements? When EPA's calculations are re-run using capacity built during the second-highest wind deployment year—6,816 GW in 2011—projected incremental annual RE generation is reduced by 23 million GWh, or about 37%. Aggregated over the course of the CPP compliance period, this reduces projected RE generation from 706 million GWh to just 544 million GWh.

When these reduced generation figures are plugged into EPA's formula for calculating "performance standards," the changes translate into increases in the coal- and NGCC- performance standard of 135 lbs/MWh and 26 lb/MWh, respectively. At the state level, these changes average out to an increase of 89 lbs/MWh. And finally, once this rate-based standard is converted to a mass-based standard, it results in nearly **93 million tons of additional allowable emissions**—or 22% of all anticipated CPP reductions. (State-by-state impacts are shown in Tables 5 and 6 and Figure 8 at the end of this report.)

This illustrates how a single faulty assumption can significantly influence the entire calculation, and in doing so, drive down resultant state requirements, potentially costing billions of dollars more in implementation and/or carbon trading fees.

[9] NREL. 2014. *Implications of a PTC Extension on U.S. Wind Deployment.* Available at: http://www.nrel.gov/docs/fy14osti/61663.pdf.

This illustrates how a single faulty assumption can significantly influence the entire calculation, and in doing so, inflate resultant state emissions reduction requirements, potentially costing billions of dollars more in implementation and/or carbon trading fees. If EPA had simply based its performance standards on the 2nd-highest wind deployment year between 2010 and 2014 instead of the anomalous PTC expiration year of 2012, states would be facing far less onerous—and less costly—compliance obligations.

Example 2: EPA's Geothermal Deployment Error

Returning to the tables that EPA uses to calculate renewable generation and make state goals so stringent, a quick check reveals that EPA's assumptions regarding potential increases in geothermal power generation also are extraordinarily high. This is because EPA based its estimate on an obvious error that overstates 2013 geothermal deployment by a factor of four. The aforementioned Tables 4-1 and 4-3 of EPA's GHG Mitigation Measures document shed light on the origin of this mistake.

EPA asserts that 407 MW of geothermal generation capacity was deployed in 2013, far more than any other year in recent history. As a source for this figure, EPA cites both the Geothermal Energy Association (GEA) and the Energy Information Administration (EIA). But neither source supports EPA's assertions. The GEA report cited by EPA estimates that 85 MW of new capacity was added in 2013.[10] Similarly, EIA, which is widely respected as the gold standard on electricity generation data, reports that 96.5 MW of geothermal capacity was added in 2013.[11]

So how did EPA get this so wrong? It appears that the agency sourced a slide from a National Renewable Energy Laboratory (NREL) data book showing 407 MW of geothermal capacity was added in 2013 (Figure 3).[12] However, the NREL slide includes an asterisk stating that "2013 Geothermal: Shift in capacity represents a source change from GEA to EIA."

In other words, before 2013, NREL used GEA data, and after 2013 they began using EIA data. The 407 MW difference was not added capacity, but rather the difference in total installed capacity estimates between GEA and EIA. As in the case of EPA's wind projections, this mistake then works its way through EPA's calculation of performance standards, ultimately increasing the stringency of state emissions reductions requirements.

[10] GEA. 2014. *2014 Annual U.S. & Global Geothermal Power Production Report*. Available at: http://geo-energy.org/events/2014%20Annual%20US%20&%20Global%20Geothermal%20Power%20Production%20Report%20Final.pdf.

[11] EIA.2014. *Electric Power Monthly* (Table 6-1). Available at http://www.eia.gov/electricity/monthly/current_year/february2014.pdf.

[12] 2013 Renewable Energy Data Book, available at http://www.nrel.gov/docs/fy15osti/62580.pdf

Figure 3. Screenshot of NREL slide used by EPA in inflated geothermal deployment assumption (red highlights added)**.**

U.S. Renewable Electricity Nameplate Capacity Added (MW)

	Solar PV*	CSP	Wind	Geothermal	Biomass	Hydropower	Total Capacity Added	Capacity Added as a Percentage of Total Renewable Energy
2001	11	0	1,697	0	(100)	(35)	1,573	2%
2002	23	0	411	0	291	136	861	1%
2003	45	0	1,667	0	(11)	(27)	1,674	2%
2004	58	0	372	0	177	110	717	1%
2005	79	0	2,396	30	189	224	2,918	3%
2006	105	1	2,454	3	331	65	2,959	3%
2007	169	64	5,237	105	185	13	5,773	5%
2008	311	0	8,425	103	747	208	9,794	8%
2009	438	11	9,918	46	351	270	11,034	8%
2010	896	78	5,112	15	218	294	6,613	5%
2011	1,858	0	6,816	138	154	(10)	8,955	6%
2012	3,333	0	13,131	147	840	47	17,498	11%
2013	4,746	410	1,087	407	658	216	7,524	4%

- annual decrease | annual increase +

Sources: EIA, GEA, LBNL, SEIA/GTM, Larry Sherwood/IREC

*Grid-connected only

2013 Geothermal: Shift in capacity represents a source change from GEA to EIA.

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Extrapolated out over the CPP compliance period, the difference between EPA's erroneous projection and actual installed capacity results in an overestimate of potential geothermal generation of more than 2 million GWh. Simply correcting this mistake and using the highest annual generation capacity increase between 2010 and 2014 (147 MW) translates into an increase in the performance standard for coal plants of 13 lbs/MWh and an increase for NGCC plants of 2 lbs/MWh. These, in turn, add another 8 lbs/MWh to the average state target and would allow more than 8 million additional tons of CO_2 emissions under a mass-based compliance regime.

While EPA and its allies might dismiss this embarrassing mistake as inconsequential in nature, at a reasonably expected carbon price of $30 per ton, the error that led to those 8 million tons of additional stringency would cost states (and, ultimately, electricity consumers) more than $240 million.

