Protective Carbon Pollution Standards and Electric Reliability

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Abstract

Last June, EPA proposed the first ever national carbon pollution standards for existing power plants. Fossil fuel-fired power plants account for almost 40 percent of U.S. carbon dioxide emissions, making them the largest source of greenhouse gas emissions in the nation and one of the single largest categories of greenhouse gas sources in the world. Under the Clean Power Plan, these emissions will decline to 30% below 2005 levels by 2030 – accompanied by a significant decline in other harmful pollutants from the power sector, such as sulfur dioxide and oxides of nitrogen. The EPA has carefully designed the Clean Power Plan to provide extensive flexibility so that states and power companies can continue to deliver a steady flow of cost-effective electricity.

Grid operators are well-equipped to ensure reliability as we transition to a cleaner and more efficient power sector. Namely, operators have the ability to deploy long-standing tools and processes that have been successfully used in the past to keep the electric grid operating during periods of change. EPA's proposed Clean Power Plan is eminently achievable, reliable, and cost-effective – and integral to our climate security, human health and prosperity.

Background

EPA's proposed Clean Power Plan sets forth state-wide targets for reducing carbon pollution from existing power plants through 2030, based on cost-effective and proven means for reducing emissions from the power sector – including investing in energy efficiency, deploying zero-emitting renewable energy sources, improving the thermal efficiency of existing coal plants, and utilizing lower-emitting power plants more intensively. The Clean Power Plan builds on highly successful policies and practices that many states and power companies are already demonstrating, and that have already helped the power sector reduce carbon pollution by 15% since 2005[i].

Consistent with the "cooperative federalism" framework of the Clean Air Act, the proposed rule also provides each state with tremendous flexibility to design individualized plans to reduce carbon pollution going forward. Among other things, states can average their emission levels over the first decade of the Clean Power Plan; utilize a wide variety of policies and mitigation to achieve the state-wide goals that reflect the state's power mix and policy priorities, including market-based emissions compliance programs such as those that have been successfully used across Republican and Democratic administrations to cost effectively reduce sulfur dioxide and oxides of nitrogen emissions from the power sector; and coordinate with other states in the development of effective state plans to harness efficiencies.

EPA has carefully evaluated the technical and economic feasibility of the Clean Power Plan, including the implications of the proposed rule for the reliability of electric service. The nation's electric grid, sometimes referred to as the world's 'largest machine[ii]', provides dependable and consistent power to millions of Americans. Reliability is not only valued as a matter of convenience; life-saving medical devices depend on constant and reliable power, as do businesses, schools, and other essential facilities. It should come as no surprise, then, that the United States has a variety of entities charged with ensuring that electricity is reliable – as well as a robust array of regulatory standards, monitoring tools, planning processes and market instruments that these entities utilize to ensure a steady flow of power. These entities ensure that sufficient generation and transmission exist to provide reliable access to electricity. This framework has functioned extremely well to maintain reliability over the last two decades, even as the power sector has undergone major market transformations and implemented other important Clean Air Act safeguards to protect human health and the environment.

Grid operators and regulators

The U.S. energy grid is regulated and run by a number of entities working in concert. These entities include:

- **FERC**: the federal agency charged with ensuring that wholesale sales of electricity and interstate transmission function properly at 'just and reasonable' rates. Under the Federal Power Act[iii] and Energy Policy Act of 2005,[iv] FERC also approves and oversees the enforcement of reliability standards for the bulk power system.

- **Independent System Operators ("ISO") and Regional Transmission Organizations ("RTO"):** ISO/RTOs are responsible for the actual operation and functioning of the electric grid. These entities coordinate, monitor, and control the electric grid, and play a critical role in ensuring long-term availability of generating capacity and maintaining reliable operation of the grid on a day-to-day basis. Although ISO/RTOs exist in much of the country, parts of the United States are not covered, with state public utility commissions and utility commissions instead fulfilling this function.

- **The North American Reliability Corporation ("NERC"):** A FERC designated "electric reliability organization" charged with developing and enforcing reliability standards since 2006. These standards are specifically focused on "defin[ing] the reliability requirements for planning and operating the North American bulk power system."[v] NERC will also engage in efforts in addition to this primary mission, such as previous examination of cyber-security and current examination of the Clean Power Plan.[vi]

- **Regional Balancing Authorities:** Regionally, reliability councils like the Western Electricity Coordinating Council and Midwest Reliability Organization help monitor and enforce NERC reliability standards across the United States.

