EPA's Clean Power Plan and Reliability

Assessing NERC's Initial Reliability Review

EXECUTIVE SUMMARY

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Executive Summary

The United States ("U.S.") power system is undergoing a fundamental transformation, largely driven by advances in technology and low natural gas prices. This transformation is putting significant pressure on existing coal-fired and even nuclear generation, increasingly leads to renewable energy resources being cost-competitive with fossil-fired generation,[1] and results in myriad choices for consumers that promise to permanently alter the role of demand in the power system. As a consequence, the fuel mix and associated emissions of the U.S. power system are changing rapidly, as are the actions taken by system operators to manage the quickly evolving electric system.

Against this backdrop the U.S. Environmental Protection Agency ("EPA") released in June 2014 the proposed Clean Power Plan ("CPP") as a means of implementing Section 111(d) of the Clean Air Act to regulate carbon dioxide ("CO_2") emissions from existing power plants and has since received over four millions comments on the CPP.[2] In November 2014, the North American Electric Reliability Corporation ("NERC") released an Initial Reliability Review ("IRR") of the CPP.[3] In this review, NERC questions several assumptions in the CPP and identifies elements of the CPP that it suggests may lead to potential reliability concerns. Several Regional Transmission Organizations ("RTOs") and Independent System Operators ("ISOs") have issued their own reports and submitted comments highlighting their concerns about how the CPP might impact reliability in their areas.[4]

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1 In several recent procurements in the United States renewable energy sources were chosen over both coal and natural gas-fired generation. For example, it was reported that Austin Energy signed a 20-year contract with a solar PV project at a cost below 5 cents/kWh, which it estimated to be cheaper than either natural gas (7 cents/kWh) or coal (10 cents/kWh). See http://www.greentechmedia.com/articles/read/Austin-Energy-Switches-From-SunEdison-to-Recurrent-For-5-Cent-Solar (accessed February 3, 2015). Prices of wind PPAs executed in 2013 were at the low end of average wholesale prices and often below $30/MWh; see U.S. Department of Energy, 2013 Wind Technologies Market Report, August 2014.

2 The proposed Clean Power Plan regulations are available on the EPA's website at: http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule

3 NERC, Potential Reliability Impacts of EPA's Proposed Clean Power Plan: Initial Reliability Review, November 2014.

4 MISO, MISO comments RE: Docket ID No. EPA-HQ-OAR-2013-0602 to the EPA, November 2014; SPP, SPP assesses Clean Power Plan, says more time is needed to implement, October 2014; NYISO, Comments of the NYISO on the Carbon Pollution Emission Guidelines for Existing Stationary sources: Electric Utility Generating Units; SNL, ISOs, RTOs agree: EPA must include 'reliability safety valve' in CO2 rule, December 2013.

Maintaining reliability is the primary focus of system planners and operators. At a high level, NERC recommends in the IRR, and we agree, that further in-depth analysis should be conducted as the EPA finalizes the CPP so that any emerging reliability issues can be managed.[5]

Following a review of the reliability concerns raised and the options for mitigating them, we find that compliance with the CPP is unlikely to materially affect reliability. The combination of the ongoing transformation of the power sector, the steps already taken by system operators, the large and expanding set of technological and operational tools available and the flexibility under the CPP are likely sufficient to ensure that compliance will not come at the cost of reliability.

NERC's IRR identifies several issues with the methodologies used by the EPA to estimate the four "building blocks" that make up the Best System of Emissions Reductions ("BSER"), which in turn is used to set state-level emissions rate standards between 2020 and 2029. NERC also discusses the potential reliability concerns of implementing the building blocks as suggested by the EPA's analysis. Some RTOs/ISOs have gone further in their own reports and statements, being at least suggestive that the CPP, if implemented as proposed, will cause reliability problems.[6]

NERC's concerns with the EPA's assumptions in constructing the BSER should conceptually be separated from NERC's arguments about potential reliability issues that could arise from the states' approaches to complying with the CPP. We look at these two issues in order below.

Table ES-1below summarizes NERC's main concerns with the assumptions underlying the EPA's development of BSER and provides our view of these concerns and a description of the set of tools available to address each concern where appropriate. NERC is concerned that overstating the potential for emissions reductions from some of the BSER building blocks may challenge the reliability of the system. It is concerned that in the short term, emissions rate reductions will have to come from increases in the use of natural gas-fired plants, which NERC believes could be difficult to accomplish due to pipeline constraints and resulting reliability issues due lack of natural gas supply. In the longer term, NERC believes that the CPP could require increased deployment of Variable Energy Resources ("VERs") such as wind and solar photovoltaic ("PV") capacity, which could challenge operation of the power system.