Example 3: Overestimation of Capacity Factors

As described earlier, EPA's "Best System of Emission Reduction" (BSER) in the Final Rule assumes that future increases in renewable energy generation will replace coal- and NGCC-fired generation on a one-to-one basis, regardless of grid circumstances or renewable resource potential in individual states.[13] What makes this all the more disconcerting is that the final CPP compounds this unreasonable assumption by making optimistic, one-size-fits-all assumptions on the availability of RE generation, regardless of time of day, time of year, or location.

One indicator of these aggressive assumptions is EPA's selection of renewable resource capacity factors in its Building Block 3 calculations. For onshore wind, geothermal, and hydropower, EPA's BSER projects capacity factors significantly greater than what is currently achieved (Table 3). While it is quite reasonable to assume technological improvements will enable higher capacity factors for future renewable projects, the evidence EPA cites in support of its specific assumptions is scant and even contradictory.

Table 3. Renewable resource capacity factors for existing capacity and projected new capacity under the CPP.[14]

Resource Type	2014 Average EIA Capacity Factor (percent)	CPP-projected capacity factor (percent)
Onshore Wind	33.9	41.8
Geothermal	68.8	85.0
Hydropower	37.5	63.8

For example, EPA technical support documents state that projected capacity factors are based on NREL's Annual Technology Baseline (ATB), a spreadsheet with projections on various RE cost and technology factors.[15] While undoubtedly an excellent tool for monitoring changes in factors that could drive deployment of renewable resources, the use of the ATB as a basis for such sweeping regulatory measures is questionable.

For hydropower, the data source cited in support of the ATB's 63.8% average capacity factor projection is listed as "N/A," and no other description or explanation is provided. While it is possible that new hydro projects could in fact achieve EPA's assumed capacity factor, EPA did not bother to make the case at all.

For geothermal energy, the ATB cites a 2010 PacifiCorp report that explores the economic potential of eight geothermal sites in its service territory.[16] The report estimates capacity factors of 80% to 90% for these sites, but emphasizes that the analysis is only "a high-level screen of potential geothermal resources in the PacifiCorp service territory and does not represent a detailed analysis of site specific issues that may affect final development and costs." In other words, EPA is basing future nationwide geothermal energy generation on what appears to be a

[13] Under the Clean Air Act, EPA is authorized to set performance standards based on the "best system of emission reduction" that a source (in this case a power plant) can take to reduce emissions. The CAA requires that BSER be achievable (taking cost into account) at the regulated source or facility.
[14] EIA. *Electric Power Monthly*,=. Available at: http://www.eia.gov/electricity/monthly/epm_Table_grapher.cfm?t=epmt_6_07_b. Note: EIA's most recent report on solar PV and CSP capacity factors includes only partial year data, thus they are not compared to EPA projections.
[15] Available at: http://www.nrel.gov/analysis/data_tech_baseline.html.
[16]Available at: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Integrated_Resource_Plan/2011IRP/PacifiCorp_GeothermalStudy2010_08-10-2010.pdf.

ballpark estimate of a handful of locations. Again, it's quite possible that new geothermal generation will average capacity factors of 85%, but an indirect referencing to a narrowly-focused analysis of a handful of potential sites is hardly the level of evidence necessary to support projections that ultimately saddle electricity consumers with millions in additional regulatory compliance costs.

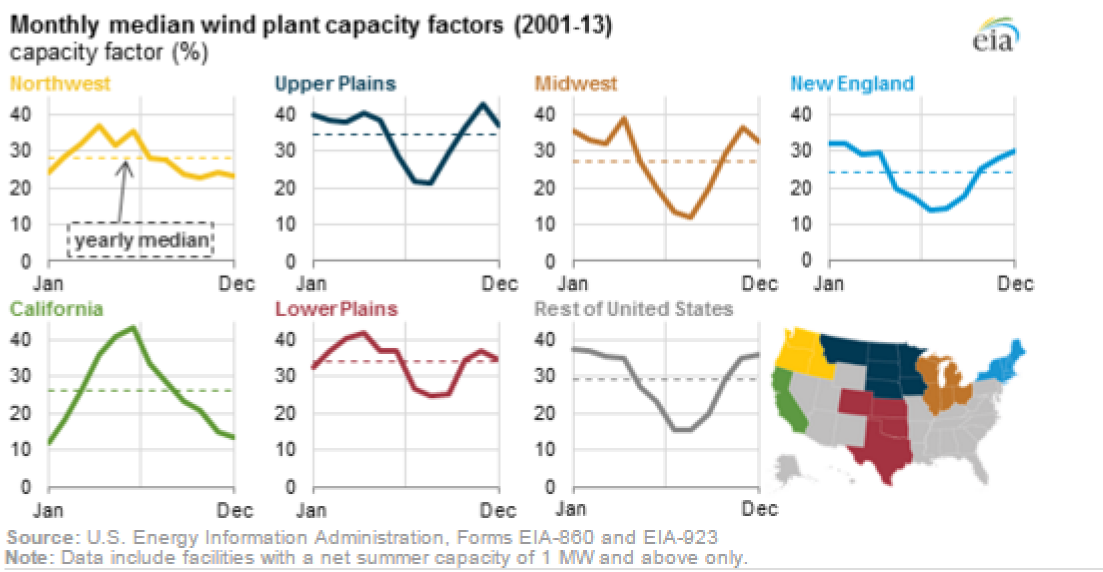
In the case of wind, the ATB cites the Department of Energy's 2015 Wind Vision report.[17] The Wind Vision report does in fact include projections regarding future nationwide capacity factors for onshore wind, but these are based on potential technological capabilities and not necessarily what will actually happen. In fact, the report explicitly notes that steady technological improvements have not translated to increased capacity factors, stating:

> "Although, increased turbine productivity would, under equivalent wind resource conditions, drive an increase in observed capacity factors, *the confounding trend of siting wind power plants in lower quality wind resource areas* (as well as the lag time between technology commercialization and technology deployment) *has resulted in fleet-wide capacity factors remaining relatively flat with time*." [Emphasis added.]

