Guiding Principles for Reliability Assessments Under EPA's Clean Power Plan

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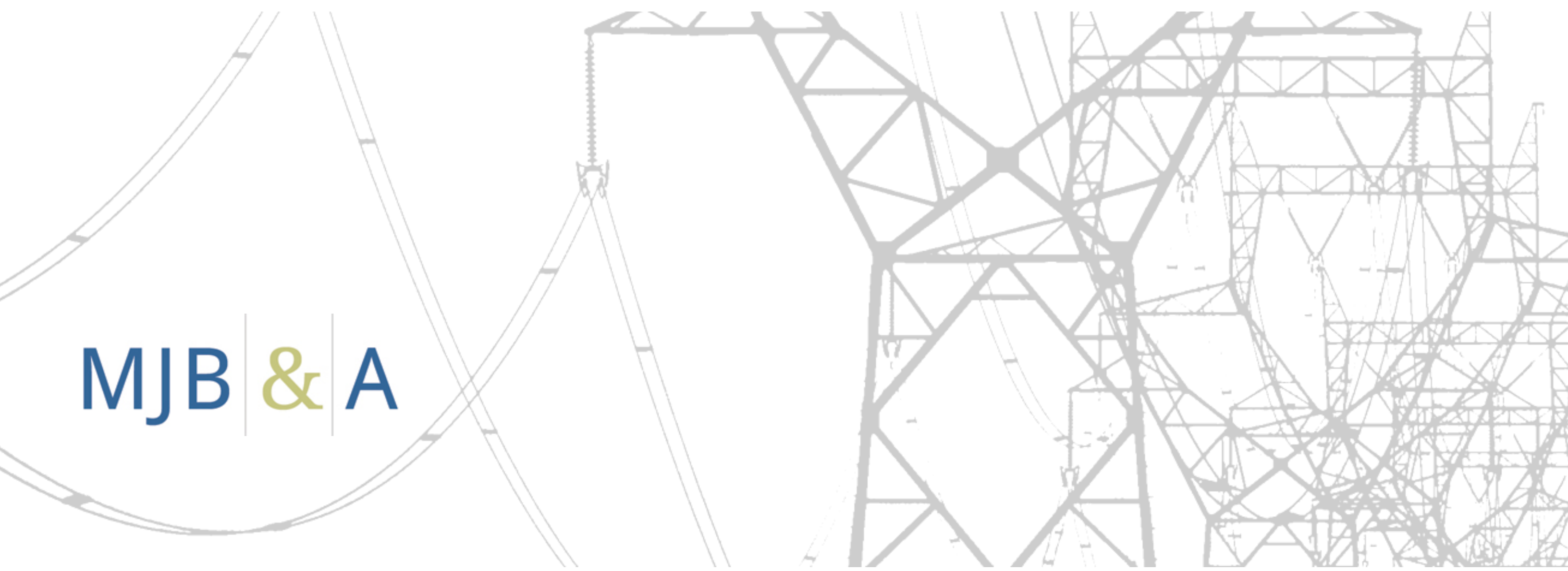

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Executive Summary

A robust discussion and healthy debate has emerged in recent months regarding the interplay of electric system reliability and the implementation of the U.S. Environmental Protection Agency's (EPA's) Clean Power Plan (CPP). The CPP will, for the first time, establish nationwide standards for emissions of carbon dioxide from existing power plants. During the course of the policy development, a common proposal has emerged through stakeholder dialogue: to institute a process to study the potential reliability impacts of state plans under the CPP before and as they are implemented. Many organizations have already begun to conduct such assessments.

We believe that the electric grid is more than capable of supporting a transition to a lower carbon mix of generation. The United States electricity system is in the midst of transformative change. We have seen meaningful changes in competitive energy markets, increased investment in grid modernization and development, and advances in renewable and natural gas generation. These changes have been driven by technological advancements, changes in public policy, customer expectations, and practical necessity. Throughout this period, and indeed, since the institution of the Clean Air Act nearly a half century ago, environmental standards and controls have coexisted with electric reliability. As our grid undergoes update and change, our toolkit to maintain reliability continues to improve. Recent experience under the Mercury and Air Toxics Standards has shown how existing reliability practices, combined with proactive and commonsense policymaking, have maintained reliability through the start of a new regulation. The CPP, through its flexible design, can take advantage of existing and emerging practices to support reliability on the path toward a clean, more efficient, electric industry.

To assist in this continuing transition, we must have a clear way to identify, plan for, and address reliability issues. Crucial to this will be reliability assessments conducted on a national and regional level that provide a consistent, productive, and comprehensive view of reliability. We, like the Federal Energy Regulatory Commission, do not call for new requirements or statutory changes to achieve this reliability review, and we agree that existing procedures are a strong foundation for assessments so long as they are conducted thoroughly. To that end, we encourage the industry and its stakeholders to utilize a standardized set of guiding principles for use in undertaking these important assessments. We recommend the following six guiding principles:

1. <u>Utilize a transparent process.</u> Organized and focused stakeholder involvement will help incorporate up-to-date assumptions, create consistency across assessments, sanity check initial results, and ensure that reliability assessments are based in objective facts and data.

2. <u>Reflect existing status of the grid in modeling assumptions.</u> In setting the assumptions for the analysis, both in a reference case and CPP compliance scenarios, a reliability assessment must incorporate key elements of the electric grid's ongoing transformation that will drive assumptions on, for example, renewable development, ongoing generation and infrastructure improvement, and energy demand and energy efficiency.

3. <u>Clearly identify base case and context.</u> Actions to comply with the CPP will build upon existing electric sector trends and will take advantage of already in progress planning and infrastructure development to address reliability needs. Policymakers must understand the portion of activity that they can directly affect through their CPP compliance activities.

Reports must clearly indicate if the conclusions are based on combining the impacts of the CPP with the ongoing changes reflected in the reference case, or if they are based on only the incremental impacts of the CPP.

4. Conduct sensitivity/probabilistic analyses where possible. Reliability studies should incorporate multiple sensitivities or a probabilistic analysis around key inputs of future conditions that are based on forecasts, including electricity demand, fuel prices, and development costs. Assessments should be careful to avoid only focusing on a low probability/high risk scenario.

5. Reflect the flexibility of compliance options under the CPP. The proposed CPP provides significant flexibility that will allow states to adjust their compliance approaches to maximize reliability and minimize cost. Assessments should reflect this flexibility in model design through methods such as allowing a range of compliance options (e.g., natural gas dispatch, increased renewable development, or additional energy efficiency) as outputs of models, indicating trading within (or outside of) the modeled region, and examining options for phased-in compliance.

6. Provide realistic but reliability-focused results. The focus of these assessments should be on identifying reliability concerns that result from realistic projections of compliance options. While cost projections provide crucial bounding of assumptions and scenarios, "reliability" should not be equated with "cost effectiveness." The added value of reliability assessments is to identify key electric system risks, vulnerabilities, and opportunities that arise from various compliance options.

Following these principles will help create reliability assessments that provide practical, realistic results that recognize and address both EPA's imperative to reduce greenhouse gas emissions and the shared interest in maintaining and enhancing affordable, reliable electricity.

