NRG ENERGY

EPA's proposed 111(d) rule

Glide Paths instead of Cliffs: Greater Emission Reductions at Lower Cost

Electric Pass, Colorado

It is far easier to descend on the gradual slopes at the right than the cliffs on the left

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Executive Summary

The EPA's proposed rule to regulate carbon dioxide from existing power plants emphasizes the ample flexibility it provides to states. However, careful analysis of the rule shows that it provides significant flexibility for *how* states can achieve the required CO2 reductions, but little flexibility on *when* to achieve them. In fact, most of the emission reductions it calls for are required in 2020, the rule's first year.

These dramatic early emission reduction requirements – often 30% to 50% below the 2012 benchmark – should be expected to render large numbers of coal plants uneconomic and hence lead to their retirement in 2020. This sudden retirement is likely to cause resource adequacy risks, high power prices, and the rapid deployment of large numbers of new natural gas combined cycle power plants, especially in certain states and regions. Large amounts of new natural gas power plants at the beginning of the 2020's, in turn, will tend to lock-out renewable and other clean energy technologies, potentially for decades -- especially since more efficient end use is likely to keep overall demand for additional power plants from growing.

This lock-in of new gas generation and corresponding lock-out of renewable and other energy technologies could seriously delay the longer term de-carbonization of the US power sector. However, this unintended consequence of the proposed rule can readily be avoided by one or more of the following modifications in the EPA's final rule.

- EPA should broadly defer to states to set the actual emission reduction trajectories needed to achieve the ultimate emission reduction goals in EPA's final rule. Each state can craft an emission reduction trajectory to achieve these goals that will address legitimate state concerns such as resource adequacy, cost and stranded assets.
- Alternatively, EPA should modify the rule's 10-year average compliance requirement, which is largely responsible for the dramatic first-year reduction requirements of the proposed rule. Allowing states to comply by meeting, on average in the first ten years, half of the reductions required by their interim goals would allow each state to select a uniform "glide path" trajectory from its 2012 benchmark levels to the EPA's 2030 goals.
- EPA should also modify the timing of and the degree to which various building blocks in its assumed best system of emission reductions are activated. In particular, the EPA's assumption that a full re-dispatch of existing gas to displace coal could be implemented overnight is unwarranted. Such a dramatic change needs to be phased in over time to avoid the significant resource adequacy, cost and other consequences of suddenly rendering large numbers of existing power plants uneconomic.

These changes will support state plans that ensure the gradual but persistent transition from high to low power sector CO2 emissions, while limiting the reliability risks, price shocks, and other significant problems the proposed rule is poised to create. At the same time, they will help avoid the immediate lock-in of large amounts of new gas. Instead, they will ensure states can devise gradual transitions to renewable energy, fossil resources that capture and use carbon, and efficient distributed clean energy systems, thus producing far greater overall CO2 reductions at a lower cost.

1. Introduction

On June 18, 2014, EPA released its proposed rule for the regulation of greenhouse gases under the Clean Air Act's Section 111(d). NRG Energy views climate change as the pre-eminent challenge of this generation, and supports effective and well-designed policies to reduce greenhouse gases and accelerate the deployment of clean energy technologies. Accordingly, we have carefully reviewed the EPA's proposed rule, and have identified key aspects that we view as likely to create unintended but serious negative consequences, while limiting the rule's effectiveness in achieving the overall objective of limiting greenhouse gas emissions and thereby mitigating the more serious risks of climate change.

These problems stem from three key features of the rule:

- ***Too many short term emission reductions up front, but not enough long term.*** The vast majority of the emission reductions required of states by 2030 – often 90% or more -- will be required in the very first year of the rule. As a result, the rule is likely to threaten reliability and accelerate the "lock-in" of large amounts of new natural gas generation, particularly in some regions, while generally delaying the deployment of tomorrow's cleaner and cheaper renewable energy and emerging competitive distributed energy resources.

- ***Vastly disparate impacts on states.*** The proposed rule has dramatically different state emission reduction targets, based on a small number of assumed or administratively-determined factors. These factors appear likely to impose disproportionate costs of achieving the required emission reductions on certain states, particularly among those that face the largest emission reductions. This approach is inconsistent with the joint state-federal approach at the heart of the Clean Air Act.