Given that national wind deployment projections are built into state targets regardless of the quality of their wind resource potential (as discussed in the next section), it is reasonable to assume that the CPP may actually exacerbate the trend of siting new wind power in lower quality locations.

In addition to geographic variability, wind capacity factors also vary substantially throughout the year (Figure 4) and throughout the day.

Figure 4. Wind capacity factors by month and geographic location.[18]



[17] Available at: http://www.energy.gov/sites/prod/files/WindVision_Report_final.pdf.

[18] EIA. 2015. "Wind generation seasonal patterns vary across the United States." Today in Energy. Available at: http://www.eia.gov/todayinenergy/detail.cfm?id=20112.

During the day, peak loads typically occur in the early evening hours, while generation from wind tends to be highest later in the night after electricity demand has subsided. As a result, utilities and electricity regulators cannot plan and invest based on the capacity factors used by EPA. Rather, they use "capacity credits" to evaluate how much of a given resource will be available when called upon. A recent paper estimates that the capacity credit factor for wind is in the range of 5% to 15%—far below EPA's projected 41.8%, and simply unrealistic as a substitute for baseload resources that must be available around-the-clock.[19]

To be clear, these criticisms are aimed squarely at EPA's regulatory design and underlying assumptions, and not at renewable energy or its potential. The U.S. Chamber is a steadfast supporter of continued efforts to advance renewable technologies to drive down costs and achieve parity with traditional electricity sources. But the advancements that we aspire to someday realize should not be relied upon as the basis for sweeping regulations.

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So how influential are EPA's capacity factor overestimations to the stringency of the CPP? Re-running EPA's calculations with the capacity factor for wind held flat consistent with the performance of newly installed generation over the last decade—33.9% instead of 41.8%— the resultant coal and NGCC performance standards would increase by 27 lbs/MWh and 6 lbs/MWh, respectively. This translates to increase average state targets by 18 lbs/MWh and would increase the total national mass-based target by more than 18 million additional tons of CO_2 (Table 4).

[19] Available at: http://www.wbklaw.com/uploads/file/Articles-%20News/2015%20articles%20publications/Gifford,%20Sopkin,%20Larson%20EPA%20Building%20Block%203%20Assumptions%20Aug15.pdf.

Collective Influence of EPA's Questionable Building Block 3 Assumptions

Collectively, our modest corrections to the three questionable assumptions examined as part of this analysis would reduce projected increases in renewable generation under the CPP by 211 million MWh—approximately 30 percent of the 706 million MWh increase upon which EPA based state requirements. As shown in Table 4 and Figure 8 (located at the end of the report), the impact of those questionable assumptions on performance rates and state targets is substantial.

Together, replacement of EPA assumptions with more realistic data would reduce the stringency of CPP performance standards for coal and NGCC plants by 175 lbs/MWh and 34 lbs/MWh, respectively. This translates to an increase in average state target rates of 115 lbs/MWh, and would reduce the stringency of nationwide mass-based emissions caps by 117 million tons of CO_2—equivalent to 28% of the entire 413 million tons of reductions that EPA claims will occur because of the rule (Figure 5). The PTC expiration anomaly comprises the bulk of these changes. In fact, EPA's assumption that the highly anomalous 2012 wind deployment rate would be repeated for seven straight years represents *more than 92 million tons, or 22%, of all CPP CO_2 reductions EPA expects from the rule*.

At a reasonably expected carbon price of $30 per ton, the 117 million tons of additional CPP stringency based on EPA's flawed assumptions is equivalent to $3.5 billion in unjustified compliance costs. The impacts of these variables on individual state rate and mass requirements are significant, and shown in Tables 5 and 6 at the end of the report. For example, under the modified Building Block 3 assumptions, Kentucky's target rate would be 1456 lbs/MWh, far higher than the 1286 lbs/MWh assigned to the state by EPA. Translated into mass-based compliance, the corrected BB3 assumptions would increase Kentucky's emissions cap by nearly six million tons of CO2, saving the state more than $175 million in annual compliance costs at a $30 per ton carbon price.

