December 1, 2014

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Environmental Protection Agency
EPA Docket Center (EPA/DC), Mailcode 28221T
1200 Pennsylvania Avenue, NW
Washington, DC 20460
(submitted via regulations.gov)

**Re: NRG's Comments regarding the Proposed Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units**

Dear Sir/Madam:

NRG Energy, Inc. and its operating subsidiaries (collectively "NRG") submit these comments to the Environmental Protection Agency ("EPA") regarding the proposed Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (the "Proposal"). NRG is the second-largest competitive power company in the U.S. NRG's power plants provide more than 50,000 Megawatts ("MW") of generation capacity and NRG's competitive retail providers serve almost 3 million customers throughout the country. NRG's generation fleet comprises coal, gas, nuclear, wind and solar power plants. We are both one of the nation's developers of renewable energy, and one of its largest emitters of CO2. Recognizing the need to address climate change to ensure a sustainable business and a sustainable future, NRG recently announced goals to reduce its absolute CO2 emissions by 50% by 2030 and 90% by 2050. These comments thus represent the view of a major power sector emitter of CO2 that intends to achieve those reductions, while reflecting NRG's considerable knowledge of energy markets, the bulk electric system, and of both operations and investment in traditional and innovative power sector technologies.

Section I of these comments describes NRG and its approach to addressing climate change. Section II describes the reasons that the Proposal would not effectively address the problem. Section III suggests improvements that would make the Proposal more effective.

NRG recognizes that there are numerous legal vulnerabilities regarding the Proposal but will not address them in detail, since we anticipate they will be addressed by others. We do, however, provide suggestions on how these vulnerabilities might be reduced.

**Executive Summary**

NRG understands the need for, and is committed to, the substantial reduction of GHG emissions by 2030 and their near-elimination by the middle of this century. NRG supports well-crafted regulation of GHGs in furtherance of these goals. However, NRG does not view the Proposal in its current form as well-crafted, and believes it will conflict with rather than further these goals.

The chief flaw in the Proposal is the drastic emission reduction from existing plants it would require in many states in 2020. Such reductions could only be achieved by reducing the output of coal-fired plants to the point where they would not be able to survive economically. Their loss would jeopardize reliability, impose high costs on consumers, and distort market outcomes. In particular, the Proposal would likely incite a rush to build new baseload gas units to preserve or restore reliability, thereby increasing long term CO2 emissions while limiting the development of cleaner portfolios, such as combinations of renewable energy and clean distributed energy resources, with appropriate amounts of new, highly flexible gas assets to provide both reliability and substantially lower emissions.

The Proposal is also flawed in its disregard for the complexity of the US bulk electric system ("BES"), and for the amount of time its numerous state and federal regulators, ISOs and RTOs, market participants and other stakeholders would require to develop and implement new policies and practices needed to support the investments needed to achieve GHG reductions comparable to those called for by the Proposal.

To remedy these flaws, NRG respectfully urges EPA to allow each state to determine its own glide path for achieving the desired reductions by 2030, and to develop state plans and associated policies in stages. This will allow states to achieve moderate emission reductions in the early years with relatively straightforward policy approaches, while providing them with more time to develop additional policies needed to spur greater emission reductions in the later years of the next decade. This will facilitate early plan development and compliance, while allowing more time for states to include new, lower cost clean energy technologies and coordinate their actions regionally.

NRG also urges EPA to modify its "building blocks" so they have a firmer foundation in fact and will support true glide-path emission reduction trajectories, and to encourage, and encourage and allow states to incentivize less carbon-intensive energy solutions, other than the shift of baseload energy production from coal to existing and new natural gas facilities. We believe this will allow more long term emission reductions at a lower cost than the Proposal.

## I. NRG Is a Leader in Reducing CO2 Emissions

NRG views climate change as this generation's most significant challenge. NRG is working diligently to reduce its CO2 emissions. NRG already has reduced its CO2 emissions by 40% since 2005. Further, on November 20, NRG announced its ambitious goal of reducing its CO2 emissions by 50% by 2030 and by 90% by 2050 from a 2014 baseline.

NRG owns and operates a wide diversity of fossil, nuclear and renewable power plants. The company actively develops utility scale, commercial and residential solar, combined heat and power, high-efficiency natural gas-fueled power plants, electric vehicle charging networks, a variety of distributed energy resources, and a post-combustion carbon capture and sequestration solution utilizing the CO2 for enhanced oil recovery. Our significant investments in these areas have occurred, in part, because of thoughtful and effective state and federal policies. We urge EPA to embrace policies that support private sector investment in emerging technologies that are essential to achieve needed long-term GHG reductions. Unfortunately, the Proposal, in its current form, will fail in this regard for the reasons presented below.

NRG's comments are intended to help EPA develop a reasoned and well-considered final rule, which will provide states with guidance that supports the effective, reliable, and low cost transition to a power system, with emissions reduction trajectories between now and 2050 that are compatible with those recommended by the IPCC as necessary for avoiding the most severe risks of climate change.

## II. Proposal Does Not Effectively Address the Problem

### A. Summary of Fundamental Flaws.

The Proposal has five significant and fundamental flaws:

1. The front-loaded state emission reduction trajectories required by the Proposal would induce carbon-intensive responses in the BES, locking in long-term CO2 emissions that would impede, rather than enhance, the ability of the power sector to achieve emission reductions needed to mitigate climate change.

2. Insufficient time for state policy makers and other BES stakeholders to craft policies and practices required to implement the Proposal effectively while continuing to meet the key operational and infrastructure constraints essential to the reliable operation of the BES and related systems.

3. Inadequate provisions to deal with new natural gas power plant development, which faces a strong triple incentive under the Proposal, due to the combination of gas power plants' ability to meet BES constraints, its light-handed regulatory treatment under this

and other EPA rules, and the clear market incentives for gas deployment created by this and other EPA rules.

4. Flaws or problems in the way EPA defines and uses each of the four elements of its BSER for the purpose of setting emission reduction targets.

5. The EPA's apparent intent to make state plans, including specific elements of them related to the BES, federally enforceable is unnecessary for effective regulation, exceeds established precedent, and would exacerbate the legal vulnerabilities of this rulemaking.

Each of these flaws is evidence of a deep disconnect between the Proposal and the basic functions of the BES. This is a serious weakness in the Proposal, since it relies on the BES to implement the emission reductions. Correcting these flaws is therefore fundamental to a well-reasoned, effective and practicable rule. To correct them, we recommend the following modifications be included in the final rule:

- Allow states to create true "glide path" emission reduction trajectories to the final 2030 goals.

- Provide states and other stakeholders with flexibility to develop the needed policies and practices over time to support emission reductions while continuing to meet BES constraints. In particular, EPA should encourage and allow "phased" state plans that meet the early year moderate glide path reductions with a relatively simple set of policy instruments, while developing more substantial policies to meet the more aggressive reductions towards the ends of the glide paths. In addition, EPA should ensure compliance flexibility over time, e.g., through multi-year compliance periods.

- Avoid excessive incentives for new natural gas and its CO2. In particular, EPA should incentivize states to avoid or reduce the excessive development of new combined-cycle gas plants – for example, through state policies that encourage efficient mixes of fast-start and rampable gas resources, renewable resources and efficient distributed energy resources – by allowing a state to credit the avoided CO2 against any "portfolio" obligations undertaken by the state's plan.

- Correct flaws in the reasoning and application of specific BSER elements by reducing the CO2 reductions estimated to be available from heat rate improvements, phasing in gas redispatch over the entire decade, basing each state's renewable potential on a state-based renewable potential analysis, and eliminating nuclear retirements and construction from the BSER entirely.

- Limit federal enforceability to a basic "SIP call" approach, and avoid making any state or other jurisdictional rule component, function or activity in state plans federally enforceable.

**B. Proposal's Flaws.**

**1. Summary of our initial review and "Glide Paths Instead of Cliffs" whitepaper.**

There is a profound disconnect between the dramatic early emission reductions that would be required under the Proposal and emission reduction trajectories that could be realistically achieved by states, without stranding assets needed for reliability. These immediate results would destabilize and distort markets by driving the supply of power well below the levels needed by the BES to meet demand and ensure grid reliability.