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Introduction

A robust discussion and healthy debate has emerged in recent months regarding the interplay of electric system reliability and the implementation of the U.S. Environmental Protection Agency's (EPA's) Clean Power Plan (CPP). The CPP will, for the first time, establish nationwide standards for emissions of carbon dioxide (CO_2) from existing power plants. EPA released a proposed CPP rule on June 2, 2014, setting state-by-state CO_2 performance goals; states can meet these targets through a broad range of activities including increasing efficiency of existing generating facilities, switching from coal to natural gas, advancing the development of renewables, nuclear, and energy efficiency, and trading emissions "credits" with other states.

In addition to the EPA rulemaking process, the Federal Energy Regulatory Commission (FERC or the Commission) held a multi-day series of "technical conferences" in early 2015 to hear from industry and market experts on the subject of maintaining reliability through implementation of the CPP. Though EPA has stated unequivocally that the CPP will not diminish electric system reliability, and that EPA would not tolerate implementation of its rule in a manner that would harm reliability,[1] some parties to FERC's technical conferences expressed skepticism that this was possible—at least as the rule is currently drafted. Many parties hope that EPA will make changes, some of them significant, to incorporate a more deliberate consideration of reliability in the final rule to be issued later this year. However, many parties believe that the CPP can be implemented while maintaining a reliable electric system. In April, after the last of the FERC technical conferences, a trio of industry experts issued a whitepaper explaining their reasons for confidence in the electricity system planners and operators to adapt to a carbon-constrained future while providing a reliable supply of electricity.[2] This sentiment has been echoed by others throughout the stakeholder dialogue on the CPP, both at the FERC technical conferences and other forums.[3]

During the course of this dialogue, however, a common proposal has emerged: *to institute a process to study the potential reliability impacts of state plans under the CPP before and as they are implemented*. For example, the industry experts referenced above recommend that FERC help scope and guide assumptions for up-front and ongoing reliability assessments that will inform the design and eventual implementation of states' individual or joint plans. Many organizations have already begun

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[1] *See*, e.g. Prepared Statement of Janet McCabe, Acting Assistant Administrator of the Office of Air and Radiation, EPA, February 19 2015, FERC Docket No AD15-4. Available at http://www2.epa.gov/sites/production/files/2015-02/documents/20150219-ferc.pdf.

[2] Tierney, S., Parsons, B., and Svenson, E., "Ensuring Electric Grid Reliability Under the Clean Power Plan: Addressing Key Themes from the FERC Technical Conferences," April 2015 ("Tierney, Parsons, Svenson 2015"). Available at: http://www.westerngrid.net/2015/04/20/additional-comments-on-the-clean-power-plan/.

[3] *See, e.g.,* Prepared Statements from the FERC Technical Conferences of Seattle City & Light, Exelon Corporation, Brian Parsons and John Jimison, John Moore, and Susan Tierney, as well as comments submitted in EPA Docket OAR-2013-0602 of numerous parties including Calpine Corporation.

to conduct such assessments. The North American Electric Reliability Corporation (NERC), an international organization with regulatory authority over bulk electric system reliability under the oversight of FERC, has issued both an "Interim" and "Phase I" assessment of issues it considers to be possible reliability challenges stemming from its analysis of how the CPP might impact the electric system. NERC's Interim assessment preceded the FERC technical conferences and contained pessimistic warnings of potentially serious or even catastrophic impacts to reliability; it was also subject to a detailed rebuttal prepared by the Brattle Group, a leading energy industry consulting firm commissioned by Advanced Energy Economy to analyze NERC's work.

In order to ensure a consistent, productive, and comprehensive view of reliability, we would encourage the electric industry and its stakeholders to develop a standardized set of guiding principles for use in undertaking these important assessments. This will not only ensure a more thorough and useful assessment of potential reliability issues, it will allow for more coordinated responses to issues that may cross state and reliability area boundaries.

The following whitepaper provides a brief background on electric reliability through the lens of past environmental programs and then uses this context, as well as a review of already-conducted CPP-focused reliability assessments, to identify possible common elements and guiding principles for use in ongoing and future studies. Like FERC, we are not calling for new requirements or statutory changes; rather, we believe that existing procedures provide a strong foundation for such assessments, so long as they are conducted thoroughly. FERC has indicated in a recent letter to EPA that, concerning "a process to review state plans for potential reliability concerns," it believes that existing reliability modeling and planning processes, conducted by regional transmission organizations (RTOs), independent system operators (ISOs), and other planning authorities, are "generally adequate," although "increased effort" may be required as state plans are developed.[4] FERC suggested, and we agree, that the Commission should use its stated authority to "review the analyses [and] suggest or request additional or modified analyses."[5] We believe these reviews could be guided by the principles described below. We strongly support the adoption of a common set of guiding principles and a critical view of all existing and ongoing reliability assessments to be sure they comport with these principles.

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4 FERC Letter to Janet McCabe, acting Assistant Administrator of the Office of Air and Radiation at EPA, dated May 15 2015 ("FERC Letter to Janet McCabe") at p. 3. Available at http://www.ferc.gov/media/headlines/2015/ferc-letter-epa.pdf.

5 *Id.* at p. 4.

Reliability Dynamics of Today's Electric Grid

The electric system in the United States is built on a familiar model, one that has been replicated around the world. Large electricity generators, typically powered by coal, nuclear fuel, or natural gas, produce electricity that is delivered over a massive system of transmission and distribution lines. By any measure it is an impressive system: over 7,000 operational power plants, with a combined capacity of 1,060 GW, serve nearly 150 million separate residential, commercial, and industrial customers over 642,000 miles of transmission lines and 6.3 million miles of distribution lines. In 2013, 303 GW of this generation was fired by coal, 99 GW by nuclear facilities, while another 425 GW was fired by natural gas, which in turn is supported by 2.6 million miles of natural gas pipeline. In 2013, this system successfully delivered over 4 million GWh of electricity to homes and businesses.[6,7]

However, the United States electricity system is in the midst of transformative change, driven by technological advancements, changes in public policy, customer expectations, and practical necessity. Some of the key changes include:

- *Change in generation source and capability*: though a majority of national electricity needs are still served by fossil fuel-fired generators (with significant regional distinctions—for example, in the Pacific Northwest, the primary generation source is hydroelectric facilities), the past decade has witnessed an unprecedented shift in resource type. Technology advancements have dramatically increased domestic natural gas production, reducing prices from over $9/MMBtu at their 2008 peak to $4.33 in 2013. This price decrease, coupled with significant advancements in combined cycle unit efficiencies and other factors, has led to a 73 percent increase in natural gas-fired energy between 2003 and 2013.[8] At the same time, the industry has seen an upsurge in renewable generation driven by significant decreases in technology costs as well as increases in state policies supporting renewables. In 2013, renewables (including large hydroelectric facilities) served nearly 10 percent of total electricity demand in the U.S., nearly double the output in 2001. Between 2008 and 2013 alone, non-hydro renewable generation more than doubled. Combined, these factors have driven a shift away from coal-fired generation, which decreased from over 50 percent of total generation in 2003 to 39 percent in 2013. The increase in renewables has also led to changing grid management practices to incorporate their variable output, which has been aided by significant advances in the fast-ramping capabilities of natural gas fired turbines.