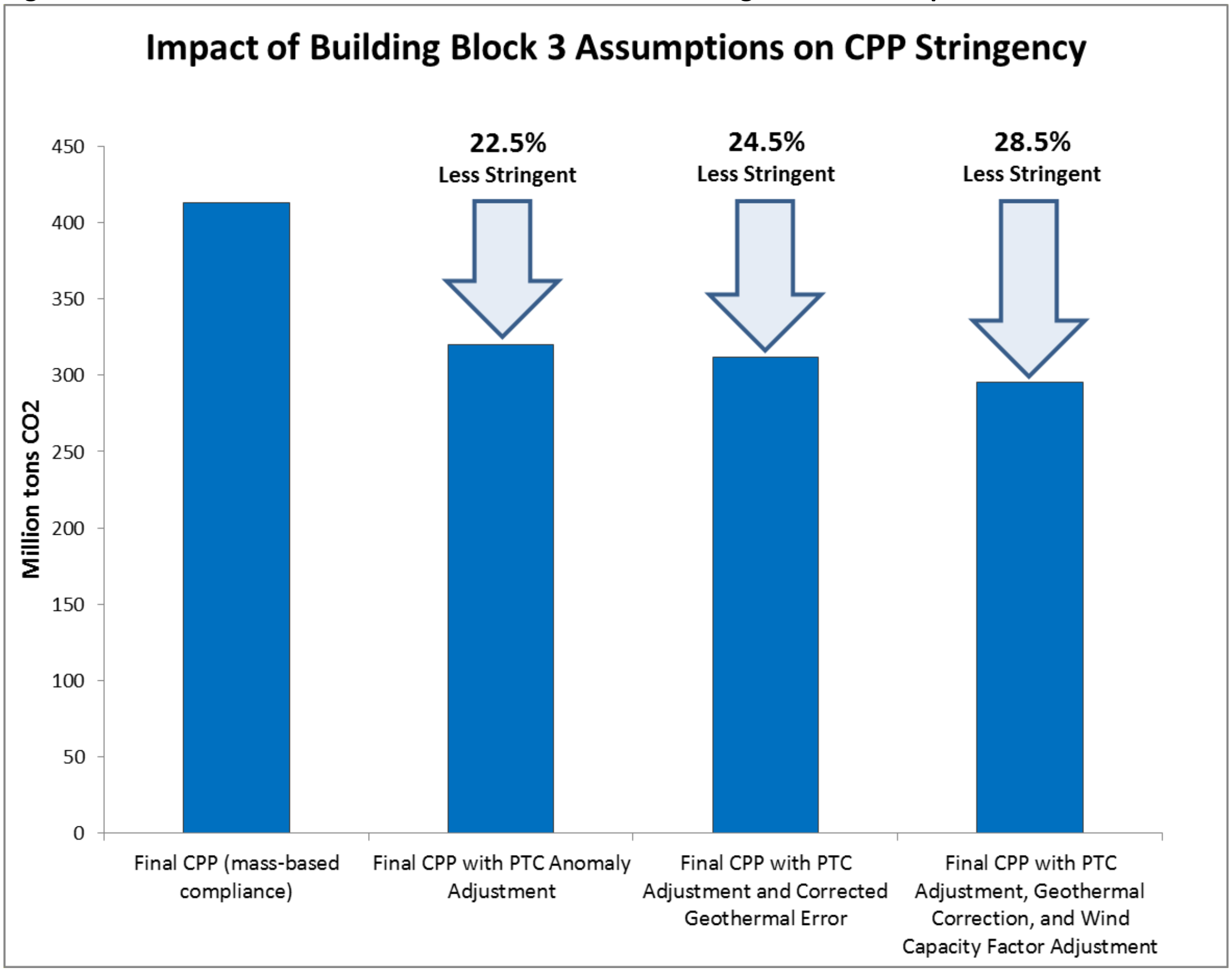
*At a reasonably expected carbon price of $30 per ton, the 117 million tons of additional CPP stringency based on EPA's flawed assumptions is equivalent to **$3.5 billion** in unjustified compliance costs.*

While EPA may choose to quibble with the alternative assumptions we used in our calculations, the fact that subjective and questionable inputs such as these so heavily influence the mandates in this rulemaking is undeniable, and in itself serves as a stinging indictment of the rule.

Table 4. Impact of various Building Block 3 assumption changes on resultant performance rates, state targets, and mass-based emissions caps.

	Rate-based "Performance Standard" (lbs/MWh)		Rate Increase Compared to Final CPP (lbs/MWh)		Average State Target Increase Compared to CPP (lb/MWh)	Mass-based Nationwide Emissions (tons)	Mass-based Increase Compared to Final CPP (tons)
	Fossil[20]	NGCC	Fossil	NGCC			
Baseline (2012)	2160	894	--	--	--	2,227,116,271	--
Final CPP	1305	770	--	--	--	1,668,104,055	--
Final CPP with PTC Anomaly Adjustment	1440	796	135	26	89	1,760,847,582	92,743,527
Final CPP with PTC Adjustment and Corrected Geothermal Error	1453	798	148	28	97	1,769,152,855	101,048,800
Final CPP with PTC Adjustment, Geothermal Correction, and Wind Capacity Factor Adjustment	1480	804	175	34	115	1,785,693,113	117,589,058

Figure 5. CPP CO2 emissions reductions under various Building Block 3 assumptions.



[20] EPA's "fossil fuel steam" performance standard category also includes a small number of oil-fired power plants.

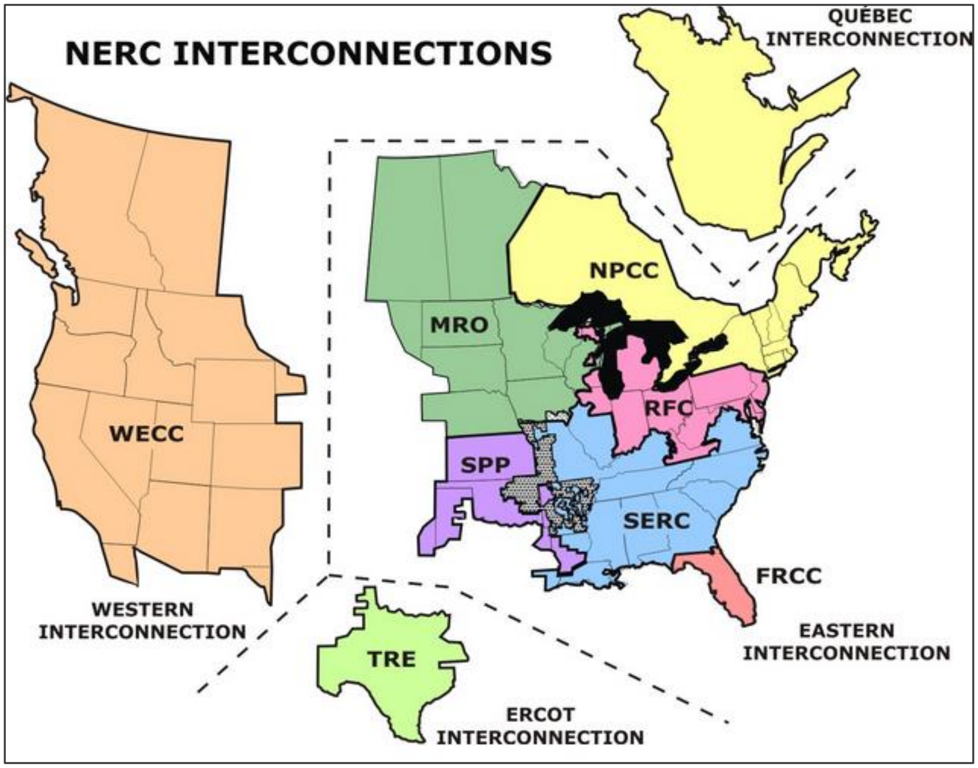
Inherent Unfairness in Basing State Mandates on Nationwide Renewable Generation Assumptions

In her speech announcing the Proposed CPP in 2014, EPA Administrator Gina McCarthy boasted that "the glue that holds this plan together, and the key to making it work, *is that each state's goal is tailored to its own circumstances*" [emphasis added].[21] The design of Building Block 3 was a prime example of this customized approach.