- ***Complex, unprecedented policy design burdens for states.*** While providing little flexibility in terms of when states must meet the rules emission requirements, the proposed rule grants nearly unlimited flexibility to states in terms how to meet these aggressive and, in some cases, unrealistic goals. The result is a heavy burden of complex and aggressive air, climate, clean tech, utility and electric market policy reform for the states to carry out – that will in many cases require contentious state legislation -- in a very short time.

In addition, the substantial uncertainty around whether the proposed rule will withstand legal review poses yet another barrier to success. This uncertainty, in turn, makes significant early action to comply with the rule less likely, and significantly exacerbates the challenges identified above and the burdens on affected entities.

Fortunately, as outlined in this paper, each of these problems can be mitigated to a substantial degree by relatively modest modifications in the final rule, without relaxing its final emission goals. Indeed, by avoiding resource adequacy problems, reducing the lock-in of natural gas and facilitating far greater deployment of renewable resources, these modifications will put the US power sector firmly on path of achieving the technology and business transformations needed to reduce CO2 emissions and effectively address climate change.

2. Too many short term emission reductions but not enough in the long term.

a. Even with maximum flexibility, many states must achieve dramatic emission reductions in 2020.

The proposed rule proffers tremendous flexibility to states in terms of *how* to achieve its aggressive emission reduction targets. But it provides very little flexibility over *when* to actually achieve them. This is because of two key features of the proposed rule. First, the interim goal, for many states, is a very high percentage of the total reductions required by 2030.[1] Second, the rule requires that the average of a state's emission performance in each of the years 2020-2029 equal or exceed the interim goal.[2] As the Proposed Rule's preamble explains, this 10-year average requirement means that

> "states may choose a different emission performance [...] trajectory [...], achieving lesser levels of performance in early years and more in later years, provided, of course, that the interim 10-year average requirement is met." [3]

We have calculated the emission trajectories that minimize early emission reductions for each state with material coal generation ("coal states").[4] As a result, it is clear that the 10-year average requirement provides little timing flexibility, and precludes the benefits EPA intended it to confer on states.[5]

Figure 1 (below) shows these compliance trajectories for 11 states, all with significant amounts of coal generation, to show the basic shape of these trajectories and the extremely limited timing flexibility they actually offer to states. Figure 1 also gives an example of disparate reduction requirements across various states, both in 2020 and in 2030.

Figure 2 (below) shows the 2012 benchmark, the minimized 2020 emission requirement, and the 2030 goals for all states with material amounts of coal generation. This can be visualized as a mountainside, with states in different positions along the crest, based on their 2012 benchmarks (blue line).[6] Many states face daunting first-year cliff-like reduction requirements when the rule goes into effect in 2020 (jumping from the blue line to the red line), with relatively minor reductions required between 2021 and 2030 (from the red to green line).

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[1] The interim goal is 95% or more of the 2030 goal for 19 states, ranges from 90% to 94% of the final goal for 25 states, and from 84% to 89% of the final goal for the remaining 5 states.

[2] Proposed Rule at SS 60.5740, p. 34951 and SS 60.5775, p. 34953.

[3] Proposed Rule at p. 34905.

[4] Our analysis assumes that no state chooses to over-comply in 2029 relative to its 2030 and beyond requirement; and (b) states prefer a smooth "ramp" that reduces emissions by the same amount each year from 2021 through 2029. See Appendix, item B. States with a small amount of coal generation have been excluded from this analysis since their affected unit emission reduction requirements are somewhat misleading in terms of overall impact.

[5] Proposed Rule at p. 34904. ("[T]iming flexibility ... allows states to develop plans ... that achieve a number of goals, including: Reducing cost, addressing reliability concerns, and addressing concerns about stranded assets. Therefore, EPA is also proposing to allow states flexibility to define the trajectory of emission performance between 2020 and 2029, as long as the interim emission performance level is met on a 10-year average or cumulative basis and the 2030 emission performance level is achieved.")

[6] Due to rising natural gas prices and economic growth, a number of states face even higher 2019 emissions.