The assumptions underlying the construction of achievable emissions reductions in each of the four building blocks comprising BSER are likely all subject to some level of debate. As indicated in Table ES-1, we agree that in several areas the methodology used by the EPA to derive BSER is likely a simplification. However, we also show that legitimate arguments exist to counterbalance NERC's concerns in each building block and that, as a result of these arguments (and the

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5 "NERC should continue to assess the reliability implications of the proposed CPP and provide independent evaluations to stakeholders and policy makers." NERC, 2014, p. 3.

6 See Section III in the main report for a summary of the comments submitted by regional entities to the EPA.

additional tools we outline as options to counteract the issues raised by NERC) NERC's reliability concerns could be partially or entirely mitigated.

Table ES-1
Summary Analysis of NERC's Building Block Concerns

NERC Building Block Concern	Response to NERC Concern	Solutions Not Considered by NERC
Projected coal heat rate improvements may be difficult to achieve	Plant-level heat rate improvements may be harder to achieve than BSER assumes, but fleet-level heat rates would likely improve due to retirement and re-dispatch. Also, some plant level emission reduction strategies that are not considered in BSER could help.	- Fleet level heat rate improvements due to Mercury and Air Toxics Standards ("MATS") retirements and re-dispatch or retirements as a result of CPP - Co-firing with biomass - Waste heat recovery - Co-generation
Regional gas pipeline issues may limit coal-to-gas switching	Potential constraints in some regions are offset by additional coal-to-gas switching within regional electricity markets elsewhere.	- Regional coal-to-gas switching - Use of LNG and gas storage - Gas demand response
Expansion of renewable capacity does not account for differences amongst state-level Renewable Portfolio Standard ("RPS") mandates	The EPA methodology for developing regional renewable penetration rates has shortcomings, but in many regions existing state-level targets exceed BSER levels and significant additional potential exists.	- Renewable energy solutions not relying on additional transmission infrastructure, such as distributed wind and solar PV - Operational changes to managing transmission to increase transfer capacity - Merchant transmission projects in addition to ongoing transmission improvements can increase access to renewables over time
Assumed EE growth exceeds achievable reductions in load	The EPA's BSER methodology may be over-simplified and the ability to maintain high levels of Energy Efficiency ("EE") growth in leading states is unproven to date, but EPA's BSER also omits several important drivers of EE that could help states meet or exceed BSER.	- Program experience in leading states helps identify untapped EE potential - New EE technologies continue to shift boundary of EE potential - Adoption of best practices by lagging states will facilitate ramp-up - Options exist beyond BSER, including Energy Service Companies ("ESCOs"), changes to codes and standards, and other non-utility EE efforts - Regional cooperation to overcome current limit on EE credit to in-state generation

Table ES-2 below provides a summary of NERC's primary reliability concerns as well as our comments and suggested tools to address those concerns.

Table ES-2
Summary Analysis of NERC's Reliability Concerns

NERC Reliability Concern	Response to NERC Concern	Solutions Not Considered by NERC
Maintaining resource adequacy within the constrained time period due to potential coal and oil/gas steam unit retirements	Coal plants required to maintain adequate reserve margins can continue operating at a lower capacity levels. Not all retirements need to be replaced due to excess capacity in many regions. Several capacity resources can be deployed in less than 2 years; longer term planning processes, such as capacity markets and integrated resource planning are capable of adapting to the CPP requirements.	- Gas and electric demand response - Energy efficiency - Natural gas-fired combustion turbines - Energy storage
Obtaining sufficient natural gas service during high-use periods due to pipeline constraints and other gas and electric interdependencies	Market rules are adapting to ensure sufficient resources are available during constrained operation periods. Gas storage and demand response can help manage gas demand during constrained periods.	- Market incentives to improve performance (such as ISO New England's Pay for Performance rules) - Natural gas storage - Gas demand response - Gas and electric energy efficiency
Increased generation from renewable VERs will create operational challenges and require transmission build out	Current levels of renewable generation in many regions exceed penetration levels assumed by the EPA without negatively impacting operational reliability. Transmission planning processes are adequate due to the significant build out expected regardless of CPP standards. Many tools exist for managing high levels of VERs and studies show significant integration is possible without reliability issues.	- Non-VER renewables - Improved scheduling of energy and ancillary services markets, including participation by VERs - Balancing system with non-traditional technologies - Cooperation/increased transmission between balancing areas - Flexible operation of transmission network - Energy Storage - Improved VER forecasting
Limited timeframe for compliance and the potential for reliability issues require EPA include a "reliability back-stop" in the final rule	EPA provides states significant flexibility in achieving standards that can be utilized prior to considering a "reliability back-stop".	- Interim 10-year average standard - Emission reductions beyond BSER - Option to pursue market-based strategies - Multi-state compliance options