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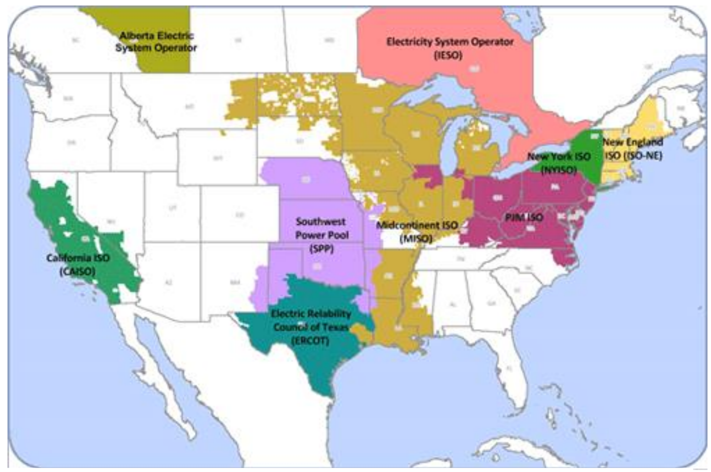
6 U.S. Energy Information Administration, "Electric Power Annual," March 23 2015 ("2015 Electric Power Annual"). Available at: http://www.eia.gov/electricity/annual/.

7 Quadrennial Energy Review Report: Energy Transmission, Storage, and Distribution Infrastructure," April 2015 at Chapter 1. Available at: http://energy.gov/sites/prod/files/2015/04/f22/QER-ALL%20FINAL_0.pdf.

8 *See* 2015 Electric Power Annual.

- *Expansion of markets*: for the past century, most electricity was delivered by vertically-integrated utilities that owned and operated power plants and transmission/distribution systems to bring electricity to customers. This model began to change in response to the energy crises of the 1970s, starting with the enactment of the Public Utility Regulatory Policies Act (PURPA), which aimed to encourage domestic energy investment and opened the door to independent (non-utility) power producers while promoting energy conservation and new technologies such as co-generation. The move toward "deregulation" accelerated in earnest at the federal level with passage of the 1992 Energy Policy Act, followed shortly thereafter by FERC Order 888 and its pro forma Open Access Transmission Tariff, which opened the wholesale market to competition among generators through access to the bulk power system on a non-discriminatory basis across utility regions. Concurrently, many states opened their electricity generation models to restructuring and unbundling of generation assets. In the last 30 years, restructured markets have emerged in which numerous parties own generation that then contract with utilities or sell into organized markets. These markets cover roughly half of the country by area and around two thirds of total electric demand (see Figure 1). Though there have been growing pains and the operations of markets vary significantly by jurisdiction, overall, markets have been proven to stimulate technological innovation and increase the flexibility of the system while maintaining reliable and cost-effective service.

<u>Figure 1.</u> North American Regional Transmission Organizations and Independent System Operators



Source: FERC

- *Grid development, replacement, and modernization*: as electricity demand and sources change, so too must the system of wires and pipes that serve it. The time is ripe: 70 percent of the grid's transmission lines and transformers are over 25 years old,[9] and many systems still operate using equipment not significantly updated since the 1950s. Due partially to an investment lag beginning in the 1990s, the electric industry predicts that it will invest between

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[9] Executive Office of the President, "Economic Benefits Of Increasing Electric Grid Resilience To Weather Outages," August 2013 at p. 7 ("Economic Benefits Of Increasing Electric Grid Resilience To Weather Outages"). Available at http://energy.gov/sites/prod/files/2013/08/f2/Grid%20Resiliency%20Report_FINAL.pdf

$1.5 and $2.0 trillion in total infrastructure development between 2010 and 2030.[10] Beyond replacing outdated systems, however, this development will also focus on adapting to the increased use of renewables and demand-side resources. Twenty-five states have already adopted policies relating to smart grid technology,[11] which aim to improve communication and responsiveness of the grid and improve grid resiliency.[12] One large related outcome from a more interactive grid has been significant improvements in the methods of measuring and trimming the use of energy on the customer side of the meter, leading to much greater energy efficiency savings. This last development may explain, in part, why demand growth has remained below historical norms even as the U.S. economy has recovered since the recession-driven lows of 2008 and 2009.

- *Adapting and responding to environmental issues*: energy production remains a significant source of environmental impact—on air quality, land management, and water use. As we better understand these impacts, regulation to address these issues have increased, leading to changes in the generation mix. Though the CPP is the first nationwide climate change policy aimed at addressing greenhouse gas emissions from existing power plants, it follows a long line of air regulations covering sulfur dioxide (SO_2), nitrogen oxides (NO_x), fine particulates, mercury, and numerous other pollutants—all of which have changed the way electricity is produced and delivered. Additionally, as industry has recognized, climate change itself is changing the conditions in which the electric sector operates, due to increased incidence of severe weather events, higher average temperatures, and other factors that require investments in infrastructure to strengthen electricity generation and distribution systems.

Hundreds of federal, state, and regional organizations, corporations, and governmental agencies work together to ensure that this energy delivery system operates reliably, safely, cleanly, and cost-effectively. Chief among these on the federal level are EPA and FERC; the former regulates the environmental impacts of energy production and transmission, and the latter is tasked with assisting in guaranteeing "reliable, efficient and sustainable energy services at a reasonable cost" through regulating competitive energy markets and the interstate transport of electricity and natural gas.[13] Reporting to FERC, NERC assists in maintaining national bulk power system reliability by developing and enforcing reliability standards, assessing seasonal and long-term reliability, and helping train local operators to monitor the bulk power system through system awareness. On a regional level, reliability coordinators, RTOs, and ISOs help monitor, design, and track local systems, including any electricity

10 *See* Chupka et al., prepared on behalf of The Edison Foundation, "Transforming America's Power Industry: The Investment Challenge 2010-2030" at p. 2. Available at http://www.eei.org/ourissues/finance/Documents/Transforming_Americas_Power_Industry_Exec_Summary.pdf.

11 *See* http://www.infrastructurereportcard.org/a/#p/energy/overview.

12 *See* Economic Benefits Of Increasing Electric Grid Resilience To Weather Outages.

13 *See* http://www.ferc.gov/about/about.asp.

services markets.[14] Each of these parties plays a vital role in maintaining current operating reliability as well as planning for future threats and changes to the grid. These RTOs and ISOs, among others, establish electric system wholesale markets under FERC-approved rules and plan the bulk electric system based on FERC and NERC regulations.

Maintaining Reliability Under Environmental Regulations

History has shown that the electric power industry is capable of reducing air and water pollution without threatening reliability. For example, the industry has reduced NO_x and SO_2 emissions by more than 70 percent without causing diminished service or power outages. The many levels of flexibility and multiple options for compliance contained in the proposed CPP suggest that this will continue to be the case, provided that sensible resource planning, with rigorous oversight from FERC, RTOs, state utility regulators, and other reliability organizations continues as it should.

The CPP reflects (and in many ways depends upon) the technological transformation already underway in the electric sector. Trends that have already started reducing emissions, such as increasing renewables and natural gas generation and greater investment in energy efficiency are jump starting efforts to comply with the rule. Additionally, expansions in infrastructure and markets are strengthening the ability of grid managers to incentivize, track, and respond to further emissions reductions while maintaining reliability. These tools, and others, have helped the industry maintain reliability under environmental regulations such as the Mercury and Air Toxics Standards (MATS) and will serve a similar function under the CPP.

