Reliability Standards, Safety Valves, and the State Clean Power Plan Compliance Obligation

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Introduction

In its April 2015 assessment of the proposed Clean Power Plan (CPP),[1] the North American Electric Reliability Corporation (NERC) recommended that: "[t]he U.S. Environmental Protection Agency (EPA) should include a formal reliability assurance mechanism in the final rule that provides the regulatory certainty and explicit recognition of the need to ensure reliability during both the plan development and the implementation period through 2030—and potentially beyond." NERC's recommendation, alluding to the "safety valve" concept put forward in other similar proposals, suggests that such a mechanism could "include timing adjustments and the granting of extensions to an entity's implementation of and compliance with its CPP implementation plan where there is a demonstrated reliability need."

NERC is right to assert that proposed state plans for complying with the 111(d) regulations must not jeopardize bulk power system reliability. However, NERC errs in placing the burden for specifying a mechanism to ensure reliability on EPA within the 111(d) regulation. EPA is giving states flexibility in defining their compliance plans and it is reasonable for EPA to require that states present plans that safeguard reliability. EPA only needs to consider a "reliability assurance mechanism" after a state proves to EPA that it has fully explored all combinations of carbon reduction measures available to it and that it is unable to comply in a manner that meets well-defined standards for reliability.

Given the number of carbon reduction tools available and the compliance flexibility the proposed rule offers, it seems unlikely that states will be unable to comply in a manner that protects reliability. It is nevertheless worth considering what EPA should do if a state is legitimately unable to present a CPP compliance plan that maintains compliance with existing reliability standards. A reliability assurance mechanism that includes a "safety valve" could be established in concert with NERC to address this exceptional situation and it is worth considering how such a safety valve might be designed.

EPA Should Require States to Present a Compliance Plan that Meets Reliability Standards

NERC's recommendation that EPA should provide a safety valve is sound in its intended *purpose*. Some sort of mechanism is warranted to ensure that state plans for complying with the 111(d) regulations, as well as actions taken to implement state plans, will not jeopardize bulk power system reliability. There is little if any disagreement among any of the interested parties on this question. However, NERC appears to be laying the responsibility for this safety valve at EPA's doorstep, implying that the final rule will be unworkable unless it includes such a mechanism. This is inconsistent with the established requirements of the Clean Air Act. Furthermore, NERC appears to be suggesting, and frequently is interpreted to be suggesting, that the only way to protect reliability is to relax the proposed CPP standards, delay implementation,

1 The proposed Clean Power Plan and other relevant information are available at http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule

or offer waivers or exemptions to individual power plants. NERC appears not to have considered the possibility that in the unlikely event of a conflict between the standard promulgated by EPA and the standard promulgated by NERC, both standards could be understood to accommodate some degree of flexibility in allowing remedial measures to take effect, depending on the specific circumstances. Whether intentionally or unintentionally, this fuels a public narrative that has more to do with opposition to greenhouse gas regulation than it has to do with reliability.

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Section 111(d) of the Clean Air Act actually lays the burden of developing workable compliance plans *with the states*. Each state must submit "a plan which provides for the implementation and enforcement of… standards of performance." EPA must *permit* states "in applying a standard of performance to any particular source to take into consideration, among other factors, the remaining useful life of the existing source to which such standard applies." But it is not EPA taking into consideration those factors, it is the states – at least initially. If a state fails to submit a satisfactory plan, only then does the Clean Air Act give the EPA Administrator the authority to prescribe a federal plan for the state and to take into consideration those same factors. Thus, the only proper place for EPA to include a safety valve would be in a federal implementation plan.[2] That plan would only be applied if a state fails to submit an acceptable plan.

A better solution—one that is more consistent with the Clean Air Act and more consistent with the almost universally stated desire for flexibility in the 111(d) rule—would be to place the burden on states to develop 111(d) compliance plans that do not jeopardize reliability. States can and should take those "other factors" into consideration as they develop their plans, and they can and should assess their plans for potential reliability impacts. EPA could consider adding to the final 111(d) rule an expectation for states to assess reliability impacts in their plan submissions. If a state's proposed plan has the potential to jeopardize reliability in that state or another state, it would be appropriate for EPA to reject the plan and send the state back to the drawing board or, if necessary, impose a workable federal plan. There is no need for EPA to consider relaxing or delaying the standards unless and until a state can demonstrate that there is no feasible compliance plan (including entering into a multi-state compliance plan or adhering to a federal implementation plan) that does not jeopardize reliability. As importantly, EPA can join with NERC, the Federal Energy Regulatory Commission (FERC), and the Department of Energy (DOE), in establishing the performance threshold at which the threat to reliability is material enough to warrant activation of the safety valve, as discussed below.