- **State Public Utility Commissions ("PUC"):** PUCs regulate local distribution and retail sales, undertaking a variety of planning and ratemaking activities to ensure that regulated public utilities have adequate resources to meet demand and preserve system reliability. In some states, PUCs regulate both generation and distribution; in other states, PUCs only regulate distribution.

- **Utility Companies:** Utility companies provide electric service to end users and are regulated by PUCs. Utilities must ensure that sufficient generation and transmission exists to reliably meet demand within their service territories.

Reliability: Industry tools and practices

Grid operators and regulators have long-standing tools and practices to ensure the grid is operated reliably, and will be tasked with continuing to use these tools to help ensure this continues as the power system continues to decarbonize under the Clean Power Plan. To help maximize the effectiveness of these existing tools, the EPA, in turn, is affording states and power companies broad flexibility in how the standards will be met.

This process has already begun. Reports from groups such as Analysis Group, Brattle Group, and PJM (the nation's largest ISO/RTO) have shown how the nation can reduce greenhouse gas emissions while ensuring reliability of the electric grid. These reports have coalesced around five major 'reliability' categories to ensure:

- How can sufficient generation be ensured to meet demand?
- How can sufficient transmission for new renewable resources and natural gas plants be ensured?
- How can energy efficiency and other 'demand side' resources help ensure reliability?
- How should new resources that are 'intermittent' be effectively integrated into the grid?
- Does the Clean Power Plan include sufficient flexibility to ensure reliability?

To answer these questions and others, stakeholders have turned to the same tools and practices that have successfully addressed reliability concerns in the past. These tools and practices, almost all of which are grounded in long-standing practice, have worked to ensure reliability for many years and will continue to do so under the Clean Power Plan. How these tools and practices can continue to be applied is examined with respect to each reliability category below.

There is compelling evidence to suggest that sufficient generation will exist and that grid authorities will have ample time to respond to the retirement of uneconomic units

Large amounts of generation are added every year to the electric grid. Since 2000 roughly 30 gigawatts of new generation have been added per year.[vii] Over the next two years, the solar industry alone expects to add another 20 gigawatts of solar power. If the nation simply continues to build new generation for the next 15 years at the same rate it has averaged over the last 15 years, then we will have 450 gigawatts of new renewables and natural gas by 2030. This is roughly 30 percent higher than the total amount of coal generation online today. This investment can be expected to continue as power companies modernize rapidly aging infrastructure as more than 30 percent of coal plants are 50 years old.[viii]

Importantly, the Clean Power Plan does not mandate particular types of compliance. The Plan provides states and power companies with great flexibility, so that reliability can be ensured.

New generation is neither ad-hoc nor an unexpected surprise. Regional entities, states, and utilities are well equipped to determine how much new generation is needed – through well-established practices, these entities look years into the future to determine the extent to which older plants will retire and new generation will be needed. This forecasting tests a number of hypothetical scenarios and provides sufficient lead time for grid operators to ensure 'resource adequacy' (the amount of generation needed to keep the grid reliable). Occasionally, plants will retire unexpectedly. However, well-established processes exist to resolve reliability issues in these cases as well. This issue is not new – grid operators have a number of tools to ensure reliability when changes lead to shifts in utilization or plant retirements.

Tools available to grid operators are numerous, and include:

- **Capacity Markets and Resource Adequacy:** Many ISO/RTOs run 'capacity markets', which provide generators and providers of energy efficiency and demand response to provide long-term supply commitments. These 'capacity payments' are provided in exchange for assurance that sufficient resources will exist far in the future to ensure grid reliability. Resource adequacy proceedings provide much of the same forecasting function, only at a state level.

- **Transmission Upgrades:** Often, upgrades in transmission can provide reliability without needing to add new generation. Because new transmission can help move generation more easily, transmission upgrades can provide reliability.

- **Long-term forecasting:** Grid planners forecast the needs of the electric grid years in advance. By determining how much transmission and generation will be needed, any long-term reliability issue can be identified and resolved quickly and effectively.

- **Reliability Must-Run ("RMR") Contracts:** Short term contracts that, in the case of sudden and unexpected retirements or plant losses, require a unit to be kept operational until reliability can be ensured through the use of longer term tools.[ix]

- **Operating Procedures: Manuals** and standard practices exist to ensure that, in the case of particular reliability scenarios, grid operators know the best way to respond.