The Existing Reliability Toolkit

Throughout the CPP rulemaking process, a broad range of stakeholders have catalogued the tools that are currently available to grid operators and reliability coordinators and planners.[15] Covering both well-established and emerging technologies and practices that span both grid systems under markets as

[14] There are also a number of non-FERC jurisdictional entities who manage reliability and bulk power system operations, including the Bonneville Power Administration, Western Area Power Administration, and the Electric Reliability Council of Texas. However, each of these entities must still comply with NERC reliability standards.

[15] Useful resources providing more detail on this reliability toolkit include: Tierney *et al.*, "Electric System Reliability and EPA's Clean Power Plan: Tools and Practices," February 19 2015, available at http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/Electric_System_Reliability_and_EPAs_Clean_Power_Plan.pdf; Prepared Statement of Brian Parsons, Director Western Grid Group, and John Jimison, Managing Director Energy Future Coalition, March 11 2015, FERC Docket No AD15-4, available at http://www.ferc.gov/CalendarFiles/20150224084400-Parsons,%20Jimison%20joint%20comments.pdf; Weiss *et al.*, The Brattle Group, "EPA's Clean Power Plan and Reliability: Assessing NERC's Initial Reliability Review," February 2015, available at http://info.aee.net/brattle-reliability-report; and Tierney, Parsons, Svenson 2015. Practices referenced here are drawn from this collection.

well as those in vertically-integrated regions, these tools and trends should continue to ensure grid reliability under the CPP. They include:

- Engaging stakeholders, state regulators, and reliability entities through methods such as:[16]
    - conducting forward-looking assessments of potential impacts on system reliability of CPP implementation;
    - incorporating all potential short- and long-term measures (supply and demand; generation and transmission) to address significant changes during the CPP transition period;
    - engaging in coordination with neighboring utilities around local concerns tied to CPP implementation; and
    - in areas with vertically-integrated utilities, developing or expanding long-term integrated resource planning processes for timely and practical incorporation of CPP compliance requirements.
- Where relevant, adding technology- and competitively neutral market rules/products and operating practices, to capture and add incentives for new reliability attributes, including:
    - local (zonal/load pocket) capacity and energy market pricing; changes to reflect scarcity pricing;
    - modifying forward capacity markets;
    - valuing and providing for reliability attributes for system security (e.g., appropriate quantities of spinning and non-spinning reserves, regulation reserves, ramping/load-following, reactive power, on-site fuel sufficiency, frequency response, black start capability);
    - shortening dispatch intervals and updating processes to incorporate unit operations capabilities and limitations (including emission limits and ramping periods) and examining how similar operational restrictions (if any) from CPP compliance would be incorporated in system operations; and
    - establishing or clarifying, where needed, provisions for the creation of reliability must run (RMR) contracts for generators need for reliability that would otherwise retire.
- Examining all options[17] and improving assessment techniques to value resources that can provide reliability services:

[16] This may be especially useful in areas with vertically-integrated utilities, cooperatives, municipal power companies, and states without competitive markets (outside of RTOs) that will not be able to access the market-based tools referenced below.

[17] These include but are not limited to: demand control, distributed generation with smart grid features, inverter-based generation advanced capabilities, incenting future flexibility capabilities, synchronous condensers, FACTS devices, energy storage, and accessing existing system physical capabilities.

- for resource adequacy determinations, use of Effective Load Carrying Capacity (ELCC) methods to incorporate site-specific resources and weather patterns and correlate that data with electric demand;
- for normal operations and load balancing, using production cost modeling with accurate representation of geographic diversity among renewables, with sub-hourly resolution to capture granular variability; and
- for disturbance response (including load flow, frequency response and dynamic stability study), capturing control settings of conventional plants to validate them against actual disturbance events; accurately representing gas and hydro units when evaluating the absence of large coal units, and capturing advanced grid features of inverter-based generation (as is being done by the WECC Renewable Energy Modeling Task Force).

Reliability Under MATS: New and Existing Tools

Concerns about electric system reliability have been raised in the past in response to new environmental policies. Although the policy is still unfolding, the system's recent experience under MATS is one recent example of how common sense policy, combined with emerging technologies and utilization of reliability management tools, has resulted in less air pollution while maintaining a reliable electricity grid.

MATS establishes air toxic emission standards for all existing and new coal- and oil-fired power plants (larger than 25 MW). Facilities were given three years from the final issuance of the rule to install pollution control technologies to bring facility emissions below the allowable levels. When the regulation was finalized in late 2011 (with an effective date of April 16, 2012), EPA included measures to address the possibility that specific individual coal-fired generating units might need additional time to either come into compliance with the rule or retire. Specifically, EPA made clear that states could provide, on a case-by-case basis, up to an additional 12 months for individual units to implement their compliance plans. Also, a process was put in place for plants to petition EPA for an Administrative Order (AO) to receive a fifth year extension if the facility could make a clear showing that this additional time was needed for reliability purposes.

As part of this process, EPA and FERC established an oversight framework whereby EPA, in effect, consults with FERC on these requests for fifth year reliability extensions. Under this framework, EPA maintains sole decision-making authority over whether to grant any reliability waiver or extension to a facility owner for any documented instance of a potential violation of a reliability standard—and EPA relies on the expertise of FERC, the RTOs or NERC when it makes these assessments and issues its decisions.[18] Per the interagency agreement between FERC and EPA, the Commission does not insist on any particular modeling, data sets, or information to be provided with the generator's request for an extension, but FERC does suggest that information pertinent to potential violations of any FERC-approved Reliability Standards be included (such as regional or state transmission planning and operations studies, system restoration plans, operating procedures, and mitigation plans). FERC then provides public comments to EPA regarding whether the absence of an extension or waiver could jeopardize its Reliability Standards. FERC stops short of giving a specific recommendation to approve or disapprove the generator's request, leaving this determination to EPA.[19]

This framework has strengthened the process for evaluating reliability needs without diminishing the environmental integrity of the MATS policy. Compliance officially began April 16, 2015, with approximately 40 percent of all covered coal-fired units requesting the fourth year extension (and 99 percent of those receiving it). However, out of approximately 1,100 affected coal-fired generators, we have identified to date only two generating facilities that have requested (and received) a fifth-year extension. When it has been necessary, generation planners and the market have responded in the vast majority of cases to replace the retiring power plants with other generation sources or transmission solutions.

Reliability Under the CPP: Building on Flexibility

This coordinated approach between EPA and FERC on MATS may serve as a template for future efforts to ensure that the CPP is implemented in a manner that anticipates changes in the resource mix and helps the industry, the markets, and state and federal regulators respond accordingly. In its letter to EPA on May 15, 2015, FERC envisioned that if EPA adopted a measure to maintain facilities necessary for reliability that may otherwise be shut down due to the CPP, FERC's role would be "[reviewing] a petitioner's claims that unforeseen or emergency system conditions will result in violation of a Commission-approved Reliability Standard or reserve margin deficiency, unless a compliance obligation is adjusted." FERC notes that similar to the MATS process, the Commission could help "identify issues…[and] review the petition's proposed mitigation." FERC expects that the information provided in such a request "could be similar to the information required of applicants seeking a fifth year [compliance extension] under MATS, with any modifications needed for the context of the Clean Power Plan."[20]

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18 *See* "Policy Statement on the Commission's Role Regarding the Environmental Protection Agency's Mercury and Air Toxics Standards," 139 FERC P 61,131 (2012). Available at http://www.ferc.gov/whats-new/comm-meet/2012/051712/E-5.pdf.