Guidance to States

Reliability Standards and Safety Valves

State reliability assessments should identify the reliability standards they will use to assess whether a compliance plan "jeopardizes reliability." The assessments would define and quantify those standards in a manner that allows decision makers to evaluate appropriate responses to different levels of expected under-performance against the standard. This assessment must also recognize that there is no bright line between "reliable" and "unreliable" but rather that this assessment will take place along a continuum from "more reliable" to "less reliable." Regional reliability organizations, electric system operators, and state public utility commissions are accustomed to reliability standards and how they operate in practice. A state air regulator will want to coordinate with these reliability experts in testing compliance and considering the appropriate nature of any proposed safety valve.

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Safety valves operate on the idea that while all critical systems must be designed with some tolerance for operating conditions outside of normal design limits, there is a point beyond which a fail-safe mechanism should be triggered to prevent catastrophic failure. When applying this concept to the resource adequacy of a power system, one must consider, how normal limits are set and how much tolerance around

2 EPA has publicly stated its intention to propose a federal implementation plan later this year, followed by a normal public comment period.

those limits can or should be allowed before activating a fail-safe measure that temporarily defers compliance with any law.

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Understanding the Resource Adequacy Standard

To determine the tolerance limit at which a safety valve should be triggered, it is necessary to understand the design standards and the consequences of exceeding them. In the case of power system resource adequacy, both the description of the standard and how it is applied vary considerably across states and regions. This in itself presents a challenge in designing a workable mechanism, but for the purposes of this brief we will apply the widely used formulation of "one day in ten years."[3]

What does "one day in ten years" mean? It does *not* mean that a customer should expect to be in the dark for 2.4 hours in an average year because of supply shortfalls. First, it is important to understand that it is a probabilistic analysis, based on a forecast of demand and supply, historical performance of the various system components, historical demand patterns, historical weather, and other relevant factors. This substantial collection of forecasts and statistics is used to construct a model of the system and run a large number of simulations to estimate how many times in ten years of operating the system as modeled one could expect demand to exceed the available supply—the same way one might estimate the number of times in a thousand rolls that a pair of dice would come up snake eyes.

Some systems explicitly frame the standard as "one event" rather than "one day." In practice, under either formulation a shortfall of any magnitude, for any period of time, leading to any load interruptions, tends to be treated as an event, a "day" during which a shortfall occurs. There is also no common understanding of what constitutes a reliability violation. Some systems count the imposition of revolving voltage reductions ("rolling brown-outs") or even calls on voluntary demand reductions, while others count only involuntary load curtailments ("rolling black-outs").[4] If the language of the standard is ambiguous in practice and if the consequences of exceeding it cannot be clearly understood by policymakers, it is practically impossible to make an informed decision about whether and how to design an appropriate safety valve.

Tolerances and Triggers: What's at Stake in Meeting or Missing a Standard?

A study done by the Brattle Group in 2012 for the Public Utility Commission of Texas offers a meaningful understanding of the "one-in-ten" standard.[5] In that analysis, Brattle postulated a set of reasonable interpretations of the language of the Electric Reliability Council of Texas (ERCOT) standard, which mirrors NERC's application of the standard. Brattle concluded that compliance means the average Texas consumer should expect to experience about 0.3 minutes—approximately 20 seconds—of supply-related service interruptions in an average year. To put this design standard for having enough generation capacity in perspective, that same Texas consumer can expect 100 to 300 minutes of service interruptions in an average year due to transmission and distribution system issues[6]—a level of

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3 The origins of and basis for this standard are obscure. References to it began to appear in professional papers on power system engineering in the late 1940s without any supporting analytical rationale. Over time it acquired its current status without any further elucidation of the underlying rationale. Some regions, such as the Tennessee Valley Authority (TVA) and SERC Reliability Corporation, use an entirely different metric.

4 For a good discussion of the ambiguity and disparity in the application of the standard see Pfeifenberger, J.P., Spees, K., Carden, K., and Wintermantel, N. (2013). *Resource Adequacy Requirements: Reliability and Economic Implications.* Retrieved from http://www.ferc.gov/legal/staff-reports/2014/02-07-14-consultant-report.pdf.

5 Newell, S., Spees, K., Pfeifenberger, J., Mudge, R., DeLucia, M., Carlton, R. (2012). *ERCOT Investment Incentives and Resource Adequacy.* The Brattle Group for the Electric Reliability Council of Texas. Retrieved from http://www.ercot.com/content/news/presentations/2012/Brattle%20ERCOT%20Resource%20Adequacy%20Review%20-%202012-06-01.pdf.