Grid operators are able to implement the tools laid out above fairly rapidly. Greater use of natural gas and renewable energy is also already underway, and provides ample evidence that transmission issues can be resolved. PJM, for example, saw roughly 12,500 MW of coal-fired power plant capacity retired from 2010 to 2014 due to economic reasons. At the same time, the region saw a large quantity of new natural gas capacity added. This 'fuel switching' did not lead to reliability concerns, despite more than two-third of the retirement occurring over only from 2010 to 2012, when natural gas prices dropped significantly.[x]

There is strong reason to expect sufficient transmission for new renewable resources and natural gas plants to exist.

New renewable and natural gas resources need sufficient transmission to carry the power produced to the end consumer. Like with generation, there is strong evidence to suggest that this needed transmission will exist as needed. Over the past five years, for example, more than 2,300 circuit miles of new transmission additions were constructed each year.[xi] FERC predicts a "high probability of completion" of close to 10,000 miles of new transmission" by January 2017.[xii] In total, 18,700 circuit miles are planned over the next five years.[xiii] This transmission also can help offset the need for construction of new generation. To put these figures into context with the Clean Power Plan, consider this: although expansion of natural gas transmission pipelines may occur as a result of the Clean Power Plan, analysis suggests that it "is likely smaller than comparable pipeline extensions in the past."[xiv]

Like with generation, grid operators have a number of mechanisms to ensure that sufficient transmission exists to integrate new generating resources and make optimal use of existing resources. FERC Order 1000, issued in 2011, gives transmission providers an important tool to determine the best response to precisely this question. The Order requires a coordinated regional planning process, where transmission build-out over an entire region must identify potential areas of concern and best solutions at the outset, and must explicitly take into account state and federal policy requirements. The resulting process is designed to ensure that transmission operators work together on a regional basis to ensure that long-term transmission needs are properly identified and planned for, and take into account new policy developments such as the Clean Power Plan.[xv] Coupled with other tools, such as the ability to expedite needed transmission projects, grid operators have ample ability to resolve transmission issues early and quickly.

Energy efficiency and other 'demand side' resources can help ensure reliability and reduce the amount of new infrastructure needed while delivering lower electricity bills for consumers

Energy efficiency stands as a cost-effective way to help meet the Clean Power Plan and reduce the need for new infrastructure. Rigorous analyses have found energy efficiency to be almost three times cheaper than the next cheapest alternative, making it "the cheapest method of providing Americans with electricity."[xvi] And opportunity is enormous; leading studies have found that the US has the potential to cost-effectively reduce energy consumption through energy efficiency by roughly 23 percent by 2020.[xvii] The International Energy Agency, appropriately dubbing energy efficiency as the 'first fuel', found that in a study of 11 IEA member countries, if not for energy efficiency, the countries would be using about "two-third more energy than they currently use."[xviii]

EPA anticipates that customer-side energy efficiency programs, such as those many public utility commissions and power companies have been implementing for decades, will be a cost-effective way of achieving emission reductions under the Clean Power Plan.

Utilities have long-standing experience in implementing energy efficiency projects to ensure that reliability is not jeopardized. For example, total utility spending increased from under $2 billion to over $7 billion from 2006 to 2011 – an almost four-fold increase in five years.[xix] This rapid increase has not created reliability concerns. In fact, the opposite is true: by decreasing the need for new transmission and generation, energy efficiency can help reduce peak load, which in turn increases grid reliability.

A number of authoritative studies have found that the grid can accommodate considerably more 'intermittent' generating resources, such as wind and solar.

Several types of renewable resources, like wind and solar, are 'intermittent', meaning that output varies throughout the day. When the sun stops shining, for example, solar energy likewise ceases. This intermittency is largely predictable, meaning that although intermittent, it can (and is) planned for by grid operators. Because states vary in renewable energy penetration, well established practices already exist to ensure that intermittent resources will not negatively impact grid reliability. Significantly, these practices equip grid operators to integrate renewable energy at far greater levels than what is expected under the Clean Power Plan. EPA estimates renewable energy to grow to 8% in 2020 under the Clean Power Plan, and 13% by 2030.[xx] Maine already uses renewable energy to provide 25% of its generation, and California meets 23% of its generation needs using renewables.

Grid operators have a number of tools available to integrate renewables. Flexible power plants – generators able to quickly turn on and off fill in intermittency gaps. Resources like demand response, itself a clean energy resource, can likewise balance the grid during times of intermittency, helping to ensure reliability.[xxi] Technologies such as energy storage, which are already being used to provide short term balancing, are a likewise ideal solution.