Under the proposal, EPA set renewable energy generation targets based on the circumstances in that state or its surrounding region by: (1) assuming states could deploy renewables at a rate eventually achieving the average renewable portfolio standard in the region; or (2) assuming states could deploy renewables based on the technical potential of renewable resources residing within each state.

In the Final Rule, EPA abandoned both of these concepts, reversing course on what it had touted as the "glue" of the CPP and basing renewable assumptions on historic *nationwide* deployment instead of more state-specific circumstances. EPA's regulatory formula then assumes that these national renewables projections displace fossil generation evenly within each of the three electricity grid regions that it uses to set state goals—the Eastern Interconnection, Western Interconnection, and ERCOT (Texas) Interconnection (Figure 6).[22]

Figure 6. NERC interconnections used for setting state CPP requirements.



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[21] Available at http://yosemite.epa.gov/opa/admpress.nsf/8d49f7ad4bbcf4ef852573590040b7f6/c45baade030b640785257ceb003f3ac3!opendocument.

[22] Not including Vermont, which has no CPP compliance obligations.

For example, the 35 states in the Eastern Interconnection currently house 62% of all nationwide fossil generation. EPA therefore assigns 62% of its 706 million MWh national renewable growth projection to this region (a total of 438 million MWh). This regional generation projection is then assigned to states based on their proportionate fossil generation. For example, Tennessee generates exactly 2.1% of the total fossil generation within Eastern Interconnection states, so inherent in the calculation of Tennessee's target rate is an assumption that it will generate 2.1% of EPA-projected renewable generation for the Eastern Interconnection (9.2 million MWh).

Further, because wind comprises nearly 80% of the projected renewable generation that drives state requirements, inherent in these calculations is an assumption that Tennessee is on the hook for 7.2 million MWh of wind generation. But there is a major problem with this assumption: Tennessee has very little technical potential for wind generation. In fact, a recent NREL study (cited by EPA in the Proposed Rule as evidence in support of its state-tailored renewable assumptions) found that the technical potential for wind generation in Tennessee is less than one-tenth the 7.2 million MWh that is built into the state's CPP target.[23]

Including Tennessee, a remarkable 18 of the 34 states in the Eastern Interconnection simply do not have the wind generation potential that EPA assigns to them in their state targets (Figure 7 and Table 5). In effect, this means that the BSER that serves as the foundation of the rule expects these states to shut down in-state coal and NGCC generation and replace it with imported wind generation from other states, in many cases via hundreds of miles of transmission lines that currently don't exist and which would be extremely expensive to construct.

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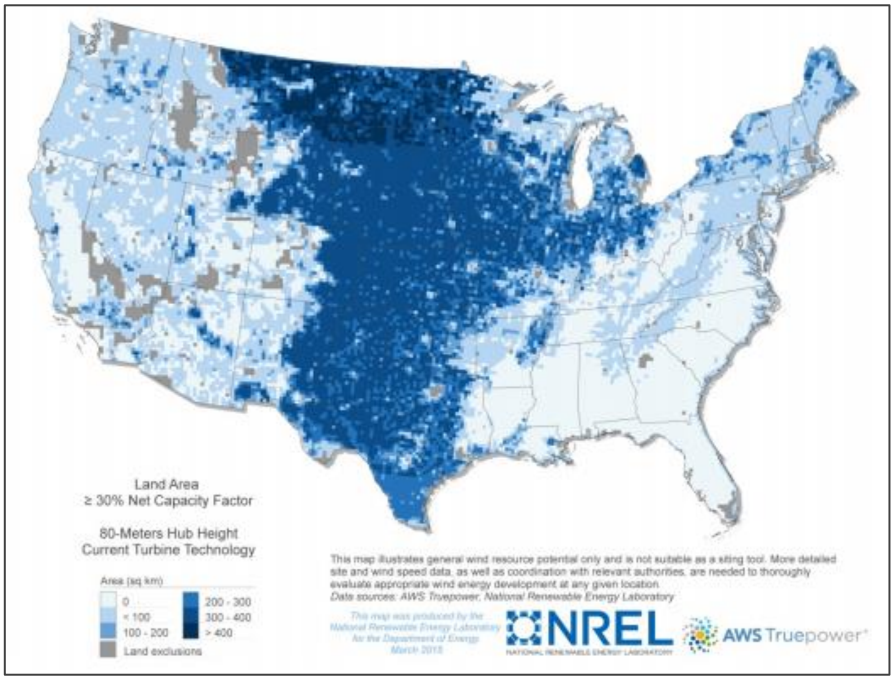
[23] NREL. 2012. *U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis*. Available at: http://www.nrel.gov/docs/fy12osti/51946.pdf.

Figure 7. Land area achieving 30% capacity factor for onshore wind (and thus commercially viable).[24]



As is custom, EPA would likely respond that the Final Rule doesn't *force* states to import this wind generation if they choose not to do so (EPA's typical response to all feasibility and achievability concerns regarding the CPP and BSER in particular is that states are free to pursue alternative options such as entering into cap and trade regimes or developing other in-state renewables such as solar).

This argument obscures the more important point that BSER—the technical basis under which EPA develops and promulgates Clean Air Act performance standards—must be achievable at a reasonable cost, and must not impose uneven requirements on different regulated entities. We'll let the lawyers debate whether the final CPP does this, but at a minimum, the requirements imposed upon certain states and utilities (particularly in the Southeast) as a result of the Final Rule's wind-dominated BSER assumptions are inherently unfair.

[24] DOE. 2015. *Wind Vision: A New Era for Wind Power in the United States*. Available at: http://www.energy.gov/sites/prod/files/WindVision_Report_final.pdf.