These immediate impacts of the Proposal should also be expected to have negative long term impacts on the ability of the country to achieve the CO2 emission reductions needed to mitigate the worst effects of climate change. The too-rapid retirement of existing coal resources, coupled with the market dominance of natural gas fired generation technology, low natural gas prices, and the fact that new natural gas generation is unregulated under the Proposal and lightly treated under EPA's NSPS, mean that the primary result of the Proposal would be the replacement of large amounts of existing baseload coal power plants with large amounts of baseload gas combined-cycle power plants.[1]

From a climate change perspective, these results are potentially disastrous. Not only would they limit the power sector wide emission reductions that can be achieved by 2030, they would – most importantly – block the much more essential long term GHG emission reductions needed to efficiently reach 2050 global carbon emission goals consistent with current climate science.[2]

To identify and help remedy these flaws, we provided EPA with our initial analysis and recommendation in the summer of 2014. In it, we urged EPA to replace the compliance "cliff" created by the combination of its aggressive interim goals and its 10 year averaging requirement with true "glide path" trajectories, provide states more time to achieve the 2030 emission targets, and also provide states with considerably more discretion regarding the actual

[1] Indeed, EPA's own reliability analysis predicts the Proposal would cause 23 GW of new combined-cycle gas to be built in 2020 (see EPA's "Resource Adequacy and Reliability Analysis" technical support document (TSD) released June 2, 2014 with the proposed rule and available online: http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule-technical-documents). A number of analyses suggest EPA's TSD may understate the amount of coal that would be driven into retirement in 2020 by the Proposal and the amount of new gas CCGT that would be built in anticipation or in response to this retirement. See references and discussion below, n. 4.

[2] EPA's TSD on emission reductions shows the Agency's IPM-based projections of power sector emissions under the Proposal increasing after 2030. Thus achieving the reductions needed to mitigate climate change and to meet the emission reductions recently pledged by the US would require stranding the massive new investment in combined-cycle natural gas early in the new plants' economic lifetimes (see EPA's IPM Run Files, "EPA Base Case for the proposed Clean Power Plan" and "Option 1 – Regional" and "Option 1 – State," released June 2, 2014 with the proposed rule and available online at: http://www.epa.gov/airmarkets/powersectormodeling/cleanpowerplan.html)

emission reduction trajectories to be enforced by state plans.[3] This recommendation still stands. As these comments will show, without significant changes to the Proposal, state plans that comply with it would be all too likely to put reliability at risk by stranding essential assets, increase power prices dramatically, and cause a stampede of new baseload natural-gas fired generation. This wave of new baseload gas generation would lock-in levels of new fossil fuel emissions in the US power sector that would make getting on the IPCC pathways to a world with no more than two degree centigrade warming much more difficult, if not impossible.

**2. Further review indicates EPA's rule is fundamentally disconnected from the realities of the Bulk Electric System.**

While our "glide path" recommendations are essential for avoiding these disastrous economic and environmental consequences of the rule, our further review the Proposal reveals deeper concerns. It is apparent that the inconsistency of the Proposal with the interconnected, complex constraints of the BES is more pervasive. This disconnect gives rise to a number of other features in the Proposal that would exacerbate the unintended consequences of stranded assets, high costs, and lock-in of additional fossil resources.

Many, including ISOs, RTOs, NERC and others with responsibility for reliability have similarly pointed out that the Proposal fails to recognize the impact the timing of its emission reduction requirements would have on impairing coal assets currently needed for reliability -- and the cascading results that would develop from that impairment.[4] Further, the Proposal, by relying

[3] NRG's earlier comments, "EPA's proposed 111(d) – Glide Paths instead of Cliffs: Greater Emission Reductions at Lower cost" are included as an attachment to these comments, and incorporated herein.

[4] See pp 6-7 NRG's "Glide Paths instead of Cliffs" paper (attached), and also see the relevant analyses from reliability or ISO/RTO organizations that emphasis the same conclusions:

- "The electricity sector's growing reliance on natural gas raises concerns regarding the electricity infrastructure's ability to maintain system reliability when facing a constrained natural gas capacity for delivering natural gas to electric power generators…Under the CPP, an accelerated shift in the power generation mix from coal to natural gas is expected to ensue…Overdependence on a single fuel-type increases the risk of common-mode or area-wide conditions and disruptions, especially during extreme weather events." See North American Electric Reliability Corporation (NERC). "Potential Reliability Impacts of EPA's Proposed Clean Power Plan." November 2014 (p27), available online: http://www.nerc.com/.
- "Based on this [ERCOT's] analysis, it is evident that implementation of the proposed Clean Power Plan will have a significant impact on the planning and operation of the ERCOT grid. The proposed CO2 emissions limitations will result in significant retirement of coal generation capacity, could result in transmission reliability issues due to the loss of fossil fuel-fired generation resources in and around major urban centers, and will strain ERCOT's ability to integrate new intermittent renewable generation resources." See "ERCOT Analysis of the Impacts of the Clean Power Plan." November 17, 2014 (pp17-18), available online: http://www.ercot.com.
- Slides 49-58 of PJM's preliminary analysis of the Clean Power Plan show steam unit retirements as high as 18,000MWs within the RTO's footprint under an Option 1 state-based compliance scenario. See "EPA's Clean Power Plan Proposal: Review of PJM Analyses Preliminary Results." November 17, 2014, available online: http://www.pjm.com.

on limited and unrealistic modeling assumptions, fails to recognize or anticipate the scope and time frame of the planning, investment, development and construction of the infrastructure and supply and demand side assets that would need to be mobilized to replace those impaired assets.[5]

**3. Both as a legal matter and to ensure economically and environmentally effective results, EPA must modify its final rule to better reflect the requirements of the BES.**

To be reasoned, well-considered and effective, the EPA's final rule must be based on a better, more accurate and realistic understanding of the relationship between key factors essential to the short-run and long-run performance of the BES. In particular, EPA's rule must reflect a better understanding of the relationship between (a) the short-run dispatch of power plants, (b) the long-run retirement and development of power plants and needed energy delivery infrastructure, and (c) the complex system of BES constraints, market dynamics, multi-jurisdictional regulation, and private sector investment and risk management that are all involved in delivering long-run energy solutions.

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- "The findings in this [SPP's] Assessment make it very clear that new generation and transmission expansion will be necessary to maintain reliability during summer peak conditions if EPA's projected generator retirements occur. Even the scenario that assumes optimal resource expansion using new natural gas fired resources could be problematic during extreme winter load conditions with gas supply and delivery challenges…Unprecedented coordination and cooperation beyond regional planning efforts will be necessary." See SPP's "Reliability Impact Assessment of the EPA's Proposed Clean Power Plan." October 8, 2014 (pp6-7), available online: http://www.spp.org/.
- "Compliance with the interim performance requirements will force actions to be taken by 2020. MISO's initial analysis indicates that up to 25 percent of the remaining coal capacity in MISO – which equates to 14 gigawatts – could potentially retire in order to comply with the proposed rule. This impact is in addition to the 10 to 12 gigawatts of retirements expected due to MATS. To avoid reliability and resource adequacy issues, retiring capacity will need to be replaced at the time it comes offline. Yet to comply with the interim performance requirements, a significant amount of retirements – approximately 11 gigawatts – would need to occur in the 2020 timeframe. This is well before sufficient replacement capacity can be placed into service. New combined-cycle natural gas generation is the most probable option to replace retiring coal-fired plants and comply with the proposed rule. See "MISO Comments on EPA Clean Power Plan." November 25, 2014 (p3). Available online: https://www.misoenergy.org.
- "To comply with the proposed Clean Power Plan, state implementation plans in the Western Interconnection will likely include acceleration in retirements of carbon-intensive resources (coal, oil and gas steam). The potential reliability impacts associated with the transition from the these traditional high-inertia resources (and related loss of essential reliability services such as frequency and voltage support) to other forms of generation need to be studied to ensure that proposed state compliance plans do not reduce the reliability of the BES." See "WECC Comments to EPA: Proposed Clean Power Plan." November 25, 2014 (p4). Available online: https://www.wecc.biz.

[5] See pp. 6-7 NRG's "Glide Paths instead of Cliffs" paper (attached), and relevant analyses from reliability or ISO/RTO organizations.