19 *See* Environmental Protection Agency, "The EPA'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. Available at http://www.epa.gov/mats/pdfs/EnforcementResponsePolicyforCAA113.pdf.

20 *See* FERC Letter to Janet McCabe.

The CPP is, of course, a very different rule than MATS, and addresses a broader scope of resources and a more flexible set of compliance options. We believe that this flexibility dramatically reduces the likelihood of needing to rely on a safety valve-type mechanism for the CPP. Regardless of what EPA decides on this issue, we believe that reliability entities and relevant state regulators have a critical role in conducting effective reliability analyses that can inform the development of state plans to proactively avoid any potential reliability problems.

One of the key flexibilities afforded by the CPP is its long lead time for compliance. In the case of MATS, EPA's new rules were statutorily required to be met in a relatively short timeline of three or four years for full implementation and compliance. In contrast, in the case of the CPP—as it is now proposed—the timeline is much longer, starting with a window of two years (or three in the case of states that agree to enter into multi-state agreements) in which states will establish and gain approval for their compliance plan, followed by the onset of plan implementation, which then phases in across an interim period from 2020 through 2029 before the final targets go into effect in 2030.[21]

Additionally, even in the existing proposal there is the built-in flexibility in the form of emissions averaging across sources and across time. This averaging feature would allow, for example, that an otherwise soon-to-be uneconomic coal facility that provides an important reliability function could continue to operate during the hours of the year when it was most needed for reliability or until an alternate generation or transmission solution can be put in place. In many cases, this generation could even continue for a number of years before the state plan requirements would need to see the generator in question replaced by a lower emitting facility or put a transmission upgrade in place to alleviate the reliability impact of the retirement. Regional compliance, which has been encouraged by market operators, would further extend this flexibility. This averaging thus provides an ability to maintain reliability-critical generating resources, results in longer lead times to develop alternative sources of generation or other infrastructure (alleviating what some have called a "cliff" effect starting in 2020), and allows for real-time adaptation of plans if these lead times are extended due to factors not considered in the original state compliance plan.

Of course, states also have broad flexibility to achieve emissions reductions through a variety of measures not limited to changes in their fleet of fossil fuel-fired generators' dispatch. For example, increasing renewable generation or energy efficiency can reduce state emissions while maintaining

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[21] Furthermore, the CPP is not yet final and there is reason to think that the EPA intends to modify the draft rule in important ways. In particular, the EPA Administrator and other senior EPA staff have signaled repeatedly in congressional testimony and in meetings with the states and industry that the Agency has heard clearly from stakeholders that a glide path or phase-in of the assumptions about the level of re-dispatch from coal to gas in the early years of the interim phase would ease the transition for states and companies.

headroom for emissions from coal or natural gas-fired units. Furthermore, these resources can provide many reliability services if necessary. In addition, states have the option to trade emissions or emissions credits with other states, meaning that one state could conceivably exceed its emissions target and acquire credits from another state that is below its own target. Given the range of state targets, this may allow for states with more challenging targets to ease into compliance by taking advantage of low-hanging fruit in other states with more economic options for meeting their targets.

As others before us have shown, this flexibility is a primary way to maintain reliability through a transition to a lower-emitting fleet. In order for states to take advantage of this flexibility, however, state stakeholders and policymakers must take proactive steps to coordinate with potential partners (both within and outside their state) and explore available options. A crucial tool to guide this process will be a series of well-conducted reliability assessments. We strongly believe that reliability entities and relevant state regulators can undertake effective reliability analyses that can proactively inform planning and assess options throughout CPP compliance.

Reliability Assessment Guiding Principles

To all users of the bulk electricity grid, maintaining electric system reliability through ongoing industry changes, including the implementation of the CPP, is of utmost importance. Indeed, this is part of the mission of all reliability coordinators, planners, and ISOs/RTOs. We are encouraged by proactive initiatives that industry members and regulators alike have undertaken to prepare for and respond to this change.

However, the dialogue around the CPP has revealed shortcomings and pitfalls of assessment processes that can skew findings in unhelpful ways. All parties in the debate about reliability and the CPP share the goal of maintaining and improving reliability. Nevertheless, we have seen some studies that significantly discount or ignore important considerations and information in their assessments, leading to conclusions that are used as arguments to forestall or prevent the CPP from going forward, rather than offering constructive adjustments and solutions. In some instances, it has seemed as though preservation of the grid's status quo has been equated with maintaining reliability.

This discrepancy has manifested most obviously in the wide range of studies and assessments that hope to inform the reliable and safe implementation of the CPP. In addition to NERC's Initial and Phase I studies, the following Regional Entities, RTOs, and ISOs have released assessments of the proposed CPP: PJM Interconnection;[22] Southwest Power Pool (SPP);[23] Midcontinent Independent

[22] *See* PJM Interconnection Inc., "PJM Interconnection Economic Analysis of the EPA Clean Power Plan Proposal," March 2 2015 ("PJM Assessment"). Available at http://www.pjm.com/~/media/4CDA71CBEC864593BC11E7F81241E019.ashxc.

System Operator (MISO);[24] Electric Reliability Council of Texas (ERCOT);[25] and the Western Electricity Coordinating Council (WECC).[26] Each of these organizations has valuable insight into how the CPP may affect their region, and their input can provide useful information for state and national regulators in designing the program and compliance plans.[27] Furthermore, we recognize that an examination of each aspect of grid reliability requires different types of modeling—assessing resource adequacy can be done through capacity expansion planning, operational reliability typically is analyzed through production cost simulations, and disturbance response is measured through load flow and dynamic response models. However, not all studies have utilized each of these methods. Indeed, to date, every assessment represents a vastly different approach to considering the CPP, and many contain problematic assumptions and methods that call into question their conclusions. These differences result in a set of studies whose findings are not mutually comparable and present conflicting and, in many cases, misleading results.

Instead, a useful reliability assessment must seek practical, realistic solutions that recognize and address both EPA's imperative to reduce greenhouse gas emissions and the shared interest in maintaining and enhancing affordable resource adequacy, operational viability, disturbance response stability, and other attributes that support the reliable and economic operation of the power system. Given the highly interconnected nature of the grid and the critical need for productive and actionable reliability assessments to guide state compliance with the CPP, these studies should be conducted following a set of common guiding principles. Though specific assumptions and models utilized will vary by region—and should, in order to best reflect local conditions—we believe there are six guiding principles that each study, regardless of method or assumptions, should follow. Taken together, these principles are a roadmap to a reliability assessment that realistically and methodically analyzes a range of potential CPP compliance pathways, highlighting impacts on multiple aspects of reliability in a way

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23 *See* Southwest Power Pool, "SPP's Reliability Impact Assessment of the EPA's Proposed Clean Power Plan," October 8 2014 ("SPP Assessment"). Available at http://www.spp.org/publications/CPP%20Reliability%20Analysis%20Results%20Final%20Version.pdf.