Figure 1

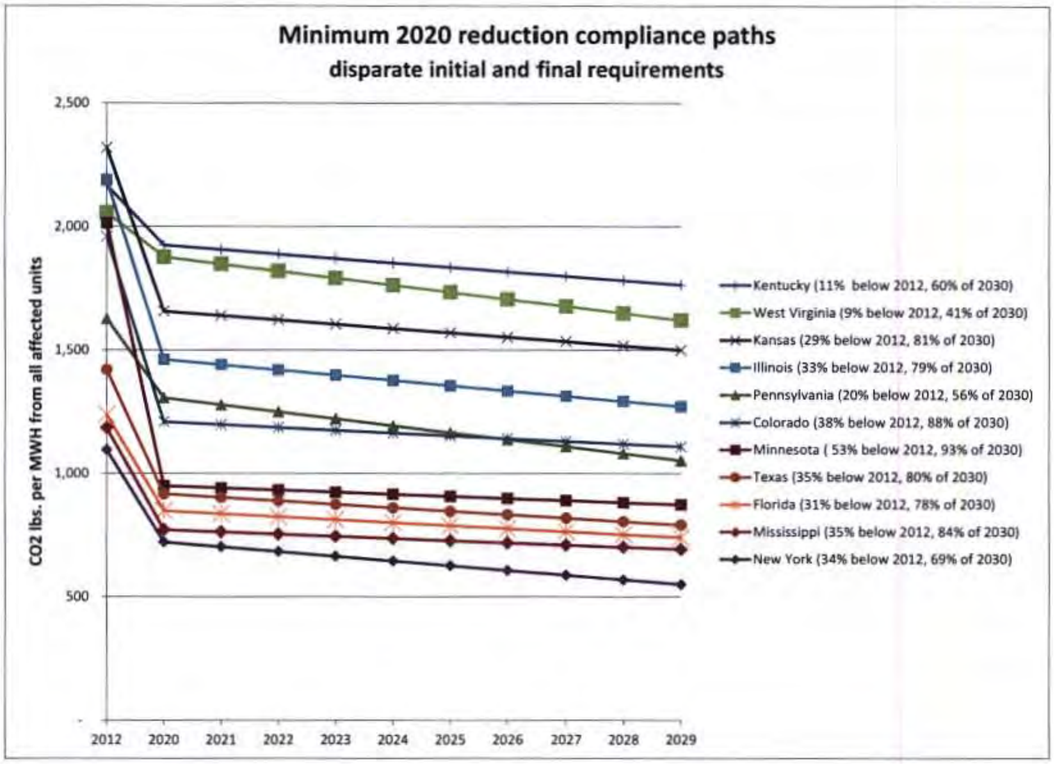
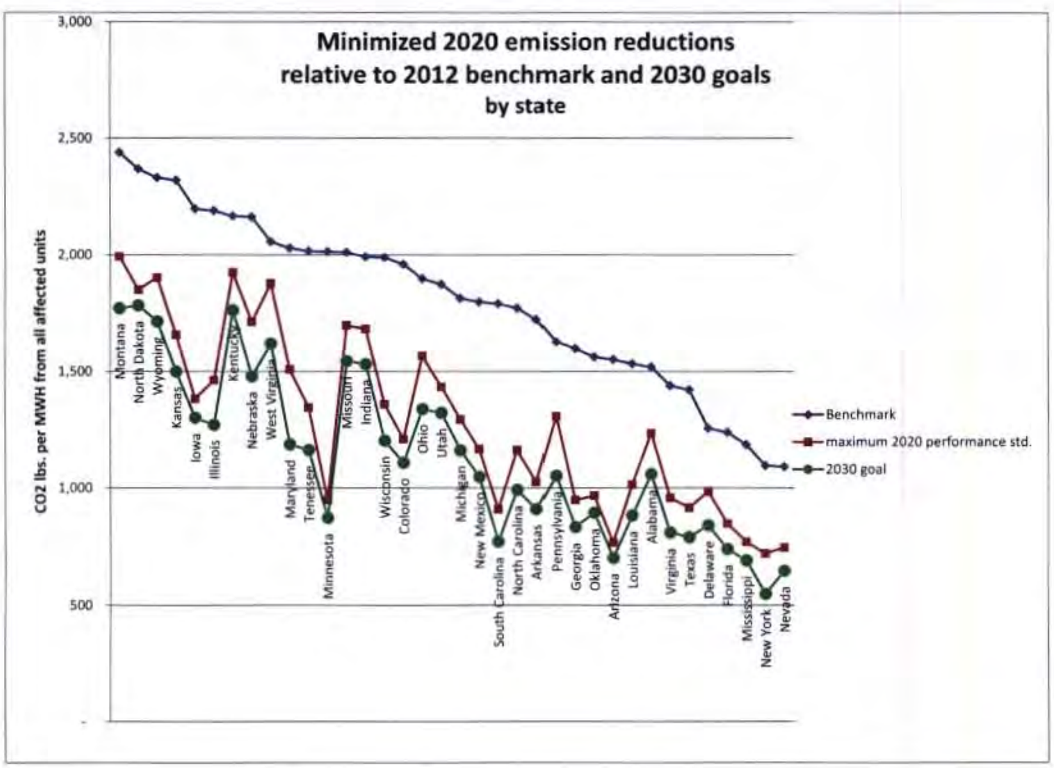