Indeed, EPA must fully understand and base its rulemaking on the facts regarding this complex system. For the first time, EPA is proposing to move beyond its established precedent of basing performance standards under Section 111 on "behind the fence" systems of emission reductions, to the "beyond the fence" system that take effect through and because of the integrated electric grid and its connected generators and loads – that is, the bulk electric system. Indeed, EPA explicitly acknowledges that it is depending on the BES and its integrated nature, both to operate the elements of EPA's BSER, and to be able to characterize them as a "system," as is required under Section 111(a).[6]

In so doing, EPA has taken on the statutory burden outlined in the definitions of Section 111 (a). That is, EPA must understand the interconnected and complex nature of the BES -- a system that sometimes is referred to as encompassing "the world's largest machine"[7] -- well enough to take into account the myriad costs of using it to achieve such significant emission reductions, along with the many non-air quality health and environmental impacts and energy requirements that are implicated by the modifications to it. An incomplete or inadequate understanding of the BES's reliability, system dynamics, interconnected grid operations, markets and the challenges of building, maintaining and coordinating power plant and energy transmission and delivery infrastructure cannot support a reasoned use of the BSER for the purpose of setting performance standards.

Yet, despite the massive complexity of this system, the many objectives it must meet and the many constraints it must respect, the Proposal presumes that the entire BES can be controlled as precisely and readily as the simple "behind the fence" pollution control systems it has based its Section 111 guidance on in the past. This presumption has undoubtedly been bolstered by assertions from parties who seek to portray dramatic emission reductions as easy, inexpensive and fully controllable by state regulators. Such assertions are, regrettably, grounded more in rhetoric than in reality. Now that EPA has chosen such a complex system as the basis for its BSER in this Proposal, it must modify its Proposal to comport with the realities of that system if it hopes to achieve the intended results.

**4. Key features of the system EPA has selected as BSER and how they affect emission levels.**

These comments do not contain or convey a full understanding of the BES. Instead, they point out key features of the BES that interact with each other to influence emissions from electric generating units, which the Proposal ignores. These features involve short-run operational

[6] See Proposal at pp34852, 34880 and 34886.

[7] See, e.g., the United Nation's Sustainability Development Goal Working Group, "Technical Aspects of Grid Interconnection." 2006, available online: http://www.un.org/esa/sustdev/publications/energy/chapter2.pdf. Also see The National Energy Technology Laboratory's (NETL) series, "Power Market Primers," which explores the complexity of the BES, focusing on the interaction between reliability, markets, and technology. NETL published the report in June 2013, publication # NETL/DOE-2013/1617, available online at www.netl.doe.gov/.

decisions and long-run decisions regarding retiring or developing fixed assets such as power plants and transmission equipment, and the interactions or feedback loops between them.[8]

**5. Security constrained economic dispatch meets reliability needs in the short-run, and emission limits are only one of many factors affecting power plant output.**

The Proposal makes much of the role of power plant dispatch in producing or supporting emission reductions. Indeed, as EPA notes repeatedly, Elements 2, 3 and 4 of the BSER work to reduce emissions precisely by influencing the dispatch process, either as an available supply resource or as a reduction in the amount of energy demanded from the system. However, dispatch is more complicated than EPA's discussion in the Proposal indicates. It is the short-run means by which the BES meets three constraints essential to its reliable operation:

- Matching generation from power plants with energy consumption by end users in real time across the entire country;
- Avoiding combinations of power plant operation and energy consumption that exceed the design capability of the transmission system; and
- Avoiding configurations of generation and consumption that lead or could allow unstable operating conditions for the power plants and other key elements of the grid.

In meeting these constraints, dispatch must also support:

- The synchronized and stable operation of all generating equipment
- Voltage and reactive power maintained at appropriate levels throughout the entire system
- Ensuring the entire system is configured so it can quickly return to these equilibrium conditions after a disturbance, such as a short circuit, loss of generation, or loss of a transmission element.

Thus any change in dispatch must ensure that all these conditions are met. This is termed "security constrained dispatch." Typically, dispatch is also carried out to minimize the operating cost of meeting the above constraints through "security constrained economic dispatch." This is done by using complex, bid-based programs to dispatch the power plants with the lowest cost resources first, subject to their ability to meet all of the other constraints identified above. Centralized electricity markets serve approximately 56 % of the wholesale load in the country[9], and employ security constrained economic dispatch under their tariffs and

[8] These comments adopt economic terminology in which "short-run" means decisions and actions that are taken with respect to the operation and output of existing capital stock, and "long-run" means decisions and actions that are taken with respect to the deployment of capital stock, such as retiring or constructing new plants and equipment.

[9] 2014 summer peak load by centralized market from EIA Electric Monthly, October 2014, divided by projected 2014 net internal demand for all interconnections in the contiguous US, data available online: http://www.eia.gov/electricity/monthly/update/wholesale_markets.cfm and

consistent with statutory and regulatory requirements. Power producers and utilities outside of centralized markets must also meet the various grid constraints described above, and typically have strong economic and regulatory incentives to minimize operating costs, and also tend to use a form of security constrained economic dispatch.

Under security constrained economic dispatch, the variable operating costs of power plants -- including the cost of any emission allowances or permits they must buy – influence their operation. But any particular price on emissions has only an indirect impact on how much any power plant in a particular state will run or how much it will emit, along with a host of other factors such as fuel costs, demand levels, electric system configuration and status, and weather. Indeed, this is one reason why most existing cap and trade systems have various kinds of safety valves, cost containment reserves, or other price-buffering policy features.[10] Imposing a strict absolute limit on emissions, and requiring the dispatch to respect that limit as an absolute constraint, can lead to extremely high allowance and power prices.[11]

Further, the actual dispatch is typically not governed by state utility regulators or other state authorities, but is typically regionally determined based on reliability requirements and procedures established by NERC and carried out by its Balancing Authorities. Thus dispatch and the three "beyond the fence" elements of EPA's BSER have only an indirect impact on the short-run emissions of affected generating units under the rule.[12] However, even such indirect dispatch effects, if large enough, can produce long-run impacts, such as precipitous plant retirements, which can have major and unintended impacts on power sector CO2 emissions.

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http://www.eia.gov/electricity/annual/, accessed November 28, 2014.

[10] In recognition of the need for stable market signals to drive emission reductions while protecting system reliability, several cap-and-trade programs feature price-buffering measures to provide program flexibility around cost and reliability. For example, RGGI's Model Rule provides for a "cost containment reserve," a pool of CO2 allowances that "would be held in reserve, and are only to be made available for sale if allowance prices were to exceed predefined price levels" (see p3, RGGI Model Rule Changes February 2013, available at http://www.rggi.org/docs/ProgramReview/). Other cap-and-trade regimes, such as California's AB 32 program and the European Union's Emissions Trading System employ some combination of design elements such as allowance price floors, ceilings, and also reserve allowances in order to ensure both system reliability and cost stability.

[11] This can be especially true in poorly designed emission trading markets, e.g. those without adequate inter-temporal compliance flexibility or those designed on the basis of unrealistic and optimistic assumptions regarding the cost of compliance, including – in power markets – the opportunity cost of not providing power needed for reliability. The RECLAIM market's failure in 2000 – 2001 is often viewed as an example of a poorly designed emission trading market, and EPA's own conclusions regarding this market are noteworthy, in particular its admonition that "Regulators need to have a strong understanding of the regulated facilities and the factors impacting their decision-making." http://www.epa.gov/region9/air/reclaim/, accessed November 28, 2014.

[12] For this reason, as discussed below, NRG urges EPA to avoid requiring excessively precise and rigid compliance milestones, and instead to provide ample inter-temporal compliance flexibility.

**6. Short-run dispatch based on emission limits can have dramatic long-run impacts on power plant viability, resource adequacy, and transmission and energy delivery infrastructure needs.**

These long-run impacts are important, because the BES must have "resource adequacy," or sufficient generating resources to meet the highest reasonably anticipated level of load and likely levels of generation outages. These long-run requirements also extend to ensuring that retiring or outdated generation and transmission assets are replaced in an efficient manner, that load growth and changing load patterns are supported by new transmission and generation infrastructure, and that fuel supply infrastructure keeps pace with evolving generation needs.