These tools have effectively been used in the past to ensure reliability in the use of intermittent resources. Many states and countries already use far higher levels of renewable energy than what is expected under the clean power plan. Iowa already supplies 27% of its total electric generation with wind.[xxii] A recent study of the PJM system found that it will not have any significant issues operating with wind and solar generation providing up to 30% of its energy.[xxiii] In addition, in every scenario examined, integrating renewables into the PJM system would lead to lower operation & maintenance costs and a lower locational marginal price of electricity (which reflects the cost of generation and transmission), while reduction in CO_2 emissions relative to business as usual would range from 12% to 41%.[xxiv] In addition, a study commissioned by the Minnesota Department of Commerce and conducted in coordination with the ISO/RTO Midcontinent Independent System Operator ("MISO") has found the state of Minnesota could obtain 40% or more of its electricity from wind and solar energy without suffering any grid reliability issues.[xxv] Germany, with already close to 30% renewable energy penetration, likewise does not experience reliability concerns. In the latter's case, the country is able to, moreover, meet stricter standards than set in the United States even with far higher deployment of renewable energy.

The Clean Power Plan includes sufficient flexibility to allow reliability organizations to deploy the tools already at their disposal to ensure reliability.

With well-established tools and practices in place, it's fair to ask whether grid operators will have the ability to use them under EPA's Clean Power Plan. The plan provides precisely this: it provides state-wide goals for emission reductions, while affording states ample flexibility in how those goals must be met. States are not limited to using the four building blocks that EPA relied upon in developing the state-wide goals, and can deploy a variety of existing and new policies to meet the state-wide greenhouse gas reduction goals, including flexible market-based tools. This already existing flexibility allows grid operators the freedom to use long-standing and tested actions to ensure reliability.

States are given substantial flexibility as to the timing of emission reductions. Specifically, the proposed rule would require states to achieve an average emission level over the "interim" compliance period of 2020-2029. This gives states the flexibility to achieve the interim standard while crafting their own path forward over that 10-year period in a way that captures their own unique GHG reduction opportunities and policy preferences while ensuring reliability of the grid.

States are also free to deploy a wide range of time-tested flexible compliance mechanisms, that can allow power companies to respond to unexpected changes in the power system without compromising the carbon pollution reduction goals of the program, including banking of emissions reductions in the form of credits or allowances, multi-year compliance periods, and other program design features that help take advantage of the 10-year interim compliance period. Together these features ensure that any plant that needs to run to maintain the reliability of the grid can do so without running afoul of the Clean Power Plan.

In addition, states have the opportunity to create state compliance plans based on long-standing authorities to regulate emissions that also link to other state plans – such as through state compliance plans that share "common elements" (such as similar trading programs and emission standard designs) to harness regional efficiencies.[xxvi] With regional entities already in place, such as ISOs, developing state-based compliance plans that also are designed to utilize platforms and synergies that harvest cross state efficiencies can help unleash additional flexibilities. State coordination comes with an added benefit: PJM has estimated reduced compliance costs.[xxvii] Some ISOs, such as PJM, already have experience in dealing with multi-state carbon emissions reductions programs. The Regional Greenhouse Gas Initiative, with three PJM member states (and nine total currently), was "implemented seamlessly from the very beginning, and without any reliability problems."[xxviii]

Conclusion

Although the Clean Power Plan represents an important step forward for our country, it builds on a nation-wide trend toward a cleaner and more efficient power sector that is already under way. As noted above, carbon emissions from the power sector are already 15% lower than in 2005 – reflecting a sharp decline in coal-fired power generation, as well as a significant increase in natural gas generation and renewables and rising investment in energy efficiency. Since 2005, many fossil fuel-fired power plants have also installed modern pollution controls in response to state and federal clean air standards adopted to protect public health from harmful particulates, ozone-forming pollution, and toxic air pollutants such as mercury and arsenic. The robust system of reliability safeguards described above has responded deftly to these developments, ensuring a consistent and reliable supply of affordable power while helping reduce harmful air pollution.

There is every reason to believe that these reliability institutions and tools will be equally effective in responding to the Clean Power Plan, with its long implementation timeframe and multitude of compliance flexibilities. Long-standing practices and tools are available to grid operators in ensuring that the lights stay on and the power continues to run. EPA has proposed a highly flexible framework that enables states and power companies to deploy dynamic and cost-effective solutions in reducing health-harming pollution while providing a steady flow of cost-effective electricity for our nation.

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