6 This does *not* include outages due to "major events" such as hurricanes.

performance roughly similar to that seen in most parts of the country. For better or worse, that is the level of service reliability to which most American electricity consumers are accustomed.

One might reasonably conclude, then, that the standard for resource adequacy sets a performance threshold for supply-related service interruptions that falls well within the background noise of the average customer's overall experience of service reliability. Strict compliance with the standard means that per customer interruptions due to not having enough generating capacity on the system are expected to amount to about 0.15 percent of service interruptions from all causes. It is difficult to reconcile this fact with the impression cultivated by many in industry that strict enforcement of the resource adequacy standard is the bright line separating a "reliable" power system from an "unreliable" power system, between "keeping the lights on" and "the lights going out." Nonetheless, "one-in-ten" is the commonly accepted standard and there is no suggestion here that it should be relaxed, for the CPP or otherwise. While accepting that the standard is the standard, important questions must be answered in considering the appropriate design of a safety valve: What is at stake in allowing the system to fall short of the standard by some amount, for some period of time, for whatever reason? How should we calibrate our responses should the risk of doing so arise? At what point(s) does exemption from compliance with the law constitute a proportionate response?

To help us answer these questions, another way of understanding the standard is to consider the cost and the value of an incremental unit of resource adequacy. Economists have assessed the value that consumers of various energy services place on avoiding interruption of those services. This value tends to fall in a range between $1,000 and $30,000 per MWh. The cost of the marginal resource to meet the "one day in ten years" standard ranges from approximately $30,000/MWh under a liberal interpretation to $400,000 or more per MWh under the interpretation most widely applied in practice. The cost of acquiring the marginal resource is thus more than 20 times higher, under accepted industry practice, than the mid-point of the range of the value estimated by economists (about $15,000 per MWh).While a case can be made, based on additional benefits, for incurring costs in excess of the value of avoided load shedding, a multiplier of 20+ times that value seems surely ample to cover all additional benefits with room to spare. How much room there is to spare, while measures are taken to bring the system back up to the desired condition, is *the* key question for any proposed safety valve. For instance, using the "liberal interpretation" of the current standard referenced above as the trigger would equate to about three minutes of supply-related service interruptions per customer per year, ten times the level in the Brattle analysis of the ERCOT standard. Yet, this would increase average total service disruptions by only about 1.3 percent, enabling the system to absorb temporary variations of five percentage points or more in system reserve margin with a barely discernable impact on reliability while remedial measures are being implemented. Just as NERC believes that it is reasonable to demand temporary flexibility in the application of the CPP standards to avoid jeopardizing reliability, it is reasonable to ask at what point along this continuum, even within the range of possible interpretations of the standard itself, reliability would be judged to be "jeopardized" and relaxation of the CPP standards would be warranted.

Deferral is a Detour, Not a Destination

Finally, if states are able to demonstrate that a safety valve is initially necessary because no feasible compliance plan can be implemented in the time frame prescribed, the provision of any compliance deferral is merely temporary. The ultimate responsibility of the states is full compliance.

One example where deferrals were effectively negotiated by states but where ultimate compliance was maintained as a goal can be found in the Regional Greenhouse Gas Initiative (RGGI). Like the proposed Clean Power Plan, RGGI—a mass-based CO_2 program for existing fossil generators in the northeast states—was designed with various flexibility mechanisms. In its initial design, the RGGI states approved various safety valve provisions to mitigate compliance costs by reducing the likelihood of unnecessarily high or volatile allowance prices.[7] RGGI established mechanisms that could, under certain circumstances, (a) extend program compliance periods, (b) temporarily expand allowances, and (c) offset allowance pools to mitigate allowance prices. A discussion of these mechanisms is provided in the Appendix.

7 Regional Greenhouse Gas Initiative. (2005). Memorandum of Understanding. Retrieved from: http://www.rggi.org/docs/mou_final_12_20_05.pdf.

Summary Recommendation for States

The purpose of this brief is not to challenge the prevailing resource adequacy standards or the need to act promptly in the event that the system falls out of compliance with them. It is rather to demonstrate that the standards specify a level of performance that allows some tolerance for deviation and breathing space for remedial action. Suspending the legal obligations associated with the Clean Power Plan, even temporarily, is a serious matter. Allowing one state to put off compliance with an obligation that others have gone to great lengths to meet is only justified if the consequences of not allowing the state to do so are at least as severe. To insist on treating any deviation of any magnitude for any period of time from the current resource adequacy standards as the trigger for a safety valve—as some of the proposals appear to do—is neither a rational nor a proportionate response. If safety valve proposals are to be taken seriously, the next step must be an honest discussion about the appropriate level of tolerance that can and should be built into the design of the trigger.