24 *See* Midcontinent Independent System Operator, "Analysis of EPA's Proposal to Reduce CO2 Emissions from Existing Electric Generating Units," November 2014 ("MISO Assessment"). Available at https://www.misoenergy.org/Library/Repository/Communication%20Material/EPA%20Regulations/AnalysisofEPAsProposaltoReduceCO2EmissionsfromExistingElectricGeneratingUnits.pdf.

25 *See* Electric Reliability Council of Texas, "Impacts of Environment Regulations in the ERCOT Region," December 16 2014 ("ERCOT Assessment"). Available at http://www.ercot.com/content/news/presentations/2014/Impacts%20of%20Environmental%20Regulations%20in%20the%20ERCOT%20Region.pdf.

26 *See* Western Electricity Coordinating Council, "EPA Clean Power Plan: Phase 1 – Preliminary Technical Report," September 19 2014 ("WECC Assessment"). Available at https://www.wecc.biz/Reliability/140912_EPA-111%28d%29_PhaseI_Tech-Final.pdf.

27 Additionally, we note that a number of other entities, such as NREL and many utilities and public utilities commissions, have conducted reliability assessments that, while not specifically CPP-focused, provide good examples of processes and practices that conform with our principles. We focus our discussion here on reliability entity-conducted assessments but strongly encourage input of these third-party stakeholders.

that can be pressure-tested by stakeholders and utilized by state policymakers. In this whitepaper, we assume that the party conducting the reliability assessment is a regional reliability planner, though most, if not all, of these principles would apply to a state- or utility-led process as well.

Guiding Principle: Utilize a Transparent Process

The CPP is subject to intense industry scrutiny and has elicited a broad range of positive and negative reactions among stakeholders. Organized and focused stakeholder involvement will help incorporate up-to-date assumptions, create consistency across assessments, and ensure that reliability assessments are, to the extent possible, based in objective facts and data. These processes can also help sanity check initial results. Organizations such as the Utility Variable Generation Integration Group have developed "principles for technical review" that should be followed for each reliability assessment.[28] In addition, to provide ongoing feedback as states incorporate results into compliance plans and reliability planners and/or coordinators plan for ongoing assessments, detailed results and assumptions should be discussed as part of the technical review process and be released in concurrence with each final report.

WECC's assessment stands out as a good example in this regard, clearly articulating the goals of the analysis, technical assumptions (and reasoning behind them), and model methodologies and limitations. As explained throughout the report, WECC also utilized cases based on stakeholder input. By comparison, other assessments have been less transparent about their assumptions and have limited stakeholder involvement. NERC, for example, delayed the release of its assumptions and provided only a narrow window for stakeholder review of the modeling results and draft reports.

Guiding Principle: Reflect Existing Status of the Grid in Modeling Assumptions

In setting the assumptions for the analysis, both in a reference case and CPP compliance scenarios, a reliability planner and/or coordinator must recognize key elements of the electricity grid's ongoing transformation. It is neither realistic nor useful to presume that the grid will revert to pre-market and pre-technological advancement conditions. Though we do not advocate for a specific set of assumptions, we urge careful consideration of the following factors:

- *Renewable development*: even without the CPP, renewable output under EIA's Annual Energy Outlook 2015 (AEO 2015) Reference Case continues to grow through 2040.[29] Other estimates

[28] Utility Variable Generation Integration Group & National Renewable Energy Laboratory, "Principles for Technical Review Committee (TRC) Involvement in Studies of Variable Generation Integration into Electric Power Systems," June 2012. Available at: http://uvig.org/wp-content/uploads/2009/05/TRCPrinciplesJune2012.pdf.

[29] U.S. Energy Information Administration, "Annual Energy Outlook 2015," April 2015 ("AEO 2015"). Available at: http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf.

show renewable build alone in 2015 expected to exceed 18 GW, mostly from wind and solar.[30] Reliability assessments must incorporate renewable energy assumptions and modeling that reflect these trends—but numerous studies to date have not. The NERC Assessment, for example, shows particularly limited renewable growth. It uses two renewable cases, "Carbon" and "No Carbon," as inputs to gauge the impact of the CPP as compared to business-as-usual activities. However, as compared to third-party projections showing 18 GW of build in 2015, the NERC Assessment assumes only half as much new renewables build in 2015—9 GW—with annual additions actually decreasing to between 2 and 2.5 GW per year between 2020 and 2029. Indeed, NERC's 2020 renewable generation projected under the CPP, 281 TWh, is actually below the amount of renewable energy generated in 2014.[31] Additionally, there is very little difference between the two cases. The "Carbon" case assumes only a 6 percent increase in solar output under the CPP, as compared to the "No Carbon" case, by 2030 in states such as Arizona, Florida, Utah, Texas, Nevada and New Mexico; similarly, it assumes only a 1 percent change in wind development by 2030 in Iowa and the Dakotas, and only a 6-7 percent change in Wyoming and Colorado. These baseline assumptions must be scrutinized, and likely improved, in order to result in assessments containing realistic views of capacity retirements and resulting reliability and energy management services available on the grid. One possible way to improve these build out estimates would be to closely consider renewable development costs—we note that NERC used 2013 data (which is readily available, and understandable), but prices have fallen so quickly that these data no longer reflect reality. Furthermore, as we discuss below, renewables—and other non-fossil emissions reduction strategies—should ideally be an output of an assessment to reflect the optionality of the CPP.

- *Ongoing generation and infrastructure improvement*: as we have presented throughout this whitepaper, the electricity sector is already undergoing significant infrastructure development and expansion. In many ways, this provides a "running start" to those who are looking to further strengthen energy infrastructure and may help cut down timelines as many important projects are already in the pipeline. For example, the Edison Electric Institute forecasted in January of this year that between 2014 and 2017, investor-owned utilities alone (not including other public utilities, co-ops, or merchant developers) will invest a total of $78 billion in transmission,[32] and FERC estimates that over 10,500 miles of currently proposed transmission

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30 Bloomberg New Energy Finance, "Medium-term outlook for US power: 2015," April 8, 2015. Available at: http://about.bnef.com/content/uploads/sites/4/2015/04/BNEF_2015-02_AMER_US-Power-Fleet-De-Carbonisation-WP.pdf.

31 Total net energy produced from solar, wind, geothermal and waste in 2014 totaled 281.1 TWh. *See* U.S. Energy Information Administration, Monthly Energy Review Data, Table 7.2. Reports available at http://www.eia.gov/totalenergy/data/monthly/previous.cfm.

32 Edison Electric Institute, "Actual and Planned Transmission Investment By Shareholder-Owned Utilities (2008–2017)," January 8 2015 at p. 1. Available at http://www.eei.org/issuesandpolicy/transmission/documents/bar_transmission_investment.pdf.

lines will be in place by 2017.[33] Similarly, FERC approved over 400 miles of new natural gas pipelines with a combined capacity of over 8 billion cubic feet per day in 2014.[34] To the extent that analyses consider infrastructure development as a limiting factor to providing reliability services, they should attempt to incorporate build out timelines that reflect this activity in electric transmission and distribution, natural gas pipeline, and generation development already underway. Many studies ignore the "pipeline" of infrastructure projects that will be in various stages of development at the start of the CPP.