Even if one accepted NERC's concerns that CPP compliance may require more reliance on natural-gas fired generation in the short run and on more variable generation from non-hydro renewables in the longer run than what is assumed under BSER, this would not imply a significantly increased risk to reliability.

Shifting electricity production from coal to natural-gas fired generation during periods without gas pipeline constraints will likely contribute significantly to reducing emissions rates, since even in the short term, gas pipeline bottlenecks only occur during relatively short periods of combined high heating and electric demand. The CPP does not require coal to natural gas switching during such periods, so that traditional resources as well as other options (such as gas storage, localized gas and electric energy efficiency measures, gas and electric demand response) can continue to provide the services necessary to ensure reliability. In addition, gas supply shortages have already been increasing due to relatively low natural gas prices, and significant efforts are underway to address those issues. Therefore, it is likely that short-term gas supply bottlenecks will be at least partially overcome in the next few years.

There is also ample evidence that power systems can and are already operating at levels of VER penetration significantly above what would be necessary to achieve the CPP emissions reduction goals even if contributions from other building blocks are less than those embedded in BSER. The EPA's modeling of least-cost compliance with the CPP (as opposed to constructing BSER) assumes that nation-wide non-hydro renewable energy production would likely rise to 8% by 2020 as opposed to 7% without the CPP. Under BSER assumptions the share of intermittent renewables would need to reach 13% nationally by 2029 assuming full contributions from the other BSER building blocks.[7] Even if emissions reductions from other building blocks were lower, national VER penetration rates would likely be both achievable and below the levels where serious integration challenges may emerge.

Ample evidence indicates that a nation-wide increase of the renewables share from 7% under a business as usual scenario without the CPP to 8% with the CPP would not lead to any reliability concerns. Many states and countries are operating at much higher levels of renewable energy today without any negative impact on reliability. The same holds true for a 13.5% average national renewables share by 2029. More importantly, even under very pessimistic assumptions about the availability and cost-effectiveness of emissions reductions from other building blocks (or measures not included in building blocks), national renewable energy shares that could become necessary to meet the CPP targets remain below 30% and thus below levels already managed in some states and countries today, using existing tools and technologies. For example, California is on target to meet its 33% 2020 Renewable Portfolio Standard ("RPS"), which is not expected to lead to serious reliability concerns.[8] Germany already reached close to 30%

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7 EPA, Goal Computation, Technical Support Document for the CAA Section 111(d) Emission Guidelines for Existing Power Plants, Docket ID No. EPA-HQ-OAR-2013-0602, June 2014.

8 California Public Utility Commission, Renewable Portfolio Standard Quarterly Report: 3rd Quarter 2014, Issued to Legislature October 10, 2014. Available at: http://www.cpuc.ca.gov/NR/rdonlyres/CA15A2A8-234D-4FB4-BE41-05409E8F6316/0/2014Q3RPSReportFinal.pdf

renewable energy generation in 2014, also without reliability concerns.[9] In both regions, the mix of tools used to manage a system with a high share of intermittent renewables includes expanded use of the current set of operational practices (re-dispatch, occasional curtailment of renewable generation, additional reserves) as well as increasingly relying on newer technologies such as storage and demand response. It is likely that over the coming decade the availability of various options to manage intermittency will increase while their cost will decrease.[10] Given the fact that much higher VER penetration is likely a longer term issue, both developments will further help mitigate any reliability concerns.