Table 5. Implied wind generation in CPP state targets for the Eastern Interconnection.

State	Wind Generation Implicit in State Target (MWh) [77.3% of total BSER RE Generation * State fossil generation as a fraction of total Eastern Interconnect generation]	NREL Onshore Wind Generation Technical Potential (MWh)	Technical Wind Generation Potential - Wind Generation Implicit in State Target (MWh)	Percent of Wind Generation Implicit in State Target that Cannot be Met by In-state Onshore Wind
Alabama	17,095,993	283,000	(16,812,993)	**99%**
Arkansas	8,209,726	22,892,000	14,682,274	
Connecticut	2,702,738	62,000	(2,640,738)	**98%**
Delaware	1,573,661	18,000	(1,555,661)	**99%**
Florida	34,994,924	953	(34,993,971)	**100%**
Georgia	13,518,407	322,680	(13,195,727)	**98%**
Iowa	5,966,636	1,709,555,370	1,703,588,735	
Illinois	16,334,016	641,741,121	625,407,105	
Indiana	18,749,031	374,393,786	355,644,755	
Kansas	5,203,152	3,096,380,387	3,091,177,235	
Kentucky	15,018,781	147,356	(14,871,425)	**99%**
Louisiana	9,666,657	934,652	(8,732,005)	**93%**
Massachusetts	4,493,459	2,737,640	(1,755,819)	**53%**
Maryland	3,411,704	3,310,047	(101,657)	**25%**
Maine	814,987	27,855,893	27,040,907	
Michigan	12,447,908	142,776,134	130,328,225	
Minnesota	5,719,147	1,420,909,275	1,415,190,128	
Missouri	13,345,802	688,274,457	674,928,655	
Mississippi	8,192,270	-	(8,192,270)	**100%**
North Carolina	13,813,956	2,037,456	(11,776,499)	**89%**
North Dakota	4,896,598	2,532,550,265	2,527,653,667	
Nebraska	4,314,272	3,009,968,971	3,005,654,699	
New Hampshire	1,425,495	5,497,781	4,072,286	
New Jersey	6,257,881	305,699	(5,952,182)	**96%**
New York	10,423,498	60,574,140	50,150,642	
Ohio	18,961,692	128,157,343	109,195,651	
Oklahoma	11,597,623	1,513,494,324	1,501,896,701	
Pennsylvania	25,096,083	6,102,024	(18,994,060)	**81%**
Rhode Island	1,397,880	128,463	(1,269,417)	**93%**
South Carolina	6,883,805	427,996	(6,455,809)	**95%**
South Dakota	928,373	2,898,943,418	2,898,015,044	
Tennessee	7,162,307	718,039	(6,444,269)	**92%**
Virginia	8,982,646	4,589,245	(4,393,400)	**61%**
West Virginia	12,034,516	3,665,603	(8,368,913)	**76%**

Conclusion

EPA has marketed the final Clean Power Plan as something that it is not. Between its June 2014 proposal and August 2015 Final Rule, the agency made dramatic changes to the CPP's design and structure, claiming to establish "source-specific performance rates" that treat all coal and natural gas power plants equally. These performance rates now drive all state and utility compliance requirements under the CPP.

But unlike every Clean Air Act standard that preceded it, EPA's performance rates are not performance rates at all. They have almost nothing to do with the fossil-fueled power plants that EPA purports to be regulating, and instead are based primarily on the presumption that power plant owners should replace coal- and gas-fired generation with massive amounts of new renewable energy.

The nature of this regulatory design is unprecedented, and is itself a stinging indictment of the rule. As this report shows, however, this design provides the foundation upon which EPA used highly unrealistic renewable energy generation projections to impose more stringent requirements on states. The compliance implications of these questionable assumptions are massive. The three questionable renewable assumptions examined in this report account for 28% of the stringency of the entire CPP. Without them, EPA's rate-based state targets would average 115 lbs/MWh higher, and allow for 117 million tons of additional emissions under a mass-based compliance scenario. At a $30 per ton price of carbon dioxide, these questionable assumptions translate to $3.5 billion in unjustified regulatory compliance costs.

The design of the final CPP adds to the unfair burdens imposed upon states by basing *state* requirements on *national* renewable projections. In short, EPA's renewable projections under Building Block 3 are incorporated into state requirements evenly, regardless of whether states have potential to achieve the projected renewable generation that is built into their target. As a result, and because of the wide geographic variability of onshore wind generation, 18 state targets are assigned more wind generation than the technical potential available to them in those states. In other words, the final CPP emissions reduction requirement for these states forces them to reach beyond state lines in order to use the massive amounts of wind resources baked into their CPP target.

To be clear, these criticisms are intended to expose the flawed design, unrealistic mandates, and inherent unfairness in the Clean Power Plan, and in no way present a statement on the potential for renewable energy to significantly contribute to our electricity system. The U.S. Chamber remains a strong and steadfast supporter of continued efforts to advance renewable technologies to drive down costs and achieve parity with traditional electricity sources, but the advancements that we hope to someday realize should not be relied upon as the foundation for sweeping regulations.

Table 6. Impact of various changes to EPA renewable energy generation assumptions on state target emissions rates.