Figure 2



b. Significant emission reductions prior to 2020 should not be expected in many states.

Some coal states may be able to realize a significant portion of their emission reduction requirements before 2020, which would further minimize the first step by pre-achieving some of it.[7] However, this is likely to only happen in states with a unique combination of features such as:

- Coal plants that are at best marginally economic under forward prices for gas and power;
- Less aggressive EPA interim emission reduction goals;
- Capacity markets to support cost recovery for repowering competitive coal plants to low capacity-factor natural gas plants;
- Ample current and future reserve margins to allow retirements without jeopardizing reliability or (in cost-of-service regulated markets) requiring expensive additions to ratebase that would create unacceptable levels of rate increases ("rate shock"); and
- A willingness to opt for a mass-based state plan under 111(d).[8]

These conditions do not exist in number of coal states. Indeed, a number of these states are likely to see increases in CO2 emissions between now and 2020, due to economic factors such as higher natural gas prices, economic growth and, potentially, from any nuclear retirements or extended outages in the intervening years.[9]

In addition, for some states, significant interim emission goals may be correlated with *higher* power sector emissions before 2020. For example, states with large amounts of both combined cycle and coal plants have the largest emission reduction requirements from the EPA's second building block (gas re-dispatch). But such mixed generation fleets will exhibit a strong tendency to increase both coal MWH and CO2 emissions as gas prices recover, consistent with forward market curves and EIA projections, especially in competitive markets. Similarly, states with large amounts of nuclear power have a larger emission reduction requirement due to the proposed rules third building block, but may also be more likely to experience a prolonged nuclear outage, retirements or construction delays, both of which would cause fossil plants to run more and produce more CO2.

These CO2 emission drivers are primarily economic or market-based. By contrast, specific policy efforts to meet some or all of EPA's GHG emission requirements prior to 2020 are unlikely in a number of coal states, for the simple reason that may be unwilling to embrace costly measures to meet the EPA's requirements before legal challenges to the rules are resolved. Such resolution is unlikely before 2020, and may take even longer, leading to the potential need for dramatic reductions in the first years of the program but little time for states to develop effective policies.

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[7] For example, NRG recently announced its plan for a combination of retiring, repowering and better controlling its Illinois coal plants, before 2020, which we anticipate has the potential to achieve roughly 50% of Illinois' 2020 emission reduction requirements under the EPA's proposed rule.

[8] Coal retirements alone are unlikely to significantly change the overall emission rate per ton of affected units.

[9] Higher natural gas prices increase coal plant operation, economic value and CO2 emissions. Natural gas prices forward prices currently reach $5 in the early 20's and continue to increase thereafter. See Appendix, item A.

c. Negative consequence of overly stringent early emission requirements.

Significant emission reductions from existing power plants in coal states will come primarily from reduced generation from coal plants. In turn, coal plants whose output falls dramatically are at high risk for economic retirement as the value of generation falls relative to fixed operating and maintenance costs. Thus significant early emission reduction requirements should be seen as leading to significant early coal retirement. It is well understood that the emission reductions needed to effectively address climate change will require the elimination of most CO2 emitted by coal plants, but it does not follow that the sudden elimination of coal plants is an effective way to address climate change. Driving large numbers of coal plants into sudden retirement creates very real risks of a resource adequacy crisis in some regions, which in turn is likely to result in the following cascading series of events:

- The rapid deployment of large amounts of new, long-lived baseload natural gas assets;
- The prolonged delay of large scale deployment of renewable and other essential clean energy technologies; and
- Excessive power sector dependency on a single (fossil) fuel and the lock-in of excessive CO2 emissions for several decades.