Conclusion

Ensuring that an acceptable level of electric system reliability is maintained as the Clean Power Plan is implemented is in everyone's interest. EPA has indicated that states will have considerable flexibility in designing their compliance plans as long as their plans lead to ultimate compliance. NERC has suggested that EPA should incorporate a "reliability assurance mechanism" into its final rule. EPA could consider requiring states to propose plans that meet their established reliability standards, but the burden for proposing a plan that meets the emission reduction obligation, while ensuring reliable service, is the responsibility of the states. This short paper suggests ways states can think about their reliability targets and associated tolerance bands in assessing whether possible compliance plans will maintain a level of system reliability that is consistent with established consumer expectations. In the unlikely event that a state explores the full range of flexibility options available from the variety of carbon reduction tools at its disposal, and determines that its reliability standard cannot be met within reasonable tolerance limits, then consideration of a safety valve option may be appropriate. The safety valve offered by EPA under such circumstances should be a temporary deferral that ensures a return to compliance in a timely fashion.

Appendix

Like the proposed Clean Power Plan, the Regional Greenhouse Gas Initiative (RGGI), a mass-based CO_2 program for existing fossil generators in the northeast states, was designed with various flexibility mechanisms. In RGGI's initial design, the RGGI states approved various safety valve provisions to mitigate compliance costs by reducing the likelihood of unnecessarily high or volatile allowance prices.[8] RGGI established mechanisms that could, under certain circumstances, (a) extend program compliance periods, and (b) temporarily expand allowances, and (c) offset allowance pools to mitigate allowance prices.

Compliance Period Safety Valve

At the outset, RGGI states rejected the acid rain program's one-year compliance period model with which regulated entities had been familiar, replacing it with a three-year compliance period. Also, unlike the acid rain program, RGGI allocated allowances through quarterly auctions, i.e., twelve auctions over the course of the three-year compliance period. RGGI's "Compliance Period Safety Valve" was designed to simply further extend this three-year compliance period under certain conditions.

The mechanism would extend the compliance period by as much as three additional one-year periods if, after the market settling period (i.e., the first 14 months of the three-year compliance period), RGGI allowance prices exceeded the safety valve threshold for an established price point ($10 per allowance) for an extended period (12 months rolling average).

Offset Expansion Safety Valve

RGGI's original Memorandum of Understanding provided additional compliance flexibility by allowing the use of offsets—emissions reductions outside of the capped electric sector. While the program limited the source of offsets to six categories and the acceptable amount of offsets to be used for compliance (three percent of an entity's reported emissions), RGGI did connect a safety valve to this limitation, allowing for sourcing offsets from a broader geographic scope and for the use of greater amounts under certain circumstances.

The mechanism that would expand the use of offsets operates in a similar manner to the compliance period safety valve. If, after the market settling period (i.e., first 14 months of the three-year compliance period),the average regional spot price for CO_2 equals or exceeds $7 for an extended period (12 months rolling average), offsets could be acquired from anywhere in North America and could cover five percent of an entity's reported emissions. Furthermore, if the trigger is exceeded twice in two consecutive 12-month periods, the availability of offsets is further expanded geographically (i.e., they could be acquired from international trading programs). The amount of offsets that an entity could use also expands beyond five percent for the first three years of a compliance period to twenty percent if there is a fourth year of a compliance period.

The Cost Containment Reserve

In subsequent program modifications, the RGGI states developed a "Cost Containment Reserve" (CCR) mechanism, similar to the mechanism adopted by the State of California for its cap-and-trade program. Displacing the earlier safety valves, the CCR provides for the addition of allowances to the market if certain price thresholds are exceeded during any quarterly allowance auction.

Conclusions

RGGI's earlier trigger mechanisms operated within wide tolerance bands, while the newly adopted CCR safety valve, implemented in 2014, has none. The compliance period safety valve and offset expansion safety valve both required

8 Regional Greenhouse Gas Initiative. (2005). Memorandum of Understanding. Retrieved from: http://www.rggi.org/docs/mou_final_12_20_05.pdf. The sections discussed here are 2.E and F.3.

extended exceedances of trigger prices, i.e., a period of 12 months after the original 14-month market settling period. In other words, RGGI went from using greater tolerance bands—triggers that were hard to pull to no tolerance bands with the CCR—triggers that are easier to pull. Because the CCR draws allowances from beyond the annual emissions budget (i.e., outside the cap), advocates have argued that RGGI should fully adopt California's CCR design, which only draws additional allowances, under certain conditions, from future year budgets rather than from beyond the cap.

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