Critically, these various constraints and requirements, like the BES itself, extend far beyond the borders of any state, and can only be monitored and managed through a complex nation-wide system of reliability authorities, wholesale market operators, federal and state regulators, utilities, and merchant power companies. In the continental US, no one state or federal authority controls or manages these requirements. Instead, the system is a complex web of market forces, voluntary and mandatory reliability practices, state and federal regulation, and private decisions to invest in or retire multi-billion dollar capital assets. Both short-run and long-run outcomes are heavily influenced by economic variables such as the price of fuel, the cost of capital, weather, and by the complex interactions of the system itself.[13]

In the face of this complexity, the Proposal wrongly presumes that an air regulator in any given state can impose controls on its state's piece of the BES that will dramatically reduce its emission levels in 2020, without impairing or damaging the system's ability to remain within all these other critical constraints. This presumption ignores key truths about how the system really works.

Ignoring or inadequately evaluating these system constraints can cause significant long-run problems.[14] This is because a big enough short-run impact, e.g., redispatch or displacement of sufficient energy production from existing coal plants, will render them uneconomic to keep operating. Various analyses, including EPA's IPM modeling, demonstrate that a price on carbon or administrative control that is stringent enough to achieve the emission reductions required

[13] For example, the failure or retirement of a nuclear plant will cause a dramatic increase in output from fossil resources, in a number of states. Low gas prices may contribute directly to such a retirement, but these prices may subsequently increase in the vicinity of the retirement until sufficient new gas pipeline capacity is constructed. However, adding new gas pipeline capacity to serve electric generation may require modifications in the federally-regulated wholesale electricity market to allow generators to recover the cost of firm fuel supply contracts. Each of these changes is likely to result in changes in the amount of GHGs emitted by EGUs across multiple states.

[14] E.g., contrast EPA's Resource Adequacy TSD with SPP's analysis of voltage support problems that could be triggered across large parts of Oklahoma and Texas due to the coal retirements projected by EPA (see pp4-7 of SPP report, "Reliability Impact Assessment of the EPA's Proposed Clean Power Plan") At least part of the discrepancy between SPP's analysis and EPA's is likely due to the fact that the IPM model is based on a simplified direct-current grid with simplified transmission constraints, and thus is poorly suited to evaluating the non-linear constraints such as reactive power and system stability requirements that are unique to alternating current transmission operation.

by the Proposal's interim goals and ten-year-averaging constraint would also render a significant number of coal plants uneconomic to operate at the very start of the 2020 compliance period -- practically overnight, especially in light of the uncertain legal challenges the Proposal faces. Substantially more plants than these modeling exercises indicate may retire due to the rule.[15] While both regulated and merchant plants are at risk, rapid retirement is particularly likely for the 42% of the country's generation fleet comprised of merchant generating units that depend on market revenues for covering operating costs.[16]

Such sudden and premature retirement of a significant share of existing power plants can, in turn, violate the constraints necessary for resource adequacy, stability, and the ability to recover from transient disturbances. To ensure compliance with these constraints, under conditions where such dramatic retirements are expected, would require the rapid replacement of the retired resources with new, controllable, dispatchable generation units that could operate in much the same manner, and produce approximately the same amount of stability enhancing synchronized operation, voltage support, and large amounts of energy production, in electrically comparable locations, as the coal plants they would replace.[17]

**7. Excessively abrupt emission limits will have carbon-intensive long-run impacts, such as the development of too many of combined-cycle gas plants.**

The reliability needs identified above would cause many of the retired coal units to be replaced with new combined-cycle gas generating units, simply to ensure reliability. Even more new combined-cycle gas plants than those strictly needed for reliability would likely be built because of the Proposal's impact. This is because the rule as proposed would create a triple combination of powerful incentives for new gas power plants: the loss of fully dispatchable, large power plants in specific regions and locations relative to reliability needs, making new investment in new natural gas power plants unavoidable; a more general shortfall of supply relative to demand in energy markets, making investment in new combined-cycle plants attractive to both merchant power and regulated utility investors; and a complete free pass from 111d, along with the regulatory benefits of easy compliance with a number of other EPA (and EPA-induced state) regulations. Thus, the Proposal not only threatens reliability, reasonable power costs, and efficient market outcomes, it also – through these very dynamics – would almost certainly lead to the construction of substantially more new gas power plants than would otherwise be built, both in the near term and the longer term.

[15] See pp9-10 of "ERCOT Analysis of the Impacts of the Clean Power Plan".

[16] NRG analysis of 2012 Ventyx and SNL data.

[17] See pp4-7 of SPP report, "Reliability Impact Assessment of the EPA's Proposed Clean Power Plan".

**8. New gas units would emit substantial amounts of CO2 for an extended period, using up a significant share of the remaining "carbon budget".**

These new gas units, of course, would emit CO2 when they run. CO2 from new power plants is not regulated by Section 111(d), since that section of the Clean Air Act applies to existing, not new, power plants. The atmosphere's radiative forcing potential, however, does not distinguish between CO2 from existing plants and that from new plants. Both sources have identical impacts on the atmosphere and the climate. Thus, the entire objective of EPA's regulation would be frustrated, and potentially defeated, if the rule's features induce too much new natural gas plant development.

Two concepts make it easier to quantify what "too much" means in this context. First is the concept of a "carbon budget" as clarified in the most recent installment of the IPCC Fifth Assessment Report.[18] Understanding the carbon budget is helpful in designing policies to address climate change, since these policies should focus on the stock of atmospheric GHGs, which is what determines the degree of climate risk, rather than the flow of GHG emissions in a particular year, which are only indirectly related to the degree of climate risk.

As the IPCC Synthesis Report explains, comprehensive analysis of many climate models and other climatological evidence strongly indicates that, to have a better than 50 / 50 chance of avoiding an increase in global average temperature of two degrees centigrade or more, total cumulative anthropogenic CO2 emissions should not exceed 3 trillion tons. Since some 2 trillion such tons have already been emitted, additional global CO2 emissions must be kept from exceeding 1 trillion metric tons.[19] These 1 trillion tons are the IPCC's best estimate of all the CO2 that can be emitted globally through the rest of this century to mitigate the worst risks of climate change. The IPCC analysis also clarifies that achievable paths towards this total amount of emissions tend to require global emissions to peak around 2030, and to decline substantially in subsequent years.[20] Accordingly, EPA's final rule should be consistent with, and support, the ability of US power companies to achieve such emission reductions.

The second concept that helps identify how much new gas is "too much" is the concept of carbon commitment accounting.[21] Consistent with the carbon budget approach and current

[18] See IPCC Fifth Assessment, "Climate Change 2014: Synthesis Report," available online: http://www.ipcc.ch/report/ar5/syr/.

[19] See slide 34 from the IPCC's presentation that accompanied the "Climate Change 2014: Synthesis Report," relevant figure in the Appendix below. Available online: http://www.ipcc.ch/report/ar5/syr/.

[20] See slide 20 from the IPCC's presentation that accompanied the "Climate Change 2014: Synthesis Report," relevant figure in the Appendix below. Available online: http://www.ipcc.ch/report/ar5/syr/. Note that CO2 emissions peak around 2030 in order to maintain a distribution of the remaining CO2 budget compatible with 2 degrees Celsius of global average temperature increase.