State	2012 Emissions Rate	Final 2030 CPP Target Rate and % Reduction from 2012		Target Rate Without PTC Expiration Anomaly and % Reduction from 2012		Target Rate Without PTC Anomaly + Geothermal Error and % Reduction from 2012		Target Rate Without PTC Anomaly, Geothermal Error, and Wind Capacity Factor Overestimation and % Reduction from 2012	
Alabama	1,518	1,018	32.9	1,094	27.9	1,101	27.5	1,116	26.5
Arizona	1,552	1,031	33.6	1,109	28.5	1,117	28.0	1,133	27.0
Arkansas	1,816	1,130	37.8	1,229	32.3	1,239	31.8	1,258	30.7
California	954	828	13.2	864	9.4	868	9.0	876	8.2
Colorado	1,904	1,174	38.3	1,282	32.7	1,293	32.1	1,314	31.0
Connecticut	846	786	7.1	814	3.8	816	3.5	822	2.8
Delaware	1,209	916	24.2	971	19.7	976	19.2	987	18.3
Florida	1,221	919	24.7	974	20.2	980	19.8	991	18.8
Georgia	1,597	1,049	34.3	1,131	29.2	1,139	28.7	1,156	27.6
Idaho	834	771	7.6	796	4.6	798	4.3	804	3.6
Illinois	2,149	1,245	42.1	1,368	36.3	1,380	35.8	1,404	34.7
Indiana	2,025	1,242	38.7	1,364	32.6	1,376	32.0	1,400	30.8
Iowa	2,195	1,283	41.5	1,414	35.6	1,426	35.0	1,452	33.9
Kansas	2,288	1,293	43.5	1,426	37.7	1,439	37.1	1,465	36.0
Kentucky	2,122	1,286	39.4	1,417	33.2	1,430	32.6	1,456	31.4
Louisiana	1,577	1,121	28.9	1,219	22.7	1,228	22.1	1,247	20.9
Maine	873	779	10.8	805	7.8	808	7.5	813	6.8
Maryland	2,031	1,287	36.6	1,418	30.2	1,431	29.5	1,457	28.3
Massachusetts	1,003	824	17.8	860	14.3	864	13.9	871	13.2
Michigan	1,928	1,169	39.4	1,276	33.8	1,286	33.3	1,307	32.2
Minnesota	2,082	1,213	41.7	1,330	36.1	1,341	35.6	1,364	34.5
Mississippi	1,151	945	17.9	1,006	12.6	1,012	12.1	1,024	11.0
Missouri	2,008	1,272	36.7	1,400	30.3	1,412	29.7	1,438	28.4
Montana	2,481	1,305	47.4	1,440	42.0	1,453	41.4	1,480	40.4

State (cont'd)	2012 Emissions Rate	Final 2030 CPP Target Rate and % Reduction from 2012		Target Rate Without PTC Expiration Anomaly and % Reduction from 2012		Target Rate Without PTC Anomaly + Geothermal Error and % Reduction from 2012		Target Rate Without PTC Anomaly, Geothermal Error, Wind Capacity Factor Overestimation and % Reduction from 2012	
Nebraska	2,161	1,296	40.0	1,429	33.9	1,442	33.3	1,468	32.0
Nevada	1,102	855	22.4	897	18.6	901	18.3	909	17.5
New Hampshire	1,119	858	23.3	901	19.5	905	19.1	914	18.3
New Jersey	1,058	812	23.3	845	20.2	848	19.8	855	19.2
New Mexico	1,798	1,146	36.3	1,249	30.5	1,259	30.0	1,279	28.9
New York	1,140	918	19.5	973	14.7	978	14.2	989	13.2
North Carolina	1,673	1,136	32.1	1,236	26.1	1,245	25.6	1,265	24.4
North Dakota	2,368	1,305	44.9	1,440	39.2	1,453	38.6	1,480	37.5
Ohio	1,855	1,190	35.8	1,302	29.8	1,313	29.2	1,335	28.0
Oklahoma	1,565	1,068	31.8	1,154	26.2	1,163	25.7	1,180	24.6
Oregon	1,089	871	20.0	917	15.8	921	15.4	931	14.5
Pennsylvania	1,642	1,095	33.3	1,187	27.7	1,196	27.2	1,214	26.1
Rhode Island	918	771	16.0	796	13.3	798	13.0	804	12.5
South Carolina	1,791	1,156	35.5	1,260	29.7	1,270	29.1	1,291	27.9
South Dakota	1,895	1,167	38.4	1,273	32.8	1,283	32.3	1,305	31.2
Tennessee	1,985	1,211	39.0	1,327	33.2	1,338	32.6	1,361	31.4
Texas	1,553	1,042	32.9	1,122	27.7	1,130	27.2	1,146	26.2
Utah	1,790	1,179	34.1	1,288	28.0	1,299	27.5	1,320	26.2
Virginia	1,366	934	31.6	993	27.3	999	26.9	1,011	26.0
Washington	1,566	983	37.2	1,052	32.8	1,059	32.4	1,072	31.5
West Virginia	2,064	1,305	36.8	1,440	30.2	1,453	29.6	1,480	28.3
Wisconsin	1,996	1,176	41.1	1,284	35.6	1,295	35.1	1,316	34.0
Wyoming	2,315	1,299	43.9	1,433	38.1	1,446	37.5	1,472	36.4
Fort Mojave Reservation	858	771	10.1	796	7.3	798	7.0	804	6.3
Navajo Reservation	2,121	1,305	38.5	1,440	32.1	1,453	31.5	1,480	30.2
Ute Reservations	2,145	1,305	39.2	1,440	32.9	1,453	32.2	1,480	31.0

Table 7. Impact of various changes to EPA renewable energy generation assumptions on state mass-based emissions caps.