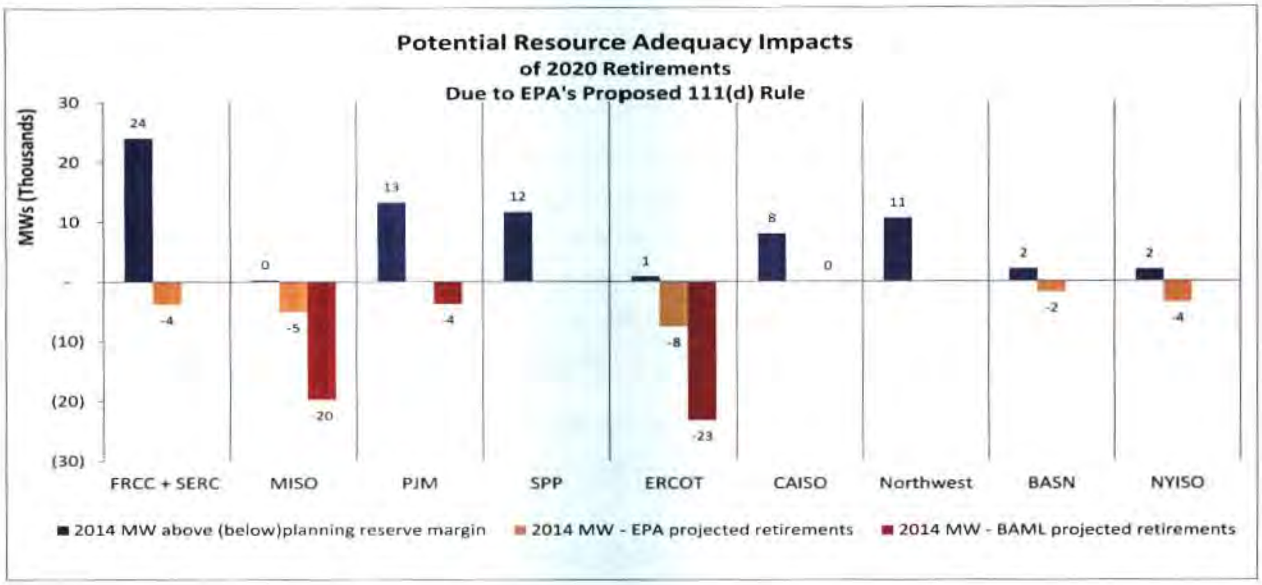
The potential for the proposed rule to trigger these unintended outcomes is explored briefly below.

i. Resource adequacy at risk. The fundamental requirement for electric reliability is to have enough generating capacity to match the energy usage of customers. If energy usage exceeds capacity, the entire grid is at risk of collapsing. To avoid such cascading grid failures, reliability rules require the power system to always maintain enough reserves of generation (referred to as *operating reserves*) to stand-in for outages or failures and still be able to meet the highest expected levels of consumption. If high levels of power consumption and outages cause operating reserve levels to fall below the required level, reliability rules require utilities to intentionally disconnect customers – called "load shedding" – to reduce energy consumption to a level that allows adequate reserve levels.

Both load-shedding and the even more serious cascading grid failure it avoids are largely unacceptable in light of the importance of electricity to our modern society. They are avoided by assuring *resource adequacy* – that is, by ensuring enough generation capacity exists to meet the highest reasonably expected levels of energy consumption, plus enough extra generation on reserve to be able to substitute for other power plants that might experience outages or failures during these high levels of energy consumption. The amount of needed extra generation to ensure resource adequacy is called the *planning reserve margin*.

The retirement of large amounts of existing power plants at once, without enough time and forward certainty to plan and build their replacements, is the perfect recipe for resource adequacy problems, especially where operating reserves levels are already close to the planning reserve margin. As shown in Figure 3, the levels of potential retirements in 2020 due to the proposed rule create serious risks of resource inadequacy in several coal states and larger regions of the US.