Assuming regional rather than national implementation,[11] regionally required renewables shares would be higher in some regions, but in very few regions would renewable generation need to approach or exceed 30% by 2029, even assuming zero contribution from other building blocks.[12]

Furthermore, aside from the four building blocks, EPA has also provided states with considerable flexibility, allowing them to employ emission reduction technologies not included in the BSER. These technologies include co-firing coal with biomass, demand response, combined heat and power ("CHP"), and non-utility energy efficiency measures. Incorporating these and other emission reduction options will lower the emission reductions that states need to achieve under the four building blocks, thereby ameliorating possible reliability concerns that may result from the strict application of BSER.

In addition to allowing states to reduce emissions by going beyond BSER, the CPP provides flexibility options that further reduce the chances of reliability issues emerging. The EPA designed the CPP to provide the states options in choosing how to comply with the CO_2 standards. The compliance options provided to the states include (1) allowing states to create their own approaches in their state implementation plans ("SIPs") for meeting the standards, including the use of a market-based approach, and as described above, the option to incorporate

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9 In Germany, renewable energy represented 28.4% of total electricity consumption in the first half of 2014. See http://www.germany.info/Vertretung/usa/en/__pr/P__Wash/2014/07/30-Energy-record.html.

10 We note that Germany has a renewable energy target of 40-45% by 2025 and of 55-60% by 2035. See http://www.mondaq.com/x/329922/Renewables/German+Renewable+Energy+ActChanges+In+2014 for an English language summary of the law including targets. German transmission service operators ("TSOs") have to file annual reports with the national regulator (Bundesnetzagentur). The latest set of reports has identified the costs of managing intermittency through curtailment and re-dispatch at a few hundred million Euros per year, when annual payments under feed-in tariffs exceed 20 billion Euros. Also, Germany has a stricter reliability standard and continues to achieve very high levels or reliability. For a more detailed discussion of integration costs in Germany, see Weiss, Solar Energy Support in Germany: A Closer Look, The Brattle Group, July 2014.

11 The CPP's flexibility options could allow states to cooperate in ways that could, de facto, lead to states fully leveraging the ability to build VERs more easily and cheaply in some rather than in other regions. We discuss the options for cooperation in some detail in our main report.

12 EPA Goal Computation, 2014. See the main report for more details on renewable penetration.

measures not included in the BSER, (2) allowing for the proposed rate-based standards to be converted to mass-based standards, (3) allowing for states to cooperate with each other to meet their standards, and (4) setting the interim goal as an average over a ten-year period rather than as annual requirements. Individually and in combination these flexibility options likely lead to both lower compliance costs and lower reliability risks associated with the CPP.

The absence of predictable reliability concerns does not mean that unpredictable reliability concerns may not appear during implementation of the CPP. However, there is some historic evidence that the EPA allows for flexibility in compliance so that reliability can be maintained, as long as states provide contingency plans in their SIPs for just such cases and implement those contingency measures to ensure that overall regulatory goals are attained or nearly so over time.[13] This approach ensures that incentives to comply with environmental regulations are maintained, while allowing for reliability concerns to trump short-term emissions goals and for overall long-term emissions reductions to be achieved. Should the timeline of approving and implementing the CPP prove particularly tight – for example because SIPs and the required actions contained therein will only be known with certainty as late as 2018 with compliance with the interim emissions rate target starting in 2020 – we expect EPA to allow the flexibility it has shown in the past. To this end, the EPA could make more explicit how it intends to measure compliance or what enforcement options it would use in situations where SIPs include contingency provisions for dealing with unexpected reliability situations, but where following those contingency plans lead to emissions not on a path to meet with interim targets or even exceeding overall average targets over the 2020-2029 compliance period.

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13 In the past, the EPA has recognized the need to balance reliability needs and compliance with environmental regulations. For example, the EPA clarified that when MATS compliance would create local reliability issues, a one-year extension to compliance with MATS can be granted and that long-term reliability issues would be dealt with on a case by case basis in consultation with FERC, RTOs and ISOs. (EPA, Memorandum, The Environmental Protection Agency's Enforcement Response Policy For Use of Clean Air Act Section 113(a) Administrative Orders In Relation to Electric Reliability And The Mercury And Air Toxics Standard, December 16, 2011). See also Jonas Monast et al, Regulating Greenhouse Gas Emissions From Existing Sources: Section 111(d) and State Equivalency, Environmental Law Reporter, 3-2012, which points to the ability to use established rules under NAAQS to allow contingency plans as backstop measures.