[21] See "Commitment accounting of $CO_2$ emissions." Steven Davis and Robert Socolow, *Environmental Research Letters*, Vol. 9, No. 8, July 30, 2014. Davis and Socolow find that, "Commitment accounting of CO2 emissions provides critical information about future emissions related to infrastructure that currently exists or might be built. Committed emissions from existing infrastructure can be readily compared to scenarios of future emissions such as

climate science, carbon commitment accounting recognizes that it is the total expected stock of atmospheric GHGs from existing and new power plants that matter in terms of climate change, not the annual flow of GHGs from them over a particular year or period of years. Commitment accounting recognizes that, once a new power plant's fixed costs are sunk, it is likely to operate for a long time, and thus counts the expected cumulative emissions from the power plant rather than its annual emissions or rate of emission intensity. In this way, it allows an accurate comparison of CO2 reductions from existing plants with CO2 increases from new plants, in the context of the essential carbon budget. Using commitment accounting to evaluate the impacts of various approaches to 111(d) is especially important in light of this Administration's commitments to reduce overall US CO2, not just that of already existing sources.[22]

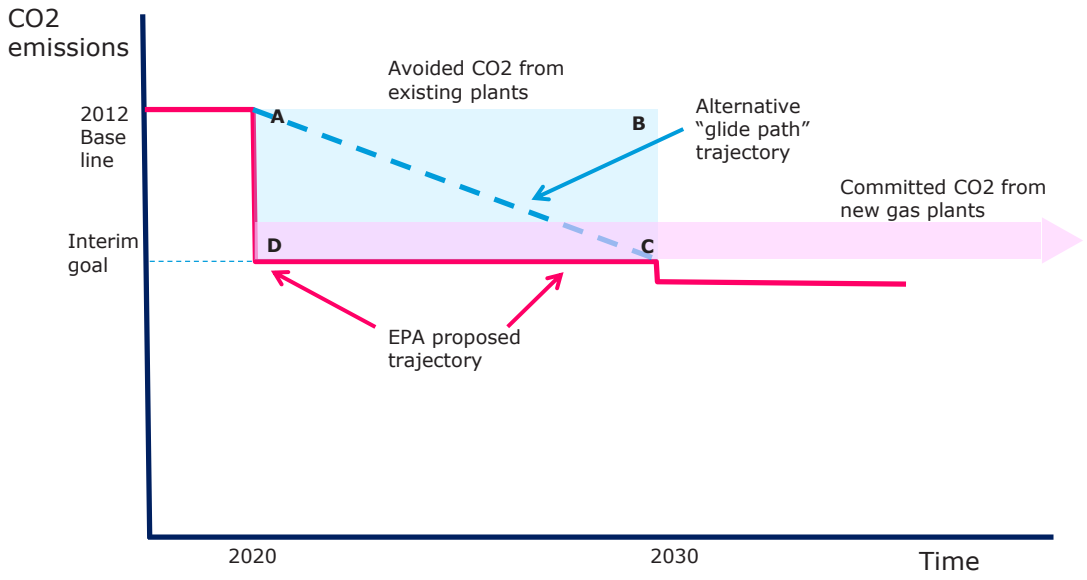
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those used by the IPCC. Assuming a 40 year lifetime of generators, our estimates of committed emissions from the power sector already represent 53%, 41% and 21% of the fossil-fuel CO2 emissions from all sectors in China, India, and the US, respectively…" (p8). This finding emphasizes the need for CO2 reduction policies and investments to account for a generation asset's lifetime GHG footprint, which is not captured in short-term measurement of CO2 rates. Failing to take a generation asset's lifetime GHG footprint into account leads at least to one of two highly undesirable outcomes: (1) replacing the generator prematurely with lower carbon assets --stranding the investment, or (2) exceeding carbon budgets.

[22] One can imagine the consternation if China, as part of implementing its recent commitment to the US to "peak" GHG emissions from its power sector in 2030, were to decide to emulate the USEPA's program by only reducing emissions from a subset of its existing fossil power plants (e.g., unscrubbable coal plants with high heat rates), while actually increasing emissions from another subset of existing fossil power plants (e.g., scrubbable coal plants with more efficient boilers), and not even counting the CO2 from new fossil plants (e.g., scrubbed, efficient coal plants). Yet this is precisely what EPA's Proposal does with respect to existing fossil plants and new gas plants in the US.

Figure 1 below illustrates how the EPA's rule can be evaluated under this critical metric of the stock of emissions added to the atmosphere.

Figure 1.




In this figure, the EPA's typical emission reduction trajectory is shown as a red, stepped line. During the 10 years from 2020 to 2029, it would avoid CO2 emissions from existing power plants equal to the shaded rectangle ABCD. An alternative emission trajectory -- a true glide path -- is shown as the dotted blue diagonal line from A to C. This would avoid emissions equal to the triangle ABC, while allowing emissions equal to the triangle CDA during this ten year period. As can be seen, the AC glide path avoids only half as many emissions from existing plants as the EPA's proposed abrupt trajectory would. Despite this, it may very well result in *lower* overall power sector CO2 emissions to the atmosphere.

This is because, as discussed above, the dramatic 2020 reductions due to the combination of EPA's proposed interim goals and ten-year averaging constraint creates triple incentives -- reliability, market and regulatory -- for new natural gas combined-cycle power plant construction. These plants will operate, and emit CO2, for a considerably longer period than 2020 to 2030. Figure 1 shows this "committed CO2" from the new gas plants as the much longer, purple rectangle extending into the future. It is readily evident that even a relatively small annual amount of CO2 from new gas plants will, over enough time, exceed the CO2 emitted by existing plants during the glide-down period (the triangle CDA).

Indeed, these results are consistent with EPA's own projection of the number of coal retirements and new combined-cycle units that will result directly from their Proposal – a projection EPA believes, erroneously in our view, to show their rule will not have adverse reliability impacts. The EPA's resource adequacy analysis indicates that 49 GW of existing coal will retire in 2020 as a result of the rule, and that the rule will simultaneously induce the

development of an additional 23 GW of new natural gas combined-cycle power.[23] Assuming for this example that the 49 GW of coal would, in the absence of the rule, operate at a 70% capacity factor, and emit an average, 2000 pounds of CO2 per MWH, the rule as proposed would avoid adding 3 billion tons of CO2 to the atmospheric stock from these coal plants during the decade, by forcing them to retire in 2020.[24]

EPA's analysis, however, shows the rule would also add 23 GW of new combined-cycle gas, both for reliability and economic reasons. Assuming the new gas plants also operate at a 70% capacity factor – consistent with the EPA's assumption in setting the BSER -- while emitting 825 pounds of CO2 per MWH, they will *add* 1.7 billion tons of CO2 to the atmospheric stock during their expected 30 year lifetime. In terms of both total US CO2 emissions and mitigating global warming, these added emissions mean the total emissions avoided by EPA's proposed trajectory would equal 3 billion tons – 1.7 billion tons or 1.3 billion tons.

The AC glide path for emission reductions, by contrast, would allow existing units to achieve reductions amounting to only half of the 3 billion ton reduction during the 10 year period (the triangle ABC). Assuming the coal plants that would otherwise retire due to the rule would face a similar reduction path as all existing plants, they would emit 1.5 billion tons more CO2 under the glide-path during the ten year period than under the EPA's rule.[25] This means the CO2 reductions from existing plants, under the glide path could be as low as 1.5 billion tons, conservatively estimated. Thus the new gas plants EPA predicts will be induced by the rule would add 1.7 billion tons of CO2 to the atmosphere, substantially more than the 1.5 billion tons that could be added by using a true "glide path" approach to avoid the premature retirement of large numbers of coal plants.

On its face, the approach of adding more CO2 from new, long-lived power plants than is avoided from old, retiring power plants is a glaringly inefficient and counterproductive approach to CO2 regulation – especially since the premature retirement of those coal plants has been identified as a driver of high social costs in terms of reliability threats, high power prices, and market distortions.[26] But, as the detailed discussion above explains, this counterproductive effect would be even more glaring because the EPA's abrupt 2020 compliance cliff itself is itself responsible for inducing a large number the new combined-cycle power plants. EPA can readily avoid this "new CO2 for old" swap by avoiding the cliff, and allowing states to develop and use true glide paths from their 2020 emission levels to the 2030 goals in EPA's final guidance.

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[23] See p14 of EPA's "Resource Adequacy and Reliability Analysis" technical support document (TSD).

[24] These avoided tons, plus emission reductions from existing coal plants that do not retire, minus emission increases from existing gas plants that run more to displace or replace lost coal MWH, make up the total avoided emissions *from existing plants* (rectangle ABCD) due to the rule during the initial 10 year compliance period.

[25] This is a conservatively high estimate, since some of the plants that EPA projects as retiring in 2020 are potentially more likely to retire during the decade in any event, rather than run throughout it.

[26] See previously cited studies or comments from NERC, ERCOT, PJM, SPP, MISO, and WECC.

Even more important, from a climate perspective, is the fact that establishing true glide path emission reduction trajectories is a critical first step in avoiding both the unintended direct effects of the compliance "cliff" and in dramatically reducing the amount of committed CO2 emissions induced by the reliability, market and regulatory incentives of the rule.

## III. Potential improvements

### A. A true glide-path trajectory will better allow states to nurture a much lower-carbon mix of resources than the EPA's abrupt 2020 "compliance cliff".