State	2012 Mass Emissions	2030 CPP Mass Emissions Cap	Mass Cap Without PTC Expiration Anomaly	Mass Cap Without PTC Anomaly + Geothermal Error	Mass Cap Without PTC Anomaly, Geothermal Error, and Wind Capacity Factor Overestimation	Total Increase in Emissions from Modified BB3 Assumptions	Avoided Annual Compliance Costs from Modified Mass Targets at $30/ton CO2
Alabama	75,571,781	56,880,474	59,529,858	59,766,748	60,238,797	3,358,323	$100,749,702
Arizona	88,864,875	30,170,750	31,624,024	31,754,007	32,012,993	1,842,243	$55,267,276
Arkansas	39,935,335	30,322,632	32,123,196	32,284,520	32,605,743	2,283,111	$68,493,320
California	46,100,664	48,410,119	49,230,424	49,302,550	49,447,192	1,037,073	$31,112,177
Colorado	41,759,882	29,900,396	31,805,693	31,976,488	32,316,502	2,416,106	$72,483,172
Connecticut	6,659,803	6,941,522	7,000,167	7,005,186	7,015,355	73,833	$2,214,990
Delaware	4,809,281	4,711,824	4,863,673	4,877,193	4,904,177	192,352	$5,770,566
Florida	118,395,844	105,094,703	108,526,574	108,832,184	109,442,107	4,347,403	$130,422,094
Georgia	62,851,752	46,346,846	48,682,333	48,891,306	49,307,614	2,960,769	$88,823,068
Idaho	703,517	1,492,855	1,500,650	1,501,294	1,502,618	9,762	$292,865
Illinois	96,106,169	66,477,156	71,139,270	71,557,456	72,389,773	5,912,617	$177,378,514
Indiana	107,299,591	76,113,834	81,431,511	81,908,489	82,857,829	6,743,994	$202,319,831
Iowa	38,135,386	25,018,136	26,850,207	27,014,585	27,341,715	2,323,580	$69,707,390
Kansas	34,353,105	21,990,825	23,619,024	23,765,121	24,055,860	2,065,034	$61,951,032
Kentucky	91,372,076	63,126,121	67,764,424	68,180,594	69,008,809	5,882,688	$176,480,646
Louisiana	43,028,425	35,427,022	37,498,507	37,684,084	38,053,612	2,626,590	$78,797,702
Maine	1,795,630	2,073,942	2,088,251	2,089,461	2,091,923	17,982	$539,445
Maryland	20,171,027	14,347,627	15,402,635	15,497,296	15,685,678	1,338,051	$40,141,534
Massachusetts	13,125,248	12,104,746	12,301,318	12,318,581	12,353,217	248,471	$7,454,134
Michigan	69,860,454	47,544,063	50,549,496	50,818,894	51,355,217	3,811,154	$114,334,613
Minnesota	28,263,179	22,678,368	24,205,758	24,342,728	24,615,365	1,936,998	$58,109,925
Mississippi	25,903,886	25,304,337	26,230,995	26,313,636	26,478,476	1,174,139	$35,224,159
Missouri	78,039,449	55,462,884	59,473,606	59,833,432	60,549,543	5,086,659	$152,599,782
Montana	17,924,535	11,303,107	12,150,328	12,226,354	12,377,644	1,074,538	$32,236,131

State (cont'd)	2012 Mass Emissions	2030 CPP Mass Emissions Cap	Mass Cap Without PTC Expiration Anomaly	Mass Cap Without PTC Anomaly + Geothermal Error	Mass Cap w/o PTC Anomaly, Geothermal Error, and Wind Capacity Factor Overestimation	Total Increase in Emissions from Modified BB3 Assumptions	Avoided Annual Compliance Costs from Modified Mass Targets at $30/ton CO2
Nebraska	27,142,728	18,272,738	19,629,583	19,751,333	19,993,621	1,720,883	$51,626,482
Nevada	15,536,730	13,523,583	13,819,601	13,845,785	13,898,175	374,592	$11,237,755
New Hampshire	4,642,898	3,997,579	4,087,601	4,095,568	4,111,506	113,927	$3,417,814
New Jersey	15,207,143	16,599,744	16,828,169	16,848,130	16,888,254	288,509	$8,655,279
New Mexico	17,339,683	12,412,601	13,170,393	13,238,277	13,373,434	960,833	$28,824,978
New York	34,596,456	31,257,428	32,271,590	32,361,894	32,542,124	1,284,696	$38,540,878
North Carolina	58,566,353	51,266,233	54,338,842	54,614,157	55,162,337	3,896,103	$116,883,099
North Dakota	33,370,886	20,883,231	22,448,528	22,588,990	22,868,510	1,985,279	$59,558,367
Ohio	102,239,220	73,769,805	78,584,466	79,016,133	79,875,433	6,105,628	$183,168,830
Oklahoma	52,862,077	40,488,199	42,619,466	42,810,238	43,190,232	2,702,033	$81,061,000
Oregon	7,659,775	8,118,653	8,320,232	8,338,105	8,373,835	255,181	$7,655,442
Pennsylvania	116,657,632	89,822,307	94,822,302	95,270,062	96,161,790	6,339,483	$190,184,481
Rhode Island	3,735,786	3,522,224	3,540,614	3,542,134	3,545,257	23,033	$690,981
South Carolina	35,893,265	25,998,967	27,609,479	27,753,820	28,041,192	2,042,225	$61,266,749
South Dakota	3,184,962	3,539,481	3,762,506	3,782,497	3,822,296	282,815	$8,484,447
Tennessee	41,222,026	28,348,396	30,251,968	30,422,668	30,762,450	2,414,054	$72,421,622
Texas	240,730,037	189,588,841	198,970,532	199,809,848	201,481,997	11,893,156	$356,794,670
Utah	30,822,343	23,778,193	25,304,418	25,441,238	25,713,613	1,935,420	$58,062,604
Virginia	27,365,439	27,433,111	28,394,277	28,479,948	28,650,868	1,217,757	$36,532,714
Washington	7,360,183	10,739,172	11,190,237	11,230,526	11,310,842	571,670	$17,150,111
West Virginia	72,318,917	51,325,341	55,172,418	55,517,636	56,204,621	4,879,279	$146,378,378
Wisconsin	42,317,602	27,986,988	29,775,633	29,935,974	30,255,175	2,268,187	$68,045,612
Wyoming	49,998,736	31,634,412	33,990,983	34,202,442	34,623,253	2,988,841	$89,665,232
Fort Mojave	583,530	588,519	591,591	591,845	592,367	3,848	$115,454
Navajo	31,416,873	21,700,586	23,327,148	23,473,108	23,763,568	2,062,981	$61,889,440
Ute	3,314,097	2,263,431	2,433,085	2,448,309	2,478,605	215,175	$6,455,238
Total	**2,227,116,27**	**1,668,104,0**	**1,760,847,582**	**1,769,152,85**	**1,785,693,113**	**117,589,058**	**$3,527,671,725**

Figure 8. Impact of Building Block 3 Assumptions on State Target Rates