Figure 3



The blue bars of Figure 3 show the excess of current generation supply, as reported in NERC's 2014 Summer Reliability Assessment, relative to various reliability regions' planning reserve levels.[10] The orange bars show the impact on current reserve margins of the retirements projected by EPA's own Regulatory Impacts Analysis (RIA) for Option 1 with state plans under the proposed rule. The red bars show the impact on current planning reserve margins of the coal plant retirements projected by Bank of America Merrill Lynch's (BAML) recent note on the impacts of the proposed rule on coal retirements. NERC's projected new builds are excluded in order to more realistically identify the potential for short term resource adequacy challenges, which projections of additional resources may simply eliminate by assumption. [11]

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[10] EPA Clean Power Plan, Technical Support Document *Resource Adequacy and Reliability Analysis.* June 2, 2014; North American Electric Reliability Corporation. *2014 Summer Reliability Assessment.* May, 2014. In Figure 3, planning reserve levels are represented as zero on the vertical axis.
http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/2014SRA.pdf ;
The EPA's Carbon Rule - A Closer Look. August 6, 2014. Bank of America Merrill Lynch. Note we do not endorse the accuracy of either the EPA's or the BAML analysis, but they do offer potential bookends for a serious evaluation of retirements and resource adequacy problems that could result from the proposed rule's dramatic early emission reductions.

[11] The EPA's *Resource Adequacy and Reliability Analysis* TSD makes seriously misleading conclusions regarding resource adequacy. It simply affirms that EPA "used the IPM model to ensure resource adequacy" -- meaning the IPM model was able to build enough new power plants in 2020, while it also retired large numbers of existing plants, to ensure resource adequacy. This approach ignores the differences between IPM and the real world. Such models are programmed to *avoid* resource adequacy problems. Their programming also makes it easy for them to do so, by assuming perfect foresight of future costs and demand, market prices that immediately reach levels that support new power plants when needed; and the prompt construction of only the needed amount of power plants. In the real world, the future is dramatically uncertain, electricity prices are renowned for their "missing money" and inability to incent resource adequacy; and it takes years to build new power plants. When such

These potential impacts are alarming from a resource adequacy perspective. The prospect that between 1/3 of the coal plants in Texas (EPA's projection) and all of them (BAML's projection) would be rendered uneconomic by the rule in its first year simply cannot be squared with resource adequacy, much less an orderly transition to a clean energy economy. Such a massive transformation of a state's power supply could only be achieved successfully if done gradually, with the appropriate combination of state policy, energy market and private sector innovation and support. Figure 3 shows the potential for problematic reserve margin impacts in a number of upper Midwestern states, as well as in New York and certain other markets, as well as those in Texas. To avoid causing these problems, EPA to modify the rule to give states more time to achieve the required emission reductions, in ways that reflect and respect the magnitude of the investment, market and technology challenges they entail.

ii. Gas lock-in. In the face of such an abrupt resource adequacy crisis, there is little question of what resources will get built – the cheapest, fastest to deploy, dispatchable resource to replace baseload coal energy production is natural gas combined cycle technology. Further, only dispatchable resources are able to fully count towards planning reserve requirements. As a result, market forces and policy makers alike in coal-heavy states will tend to replace large numbers of suddenly uneconomic coal plants with large numbers of new natural gas combined cycle and peaking power plants. If history is any kind of guide, the response to such a crisis, or even the risk of such a crisis, is likely to be an over-build of new gas plants, with commercial lives of 30 or more years.[12] Some new gas resources are a necessary part of a clean energy transition. But since the best scientific consensus is that the entire globe, including the US, has to achieve near complete independence from carbon emissions to avoid the worst risk of climate change by 2050, it is critical to avoid inducing too much new gas technology in 2020.

iii. Clean energy lock-out. Resource adequacy is one indicator of the critical role of balancing supply with demand in the power sector. Too little supply relative to demand, and reliability cannot be maintained. Too much supply, however, can also be a serious problem, especially in an era with little overall demand growth. An oversupply effectively removes the incentive to deploy additional technology. In power markets, surpluses suppress prices and make it uneconomic to deploy new resources, even the cheapest ones – clean or not. In cost-regulated utility regimes, surpluses are generally inconsistent with the basic "prudent, used and useful" criteria for cost recovery of new resources. Thus locking in a large amount of new gas resources will have the side effect of locking out renewables and other new clean technologies, in both competitive market and regulated utility regimes, for an extended period. Note this lock-out will occur even if renewables become cheaper than traditional power technologies – it doesn't matter how cheap something is if no one needs it at all.[13]

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models predict the retirement and construction of a large numbers of power plants in a single year, it is a major red flag regarding potential resource adequacy problems. This is precisely what EPA's analysis finds.