The key to a more efficient emission reduction program (comparable or greater emission reductions at a lower overall cost) is to better understand the complex power system and its constraints, as well as the limited ability of state regulators and power sector stakeholders to influence it while respecting those constraints. In particular, the EPA must avoid excessive short-run emission reduction requirements that will induce carbon-intensive long-run BES impacts, and must also encourage and support low and no-carbon BES responses to a somewhat slower reduction of coal fired generation.

The key flaw of the Proposal in this regard is its rapid retirement of fossil plants needed for reliability, which creates the triple incentives discussed above to build large numbers of new combined-cycle gas plants. To be more efficient, the EPA's rule must reduce these incentives, while still reducing emissions and allow the power system to meet its key reliability constraints.[27] Avoiding the cliff reduces the reliability incentive and, to a degree, the market incentive to rapidly replace coal with combined-cycle gas. However, slowing the rate of coal retirements is only a partial fix. It is equally important for EPA to anticipate and support a less carbon intensive set of solutions to the key BES constraints.

One such set of solutions that is increasingly broadly anticipated is to rely on renewable energy resources increasingly for energy production, while focusing on natural gas resources primarily as a source of reliability. Instead of directly replacing coal's energy production, new gas facilities would increasingly function as capacity resources, standing ready to ramp up when the wind stops blowing, ramp down when the sun comes up, and otherwise bridge the gap between clean baseload resources -- comprised of CCS, nuclear and hydro -- and intermittent

[27] Note that the standard recipe for achieving power sector emission reductions advocated by those outside the power sector – more energy efficiency and renewables – does little to enhance resource adequacy or system stability requirements (sufficient operating reserves, voltage and reactive power support, etc.). Indeed, of the EPA's four BSER elements, none does a suitable job of addressing these key system requirements. This is one reason why so much new gas would be needed under the Proposal's approach – key system elements that do support these constraints would be decimated by the rule, and the new "building blocks" have little ability to support the constraints.

renewables, while also helping integrate controllable load and distributed clean energy resources, including storage.[28]

This approach would dramatically reduce CO2 by substituting a portfolio of renewable energy production – such as solar during the day, wind at night -- for coal and gas energy production, while preserving reliability by relying on flexible gas capacity to meet load and provide other system reliability needs, such as voltage support, only when and as needed. Importantly, it takes a different kind of gas generating equipment (efficient combustion turbines or hybrid turbine – combined-cycle technologies sometimes called "CC-fast" or CCF) to perform such reliability and integration services than it does to replace coal plants by running efficiently at 70% capacity factors (typically the largest, most fuel efficient, and least operationally flexible combined-cycle units).[29]

Such a system is inherently flexible and forward-looking. Because the CT and CCF equipment is designed for intermittent, as-needed operation, it can continue to provide the capacity needed for reliability, even as storage, controllable load and other innovations over time reduce the amount of energy it actually needs to produce. Such resources can anticipate a long life of ensuring reliability while supporting continuous emission reductions. By contrast, combined-cycle units designed exclusively for high capacity factor baseload power production would be stranded by additional emission reduction requirements, or else would require expensive revamping to provide primarily reliability services in a world where increasing amounts of energy come from intermittent renewable resources and non-carbon emitting baseload technologies.

Such systems – capable of ensuring the BES's reliability and operating constraints are met, while supporting its continued de-carbonization, are the key to overcoming the inefficiency inherent in the Proposal. In terms of Figure 1, such a system allows the lifetime or committed emissions from new gas units to be minimized, thus achieving the lowest possible overall power sector emissions.

As shown above, EPA's prediction of new combined-cycle power plants could be expected to add 1.7 billion tons of CO2 to the atmosphere during their economic lifetime -- more than even a conservatively high estimate of the 1.5 billion tons the retiring coal plants might emit under the "glide path" alternative. But a smaller fleet of CT / CCF gas, coupled with far more

[28] There are several studies from the NREL that provide ample data and technical context for a renewables-centric, reliable BES. NREL's 2012 "Renewable Energy Futures Study" and 2013 "Western Wind and Solar Study Phase 2" publications show fast-start, simple-cycle gas combustion turbines are highly effective resources for backing up significant penetrations of renewable energy. In addition, these studies show that high levels of wind and solar generation may significantly displace combined-cycle generators. The "Renewable Energy Futures Study" is available online: http://www.nrel.gov/analysis/re_futures/, and the "Western Wind and Solar Study Phase 2" is available online: http://www.nrel.gov/docs/fy13osti/55588.pdf

[29] Thus the 2020 "lock in" of gas replacements for coal that will result from the EPA's dramatic early compliance problems will not only lock out renewables, it will also not be well suited to supporting their integration.

renewables and clean distributed energy resources could support reliability and low cost power equally well, while producing far less committed carbon than 23 GW of new combined-cycle.

For example, 11 GW of CT / CCF, running at an average annual capacity factor of 12% and emitting 1000 pounds of CO2 per MWH, would produce only about 170 million tons of CO2 between 2020 and 2050 – only about 10% of the committed CO2 of the 23 GW EPA predicts, thus avoiding 1.5 billion ton less.[30]

Importantly, under the simple but reasonable assumptions used above and in Figure 1, a state plan that achieves this low level of committed emissions under the glide path approach would completely offset the 1.5 billion tons of additional emissions from existing plants the glide path would allow by avoiding the precipitous retirement of coal plants due to the Proposal's 2020 compliance "cliff."

The implications are significant: EPA can achieve comparable or greater emission reductions just from the directly affected units through implementing a true glide path as it can from the more precipitous, front loaded emission reduction trajectory in the Proposal. In addition, this approach should result in far fewer power sector emissions over time as such gas – renewable combinations are more broadly deployed across the US power sector, along with other innovations such as the widespread adoption of post combustion CCS with enhanced oil recovery (EOR) at well-suited coal plants.[31]

**B. Two conditions are necessary for this more efficient approach – gradual reductions, and time for state and other key stakeholder policies and practices to evolve.**

In this rulemaking, such a system can evolve only under two conditions. First, the dramatic shocks to the power system that require substituting combined-cycle plants for coal plants need to be avoided. A suitable "glide path" with a gradual emission reduction trajectory, tailored by each state to meet its unique circumstances, is necessary to achieve greater overall emission reductions at a lower cost. Second, and equally important, states, power plant owners, renewable energy developers and other stakeholders – including the many who determine the rules and capabilities of FERC-regulated wholesale electricity markets and gas pipelines -- need time to develop the innovative policies and business models that will support lower carbon, equally reliable solutions to the BES' complex constraints. Many of these policies will need to evolve iteratively over the coming decades to keep pace with changing technologies and business models in the power sector.

[30] A variety of analyses show that CTs would be more useful than CCGT in integrating high levels of renewable resources, and that CTs in these circumstances would have relatively low capacity factors. See NREL studies, "Renewable Energy Futures Study" and the "Western Wind and Solar Study Phase 2"; selected figures from the "Western Wind and Solar Study Phase 2" are in the Appendix. These figures highlight how a high penetration of solar and wind generation resources can displace a significant amount of combined-cycle natural gas units, while gas CT generation increases slightly to provide supporting, dispatchable capacity.

[31] Forced retirement in 2020 or shortly thereafter could seriously deplete the candidates for such CCS.

The procedural and compliance requirements of EPA's 111(d) rule, in turn, must support these incremental and iterative policy and business developments. Only in this way can EPA's rule accurately and appropriately utilize a "beyond the fence" BSER comprising the interconnected bulk electric system.

**C. Key changes needed in the final rule to allow state plans to successfully use the power system to achieve aggressive emission reductions.**

Each of the problems identified above is created or exacerbated by the fundamental disconnect between EPA's BSER-based rule and the actual functionality, objectives and constraints of the BES itself. These problems fall into five basic categories:

- The front-loaded state emission reduction trajectories required by the Proposal would induce carbon-intensive responses in the BES.

- Insufficient time for state policy makers and other BES stakeholders to craft policies and practices required to implement the rule while continuing to meet the key operational and infrastructure constraints of the BES and related systems.

- Inadequate provisions to deal with new natural gas power plant development, which faces a strong triple incentive under the rule (due to the combination of gas power plants' ability to meet BES constraints, its light-handed regulatory treatment under this and other EPA rules, and the clear market incentives for gas deployment created by this and other EPA rules).