- *Energy demand and energy efficiency*: the AEO 2015 projects growth at an annual rate of 0.8 percent between 2013 and 2040, not including any increase in energy efficiency that is driven by the CPP or other not yet operational programs. In comparison, NERC assumes load growth ranging from 0.5 to 1.2 percent in 2030, even after accounting for energy efficiency under the CPP. While exact demand is impossible to predict (see principle concerning sensitivities to address these unknowable inputs), scenarios should be based around realistic assumptions. Furthermore, to the extent that modeling is able to adjust demand as an output in response to electricity prices, assessments should incorporate transparent and accurate assumptions around the elasticity of demand.

Guiding Principle: Clearly Identify Base Case and Context

Without proper contextualization, some stakeholders have used reliability assessments as reinforcement for exaggerated claims of the impact of the CPP. It is true that actions to comply with the CPP will build upon and, in some cases, accelerate existing trends, such as natural gas pipeline expansion and coal plant retirements. However, as explained above, the ongoing nature of these activities means that much of the needed planning and infrastructure development to address reliability is already in progress. This "base case" must be clearly delimited and explained, with results placed in this context. To the extent that reliability studies indicate that more time is needed to comply with the CPP, they must correctly acknowledge existing conditions and activity, which in many cases would significantly trim development timelines and requirements.

The WECC Assessment again provides a good example of this guiding principle, providing context in numerous places to help stakeholders interpret study results. This assessment shows coal retirements under the CPP as compared to a well-defined base case,[35] for example, and three different natural gas dispatch scenarios compared to a clear "common case" that is also further explained in an Appendix to

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33 FERC Office of Energy Projects, "Energy Infrastructure Update for March 2015," posted April 23 2015 at p. 5. Available at http://www.ferc.gov/legal/staff-reports/2015/mar-infrastructure.pdf.

34 FERC, "Approved Major Pipeline Projects (2009-Present)," Data as of March 31 2015. Available at http://www.ferc.gov/industries/gas/indus-act/pipelines/approved-projects.asp.

35 *See* WECC Assessment at p. 15.

the report.[36] MISO's assessment also clearly shows the impact of projected coal retirements through using a base case against which incremental retirements associated with the CPP are compared. In comparison, SPP and NERC provide little to no context throughout their studies. NERC's assessment is especially concerning, with executive level conclusions and all graphs indicating that the CPP will trigger a wave of coal retirements that, upon examining the data provided deeper in the report, are proven to actually be largely already planned or underway due to other regulations or economic decisions. Similarly, it presents power flows and capacity margins under the CPP but gives no indication of how much the CPP has changed these values. While in some cases it is useful to understand these total results for reliability planning purposes, it is misleading and ultimately regressive to indicate that all changes are due to a single policy such as the CPP. Policymakers must understand the portion of activity that they can directly affect through their CPP compliance activities. Reports must clearly indicate if the conclusions are based on combining the incremental impacts of the CPP with the ongoing changes reflected in the reference case or if they are based on only the incremental impacts of the CPP.

Guiding Principle: Conduct Sensitivity/Probabilistic Analyses Where Possible

Reliability studies, by design, are forward-looking assessments that must incorporate forecasts of future conditions. Though we have numerous models for forecasting inputs such as electricity demand, fuel prices, and development costs, no forecast can ever be entirely reliable. As such, a good analysis will incorporate multiple sensitivities or a probabilistic approach around these key inputs to gain a clearer picture of what variables may drive concerns, and how likely they are to occur. However, some existing studies focus almost exclusively on a "worst case" scenario of high gas prices, high demand, and high technology costs. To the extent that resources allow, assessments should examine a broad range of cases that are more likely to encompass future conditions. While examining a low probability/high risk scenario does have some value, it should not be the sole driver of planning considerations or become the dominant "strawman" for policymakers to consider as the possible outcome of the CPP.

The NERC Assessment, for example, focuses primarily on a worst-case scenario, and would be more valuable to stakeholders if it included additional scenarios or sensitivities around demand growth, natural gas prices, retirement/development timelines, and compliance through mechanisms other than replacing coal with natural gas. As currently conducted, the study's results are primarily limited to showing how natural gas prices affect costs of increasing natural gas-fired facility dispatch, which does not help policymakers evaluate a balanced emissions-reduction strategy that best maintains reliability at least cost. The SPP Assessment, which the authors acknowledge as "cursory," provides another example of a study based on a limited range of assumptions. For example, rather than examining

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[36] *Id*. at pp. 16-17, 32-36.

retirements from an SPP system-wide policy perspective, this assessment uses EPA's IPM retirements under their state-by-state compliance case as retirement inputs. While this is a reasonable starting point for an assessment, it is unnecessarily restrictive, eliminating the ability of the modelers to optimize emissions reductions through on-the-ground decisions and updated assumptions and instead assumes that only those actions output from a different model will occur. Furthermore, it uses EPA's worst-case retirement outputs (from the state compliance case). To improve this assessment, SPP should develop alternative compliance scenarios including sensitivities where applicable.

On the other end of the spectrum, the MISO Assessment shows the benefit of exploring sensitivities—indeed, 1,296 individual scenarios. This sensitivity analysis helps show, for example, that a "medium" level of coal retirements may be most optimal for limiting compliance costs, and that in some cases, already-planned coal retirements would be sufficient to reach regional emissions targets (though at higher cost).[37] Similarly, the PJM Assessment conducted an assessment of multiple scenarios differing across variables such as natural gas prices, renewable resource and energy efficiency availability, new natural gas development, and others. PJM also focused a section of its report on the impact each of these sensitivities had on a range of model outputs, including resource redispatch, capacity at risk for retirement, and energy and CO_2 prices.[38]

Guiding Principle: Reflect the Flexibility of Compliance Options Under the CPP

EPA has designed the CPP with significant flexibility that will allow states to adjust their compliance approaches to maximize reliability (and minimize cost). The proposed rule's state-specific interim and final goals reflect differences in each state's current mix of resources used to generate electricity, coupled with each state's potential to increase the use of lower-carbon and zero-carbon resources. In designing a compliance plan, and potentially using the insight from a reliability assessment, a state may address reliability implications of potential temporary or permanent outages of specific units in a variety of ways, including making deeper reductions at other units or instituting "outside-the-fence" options such as renewable energy or energy efficiency development. States may also enter into emissions crediting/trading within their state borders or in partnership with all or portions of other states. Finally, as a long-term emissions reduction program, the proposed CPP establishes a ten-year interim target that states will have to meet on an average basis; in other words, a state may plan for higher emissions early in the program to allow for infrastructure or generation development (so long as those emissions are balanced out by reductions in later years), or may plan for an emissions "buffer" that would allow higher-emitting units to operate in short periods of reliability need, driven perhaps by peak demands or unforeseen weather events or unit outages.

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37 *See* MISO Assessment at p. 15.
38 *See* PJM Assessment at pp. 24-76.