[12] Between 1998 and 2004, some 240,000 MW of new natural gas power plants were built in the US, when there were resource needs of perhaps 40,000 MW.

[13] Renewable Portfolio Standards could support additional renewable deployment, but a mandated oversupply is likely to be opposed by many incumbents and consumers. Far better would be innovative state policies that incentivize the replacement of coal plants with renewables and clean distributed energy resources.

By contrast, a more measured and orderly approach to phasing out inefficient coal power and CO2 emissions over the decade of the 20's offers an ideal opportunity to maximize the deployment of renewable energy technologies to replace the retiring plants, while also giving additional time for clean energy technologies, such as post-combustion CCS, to become cost effective and widely deployable on more efficient and well-situated coal plants. Such an orderly transition would avoid resource adequacy risks, drive much less gas lock-in, and dramatically accelerate the deployment of renewables and other essential clean energy technologies, such as highly responsive load, distributed solar, energy storage and other key enabling technologies. As a side benefit, such a transition would result in far more supply diversity than a dramatic and sudden switch from coal to gas in the early 2020s.

3. Vastly disparate impacts on states

As shown in Figures 1 and 2, there are dramatically different 2020 emission reduction requirements for many states. Many state regulators and owners of affected units are decrying this disparate treatment, with concerns ranging from the resource adequacy issues discussed above, to the lack of recognition of prior policy and capital investments associated with some of the larger BSER requirements, to concerns about vastly different incremental costs going forward imposed on various states and owners of affected units. Providing flexibility to states to design their own smooth emission reduction trajectories would address concerns regarding unequal initial cost impacts of achieving the EPA's emission goals.

4. Simple steps to avoid these problems while enhancing the overall effectiveness of the final rule.

All of the problems above stem primarily from the proposed rule's requirement for dramatic emission reductions in the early years of the next decade. To avoid these problems, EPA should modify the final rule so it allows states to develop performance standards that avoid dramatic early emission reductions, especially if states deem them likely to create resource adequacy and reliability problems, excessive costs and consumer rate-shock, economic dislocation, or to interfere with state plans to deploy clean technologies and reduce fossil fuel dependence over a reasonable period of time. Indeed, such deference to the states is consistent with the plain language of Section 111(d).[14] We see several approaches for EPA to provide states additional flexibility to determine when the emission reductions must be met, as well as how to meet them.

i. Allow each state to set its own pre-2030 emission reduction trajectories. States are well-situated to understand the implications of various pathways to the EPA's 2030 emission reduction goals and to select a path that is most consistent with the state's resources and needs. EPA should simply set 2030 emission goals and allow each state to determine the appropriate emission reduction trajectory to reach those goals, requiring only showings of feasibility, enforceability and reasonable progress. States that wish to make the dramatic early reductions contemplated under the proposed rule would, of course, be able to; but states that deem a glide path or other gradual transition more appropriate would be free to

[14] See USC, Section 111(d) B. "Regulations of the Administrator under this paragraph shall permit the State in applying a standard of performance to any particular source under a plan submitted under this paragraph to take into consideration, among other factors, the remaining useful life of the existing source to which such standard applies."

develop a state plan around that approach. EPA should also consider allowing states that can achieve significantly greater emission reductions in a reasonable time frame after 2030 to substitute those emission reductions for earlier, more costly emission reductions.

ii. Modify the 10 year compliance constraint to allow states to design a true glide path. Under this approach, EPA would provide more flexible compliance guidance to the states. For example, changing the 10-year compliance requirement so that states must meet at least one-half of the interim goal, on average, in each of the 10 years from 2020 to 2029 would allow each state to set a diagonal line glide path from 2020 to 2030, or a number of other trajectories that might better suit the state.[15] Dramatic early reductions would still be available, should a state care to make them. Again, EPA should consider allowing more aggressive emission reductions after 2030 to count in this flexible compliance metric.