- These problems are exacerbated by a number of flaws or problems in the way EPA defines and utilizes each of the four elements of its BSER for the purpose of setting emission reduction targets.

- The EPA's apparent intention to make state plans, including specific elements of them related to the BES, federally enforceable is unnecessary for effective regulation, exceeds established precedent, and would allow the judicial branch to wreak havoc on the BES operation and functionality.

To correct these problems, improve the final rule, and enhance its ability to support state plans that will avoid more CO2 at a lower cost, NRG respectfully recommends specific changes to the Proposal in each of these categories.

**1. Allow states to create true "glide path" emission reduction trajectories to the 2030 goals.**

To avoid the problems caused by excessive front-loading of emission reductions, NRG recommends that EPA grant states considerable deference to determine the actual emission reduction trajectory required for compliance from existing power plants in the state. The specific interim goals and ten-year averaging requirement of the Proposal are inconsistent with

a low carbon BES, for the reasons presented above and in NRG September 2014 whitepaper, previously sent to EPA and attached to these comments.

There are several forms this deference to states could take. EPA could eliminate the interim goals completely, and simply require states to file and develop plans to achieve the 2030 goals with an emission reduction trajectory of the state's choosing. Alternatively, EPA could revise its interim goals to provide a reasonable emission reduction trajectory, while granting states considerable deference to craft a different emission reduction trajectory. EPA could authorize states to apply the elements of the BSER in establishing their own emission reduction trajectories, or it could allow states to make non-BSER based adjustments on the basis of reliability, cost, effectiveness and other considerations. In addition to this *trajectory flexibility*, EPA should also allow states the *policy flexibility* and *compliance flexibility* discussed below.

**2. Provide states and other stakeholders with flexibility to develop the needed policies and practices to support emission reductions while continuing to meet BES constraints.**

Policies that will support the replacement of coal generation with truly low carbon generation while preserving reliability, electricity market efficiency and reasonable costs are much more complicated than the simple carbon pricing, RPS and energy efficiency policies EPA envisions and evaluates through its IPM model. Policy issues such as capacity market reforms or other market improvements to recover the "missing money" needed to ensure resource adequacy; transmission planning, siting and capitalization; gas pipeline siting, development and payment; the inclusion of burgeoning distributed solar and other distributed energy resources in regulated distribution systems, and the development or enhancement of truly clean baseload power production are all essential parts of reducing power sector emissions – and current policies in all these areas are likely to be materially affected by, and in many cases must be modified to support, emission reductions as significant as those sought by EPA.[32]

In choosing a BSER that is based on and embedded in the BES, EPA must allow time for regulators and stakeholders to achieve the needed changes in these complex policy arenas needed for the BES to support the emission reductions EPA seeks to use it to create. Three features of the policy changes that are needed are particularly relevant to EPA's approach to 111(d): the policies are complex and challenging and demonstrably take a long time to develop and implement; they are often developed and implemented beyond state boundaries and involve both federal and state jurisdictions under various legal authorities; and they work incrementally and iteratively in light of their complexity and the dynamic interaction of key elements of the BES.

[32] See previously cited studies from NERC, ERCOT, PJM, SPP, MISO and WECC. Numerous regulatory proceedings have already begun to start the daunting process of updating energy markets and regulation, at both the federal and state levels, to allow the BES and its associated regulatory and business models to support the increasing penetration of renewable energy, new gas, and distributed energy resources. These include New York's REV proceeding, PJM's Capacity Performance reform, California's Distributed Resource Planning docket, and many others.

To accommodate needed policy development in both states and other jurisdictions, EPA needs to provide *policy flexibility* to state regulators as they develop their state plans under 111(d). In particular, EPA should allow and encourage state plans to provide for phased implementation, with a Phase I policy, Phase II policy, etc. as needed.

This policy flexibility is a necessary complement to the trajectory flexibility presented above. A true emission reduction glide path would allow state regulators to adopt a relatively simple and BES compatible set of policies to achieve the relatively minor emission reductions and "low hanging fruit" in the early years of the next decade, and to subsequently develop a more comprehensive and integrated set of polices to achieve the deeper emission reductions in the latter part of the decade. This more comprehensive, subsequent set of policies can better be identified and realized in the early part of the next decade than it can today, because there will be far more insight into the commercial viability, cost and system implications of emerging clean energy technologies, and more ability to integrate the state policy with the more complex system of federal, regional and other stakeholder policies and practices described above.

For example, Phase I could consist of what EPA terms a "portfolio approach" to incent the deployment and integration of clean energy resources in both the grid and the distributed energy markets, coupled perhaps with a moderate mass-based budget and a generation- and consumer- friendly allowance allocation framework to minimize stranded costs. This would allow states to achieve the moderate emission reductions under the front end of their glide paths, with lower impact to the BSE, while also supporting the initial integration of cleaner resources.

Phase II could consist of a more stringent budget, rate and "portfolio" objectives designed to propel the evolving system to achieve the 2030 goals and continue to achieve greater emission reductions after 2030. Phase II, however, would be best designed after 2020, based on the greater information about the economics of remaining coal plants, the cost, performance and availability of low carbon solutions, and their integration with the BES.

This approach would also have great practical value in a number of states, which would require legislative approval or modification of existing statutes even to implement the BSER elements EPA bases its emission targets on. It would be far easier to achieve such approval for a simple Phase I plan to meet modest emission reductions in 2020 through 2025, than for the potentially drastic plans needed to achieve the EPA's current 2020 emission reduction requirements -- much less to deal with the need to protect reliability, prevent market distortions, and keep prices reasonable for consumers during such a dramatic sudden reduction in emissions.

In addition to sufficient policy flexibility, EPA should also encourage and support *compliance flexibility* to deal with the fact that the BES, in meeting the various economic and reliability constraints it must meet, cannot be used to control fuel use and hence CO2 emissions with precision. For example, changes in natural gas prices, the loss or retirement of one or several

nuclear plants, or changes in economic growth can and do create changes in power sector CO2 emissions of magnitudes comparable to those contemplated by the Proposal.[33]

To accommodate such fluctuations within the overall context of effective regulation, EPA should encourage and allow states to include two types of compliance flexibility. First, EPA should allow significant inter-temporal compliance flexibility for affected entities and for states as a whole. For example, EPA should allow and encourage a high level of banking and borrowing in mass-based systems, or equivalently, longer compliance periods, in recognition of the fact that the total tons of emissions in the budget over the 10 year period is of far greater import than the precise number of tons emitted each year. Similarly, EPA should expand and clarify its definition of "self-implementing" plans to include mass-based plans with extended, multi-year compliance periods or a high level of banking and borrowing, instead of requiring particular emissions-per-year "spot checks" and precise interim milestones. Natural variability in emissions can be smoothed out and made consistent with overall emission reductions under long-term compliance periods or similar measures, but is likely to cause state plans to fail specific "spot checks" even when they are working well.

Second, in the event of a fundamental change in system configuration – such as the extended or permanent loss of existing nuclear facilities – EPA should allow states to reset their emission rates and budgets, consistent with the higher fossil fuel consumption that will be required for some time as the system increases generation from existing power plants – typically across multiple states – to continue to ensure reliability in the absence of a significant amount of energy and capacity that the BES relied on to meet its operating constraints.

**D. Avoid excessive incentives for new natural gas and its CO2.**

Natural gas fired generation clearly has the potential to make the power sector's transition to sustainable levels of GHG emissions power sector succeed or fail. The fact that EPA cannot regulate new power plant emissions under part (d) of Section 111 should not prevent EPA from dealing with new gas in ways that point the power sector towards success in reducing GHG emissions to sustainable levels by 2030 and 2050. Three specific features are needed in the final rule to support this outcome.