Perhaps not all states will be able to take full advantage of this flexibility due to institutional challenges such as in-state political climate, infrastructure development procedures, or other planning considerations. However, reliability assessments must consider scenarios in which these flexible approaches are included. Ways this could be shown include:

- *Allowing all, or a majority, of compliance options (e.g., natural gas dispatch, increased renewable development, or additional energy efficiency) as outputs of models, not input*: a number of the reliability studies we examined are structured such that emissions reductions actions—such as increases in renewable penetration or energy efficiency—are limited as inputs of cases into assessment models. In many cases this effectively assumes that these activities will continue along business-as-usual trajectories, and that the only lever that policymakers may pull to reduce emissions is re-dispatch from coal to natural gas. In many areas, this severely and artificially limits the options a state may have to reliably and cost-effectively reduce the emissions intensity of its fleet. Moreover, it is an illogical assumption that the levels of such emissions reducing technologies will not be driven in part by a carbon-constraining program such as the CPP, and a model should be able to reflect this economic reality. This concern helps illustrate the need for different models for different reliability questions. First, capacity planning models can help evaluate least-cost resource adequacy generation mix scenarios; then, a postulated future generation mix can be input to a production cost model to analyze dispatch; finally, dispatch snapshots are inputs to load flow and dynamic stability models. A good process iterates and does "round-trip" modeling that can work toward more practical and realistic end cases and can protect against rigid acceptance of a set of inputs into any one of the models resulting in erroneous conclusions (essentially hardwired by the input assumptions). Alternatively, if an assessment cannot incorporate this complexity due to resource or time constraints, it should at least include multiple renewable, energy efficiency, and other compliance option build-out scenarios for comparison (see, for example, the MISO Assessment three renewable scenarios).
- *Indicating trading within (or outside of) the modeled region*: broad coordination among utilities and states has emerged as a centerpiece of the national discussion about the CPP and how it may best be implemented. Several studies, including notably the PJM Assessment, have found that multi-state coordination for the purpose of trading of emissions allowances increases the array of resource options for compliance, which can in turn allow for increased optionality to maintain reliability. Numerous states are in active discussion to explore ways that they could facilitate limited or modular allowance trading without necessitating legislated agreements or complicated multi-state CPP compliance plans—often called "common elements" approaches. It should also be noted that these trading mechanisms may extend beyond borders of modeled areas, and may not even follow electricity flow patterns. Assessments such as SPP's and NERC's could significantly improve the usefulness and accuracy of their results if they explored cases that included varying levels of trading.

- *Examining options for phased-in compliance*: as detailed above, the CPP sets fairly long-term compliance pathways, with "interim" compliance calculated over an average of several years and not starting until over four years from when a final rule is released. In reviewing a number of assessments and claims that the interim target is too aggressive, it appears that some may have assumed the year 2020 as a binding compliance year. Infrastructure development can be a critical path element in maintain reliability, and establishing assumptions around what amounts to premature compliance will exacerbate these infrastructure timelines, leading to misleading signs of reliability issues.

Guiding Principle: Provide Realistic But Reliability-Focused Results

Though many reliability planners have joint missions of maintaining reliability and ensuring well-operating and efficient electricity markets, the focus of these assessments should be on identifying reliability concerns that result from realistic projections of compliance options. In designing compliance plans, states and their stakeholders will no doubt pursue lowest cost actions that will vary by region. However, "reliability" should not be equated with "cost effectiveness" or a least-cost solution to compliance. The added value that reliability assessments can provide is to identify key electric system risks, vulnerabilities, and opportunities that arise from compliance options that fall across the cost spectrum.

Certainly, economic considerations are crucial in understanding how market players will react to given policies (such as energy efficiency programs or carbon prices), and we are not suggesting that these assessments be conducted absent any consideration of cost. Indeed, it is crucial that realistic assumptions of cost are built in to develop a forecast of, on one hand, the speed at which development and expansion will occur and, on the other, the rate of retirement or down-rating of existing facilities. Factoring cost and the likelihood of investment into reliability assessments needs to be done with sufficient impartiality such that the assessment skews toward neither over-built systems (by assuming high, out-of-market incentives) nor maintaining the status quo resource mix (by assuming any consumer price impact must be avoided). However, the primary output of a reliability assessment should not be a cost figure but instead a technical view of the electricity grid's capabilities. Though impossible to remove bias from any assessment, this will help focus these studies. It should not be within the scope of a reliability assessment, as it seems to be in the NERC and MISO cases, to opine on whether states may, or may not, be willing to pay a bit more than the cheapest possible compliance option in order to achieve a more optimal long-term solution, public policy consideration, or maintenance and development of reliability services. States and stakeholders will be in a better position to evaluate compliance options when they are given full information about both the reliability and cost impacts of compliance options that can serve local electricity customers. We point to the PJM and WECC Assessments as good examples of how economic factors are inputs that drive possible assumptions and cases under which to examine reliability.

Conclusions

As we have seen throughout the last half century, environmental standards can coexist with electric reliability. As our grid undergoes update and change, the toolkit to maintain reliability continues to improve. The CPP, through its flexible design, can take advantage of existing and emerging practices to support reliability on the path toward a clean, more efficient, electric industry.

To assist in this continuing transition, we must have a clear way to identify, plan for, and address reliability issues. Crucial to this will be reliability assessments conducted on a national and regional level that provide a consistent, productive, and comprehensive view of reliability. To that end, we encourage the industry and its stakeholders to utilize a standardized set of guiding principles for use in undertaking these important assessments. We recommend the following six guiding principles:

1. Utilize a transparent process. Organized and focused stakeholder involvement will help incorporate up-to-date assumptions, create consistency across assessments, sanity check initial results, and ensure that reliability assessments are based in objective facts and data.

2. Reflect existing status of the grid in modeling assumptions. In setting the assumptions for the analysis, both in a reference case and CPP compliance scenarios, a reliability assessment must incorporate key elements of the electric grid's ongoing transformation that will drive assumptions on, for example, renewable development, ongoing generation and infrastructure improvement, and energy demand and energy efficiency.

3. Clearly identify base case and context. Actions to comply with the CPP will build upon existing electric sector trends and will take advantage of already in progress planning and infrastructure development to address reliability needs. Policymakers must understand the portion of activity that they can directly affect through their CPP compliance activities. Reports must clearly indicate if the conclusions are based on combining the incremental impacts of the CPP with the ongoing changes reflected in the reference case, or if they are based on only the incremental impacts of the CPP.

4. Conduct sensitivity/probabilistic analyses where possible. Reliability studies should incorporate multiple sensitivities or a probabilistic analysis around key inputs of future conditions that are based on forecasts, including electricity demand, fuel prices, and development costs. Assessments should be careful to avoid only focusing on a low probability/high risk scenario.

5. Reflect the flexibility of compliance options under the CPP. The proposed CPP provides significant flexibility that will allow states to adjust their compliance approaches to maximize reliability and minimize cost. Assessments should reflect this flexibility in model design through methods such as allowing a range of compliance options (e.g., natural gas dispatch,

increased renewable development, or additional energy efficiency) as outputs of models, indicating trading within (or outside of) the modeled region, and examining options for phased-in compliance.

6. Provide realistic but reliability-focused results. The focus of these assessments should be on identifying reliability concerns that result from realistic projections of compliance options. While cost projections provide crucial bounding of assumptions and scenarios, "reliability" should not be equated with "cost effectiveness." The added value of reliability assessments is to identify key electric system risks, vulnerabilities, and opportunities that arise from various compliance options.

Following these principles will help create reliability assessments that provide practical, realistic results that recognize and address both EPA's imperative to reduce greenhouse gas emissions and the shared interest in maintaining and enhancing affordable, reliable electricity.