iii. Modify the BSER and its timing to produce a true glide-path. In addition to granting states such true timing flexibility, EPA should base its final rule on a more realistic BSER determination which would support more gradual emission reductions. To that end, we recommend EPA modify the timing of when it assumes its BSER building blocks to be activated, so as to produce BSER-based emission reduction pathways that avoid dramatic early emission reductions. As the resource adequacy discussion above suggests, rapid redispatch of gas plants instead of coal plants can have major negative impacts on reliability and cost. To provide a smooth glide path, and to avoid the resource adequacy problems that massive gas redispatch is likely to entail, the EPA should modify the BSER to gradually phase in gas redispatch between 2020 and 2029. Heat rate improvements should also be phased in to better reflect the fact that not all plants can make such heat rate improvements, and some that can are unlikely to if they anticipate early retirement as a result of the program.

5. Summary

By avoiding gas lock-in and giving states enough time to develop appropriate policies for replacing coal plants with distributed and centralized renewables, competitive distributed energy optimization, and CCS where feasible, any of the approaches should support greater overall long term emission reductions from the entire power sector. In addition, they should create the following benefits, relative to the proposed rule:

- reduced opposition to EPA's implementation of 111(d),
- lower levels of legal risk for the EPA and state rules,
- reduced power sector dependence on natural gas and increased energy diversity and resilience
- more effective clean energy and environmental policies at the state level, and
- increased innovation and lower costs for truly clean American energy resources.

We look forward to engaging with EPA, states and various stakeholders in further developing such improvements to the proposed rule.

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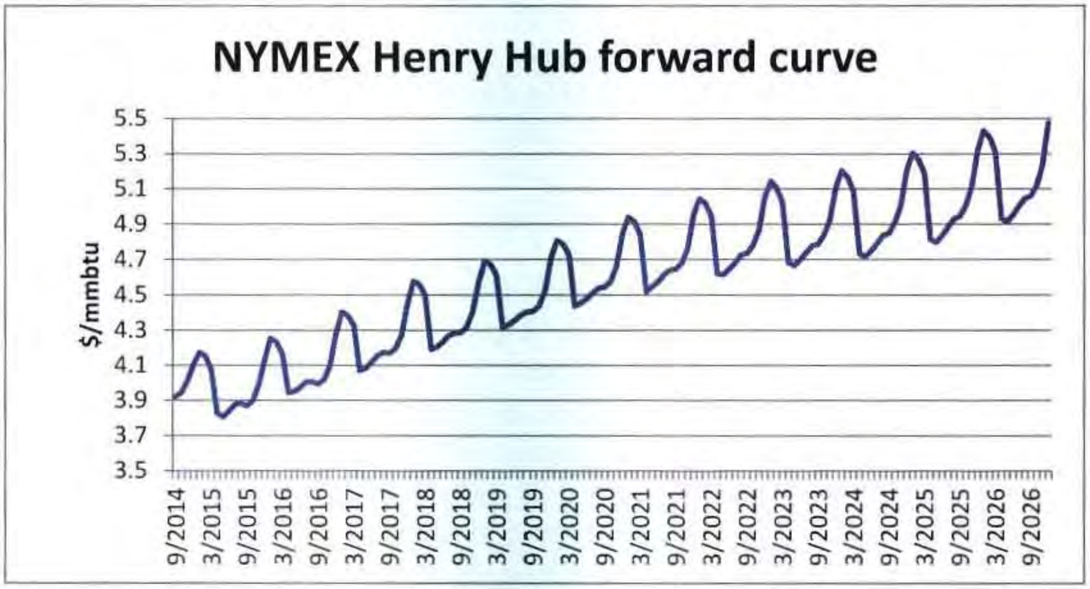
[15] See Appendix, item B.

APPENDIX

A. Forward natural gas prices, August 14, 2014



B. Minimum initial emission reduction trajectories under the proposed rule and a "Glide Path" emission reduction trajectory based on relaxing the 10-year average requirement to ½ of the reduction required by the interim goal.

Note the "Glide path" reduction trajectory's average reduction is ½ of the difference between the 2012 benchmark and the Interim goal.

Triangle ABC is equal to ½ of AB x C