First, states should be able to take credit for avoided emissions from new natural gas, which will give them an incentive to support policies and practices that deploy gas for the purpose of providing reliability while renewable resources and clean baseload plants primarily provide the

[33] The need for flexibility in environmental programs is well-documented in Lesley McAllister's "The Overallocation Problem in Cap-and-Trade: Moving toward Stringency," *Columbia Journal of Environmental Law,* Vol. 43, p. 395, 2009. McAllister's evaluation of several cap-and-trade programs, including the EU ETS, the US Acid Rain Program, and RECLAIM shows that program flexibility is important for producing cost-effective environmental outcomes. In particular, McAllister finds that programs with limited or no capabilities to react to changes in business-as-usual assumptions, such as swings in gas prices, weather, or the economy, can produce unintended and often negative environmental feedback loops.

energy needed by the economy. NRG recommends that EPA adopt the following approach in its final rule:

- States should be authorized to project lifetime carbon emissions from new combined-cycle plants based on reasonable assumptions regarding the percentage of total energy production that would be met by new combined-cycle gas plants between the issuance of the final rule and 2030.

- States should be able to include in their state plans provisions for reducing the share of total energy production met by new combined-cycle plants, relative to the above projection, through policies that result in lower CO2 emissions from new plants while continuing to meet system reliability needs.

- States should be able to submit these emission reductions, i.e., the difference between (1) and (2), as a means to comply with the "portfolio" portion of their state plans[34]

These provisions will not only give states better tools to reduce committed future GHG emissions that could otherwise be encouraged by the rule, but could also provide another tool by which states could tailor suitable glide paths, consistent with achieving total CO2 emissions consistent with the Administration's overall emission reduction goals.[35]

Second, EPA should affirmatively avoid broadly giving all states even more incentives to further deploy new gas plants -- and especially of new combined-cycle plants operating at high capacity factors -- for the purpose of supplanting the production of existing power plants, as it appears to contemplate in the preamble to the Proposal and in the NODA.[36]

Third, EPA should, in the final rule, strongly encourage and explicitly allow states that choose mass-based systems to expand their budgets to cover new natural gas plants and to regulate them, entirely under state authority, within the same mass-based system the state uses to regulate existing power plants under Section 111(d).[37] This is important to avoid creating a

[34] Portfolio plans are discussed at pp. 34876-34877 of the Proposal. It should be permissible under Section 111(d) for states to count the emissions avoided by new power plants, which are not regulated under 111(d), in the "portfolio" compliance portion of a state plan for the same reasons it is permissible to count emissions avoided by new energy efficiency resources or new renewable energy resources, neither of which are regulated under Section 111(d).

[35] Note that such credit recognizes the carbon budget and commitment accounting principles discussed above, which are critical to ensuring efficiency and effectiveness in mitigating climate change. At the same time, such credit would enhance the United States' position in international negotiations while avoiding the reliability, stranded cost and market distortion problems of the EPA's current abrupt emission reduction trajectories. As Table 1 shows, the combination of true glide paths and realistic means for states to minimize new committed natural gas emissions can achieve both goals: avoiding the shocks of the EPA's more abrupt emission trajectory, while achieving overall power sector emission reductions as great as those proposed by EPA.

[36] Proposal at p. 34876-77, NODA at p. 64546.

[37] Proposal at p. 34876-77, NODA at p. 64546

dispatch cost advantage for new gas power plants relative to otherwise comparable existing gas power plants that must compete with them in wholesale electric markets, which would distort market outcomes and incent additional entry of new gas plants and their unregulated emissions. EPA should further ensure that such state regulation does not materially alter the emission reduction trajectory for existing plants that would otherwise be created under its guidance, for example, by providing guidance for such states to increase the budget for new gas plants to levels that will produce the same marginal costs of abatement over time as the original mass-based budget.

These features will help ensure that states and the private sector deploy not only the right amount of new natural gas plants, but the right kind of new natural gas plants, to support reliability and a low cost power system that can truly achieve GHG emission reductions compatible with the global 2030 and 2050 emission reduction targets climate science indicates are needed to mitigate the worst risks of climate change.

**E. Correct flaws in the reasoning and application of specific BSER elements.**

NRG's recommendations for increased flexibility in emission reduction trajectories, phased policy development and implementation, and physical compliance all rest on the fact articulated above that dispatch and hence emissions in the BES are subject to many causal factors and variables beyond the few factors EPA selected as its BSER. Thus we strongly recommend that EPA not link interim goals or compliance directly to emission levels projected by the BSER for a particular year. However, we also see significant flaws in each of the key elements of the BSER, and thus recommend the following changes to correct those flaws, to the extent EPA continues to use the BSER to set or inform interim emission reduction trajectories or final emission targets.

**1. Unrealistic heat rate improvements at existing coal plants.**

NRG has reviewed the Sargent and Lundy study and related material on available heat rate reductions at coal plants, and we believe the EPA's Proposal materially overstates the amount of CO2 emission reductions that can be achieved from heat rate improvements at existing coal plants. Five flaws, in particular, underlie this conclusion:

- Many coal plants will be forced to retire or rendered uneconomic to operate in many hours under the rule, which would make it uneconomic for them to make the heat rate improvements EPA relies on as available;
- Many coal plants have already made investments in many of the heat rate improvements EPA relies on as incrementally available, which means they are no longer available as broadly as EPA assumes; and
- Some of the improvements EPA assumes will be made at coal plants are not practically available for or usable by some of those plants.

- Complying with more stringent traditional environmental regulations regarding air and water quality and once through cooling will have a detrimental effect on heat rate.
- Greater cycling of coal units because of greater use of intermittent resources negatively affects efficiency and heat rate.

For these reasons, NRG recommends the EPA materially reduce the magnitude of reductions assumed to be adequately demonstrated for heat rate improvements at existing coal plants. We recommend a level of no more than 3% as being more reasonable in light of the above flaws in EPA's analysis.

**2. Excessive early levels of natural gas redispatch.**

As discussed throughout these comments, we believe the EPA errs in assuming that natural gas dispatch could be carried out at the levels assumed in the BSER, and in combination with the other elements of the BSER, achieve the overall level of emission reductions required for compliance under the rule, without rendering excessive numbers of existing coal plants uneconomic, and thus creating severe problems for reliability, high electricity prices, and distorted market outcomes – including the construction of excessive and unnecessary amounts of new natural gas plants. To correct this error, NRG recommends that EPA phase in the gas redispatch amount in equal increments across the entire 10 year period from 2020 to 2029.

**3. Arbitrary and ungrounded assessment of potential renewable resources and avoidable nuclear retirements.**

- As a major renewable energy developer, NRG does not support the EPA's approach to assessing state renewable energy potential by comparison with RPS levels in other states that are at best arbitrarily related. A number of empirical, well-grounded studies of state renewable potential are readily available, and would form a better basis for this important component of a low carbon future. State policies such as RPS requirements are important in terms of renewable development, but cannot reasonably be considered the only determinant of a state's potential. NRG also suggests EPA consider allowing states to determine key, state-specific elements of the BSER, such as renewable energy potential, as part of their state plans in the phased approach recommended above under "policy flexibility". This is especially important for states with extensive renewable programs already underway, as well as in other states where breakthroughs in renewable energy technologies and business models have the potential to unlock much more competitively priced renewable energy in the future than is apparent today.

- With respect to the avoided nuclear retirement component, NRG respectfully submits that the approach EPA used to determine this element has no reasoned basis whatsoever. Nuclear retirement is a binary outcome – either a plant retires, or it does not. Further, nuclear power plants are so large and distributed in such a manner than many states with aging nuclear power plants face the risk of a substantial fraction of their entire existing power supply disappearing, far beyond the 5.8% of nuclear capacity

unrealistically assumed by EPA. EPA also assumes unrealistic and unfounded state capabilities –a state may be unable to do anything under clean air policy or any other policy to prevent the retirement of a particular nuclear plant, simply because the costs and risks facing aging nuclear plants can far exceed the ability or authority of a state to manage. Finally, while states cannot really prevent the loss of a nuclear plant, such a loss will unavoidably increase CO2 emissions from existing fossil plants in the host state and, potentially, many surrounding states. Thus EPA attributes emission reduction potential to something states can't do (preventing nuclear retirement), instead of giving them something they need (compliance flexibility to deal with emissions increases states cannot prevent in the event a nuclear plant does retire or fail). Further, states may be unable to assure that new nuclear plants are completed. For all these reasons, NRG urges the EPA to remove nuclear capacity from the BSER entirely.

- Unreasonable variability in state's long term goals. As EPA's NODA recognizes, the Proposal's application of the BSER may unfairly discriminates against states with large amounts of both combined-cycle gas and thermal fossil power plants. While some degree of differentiation between states resource mixes may be reasonable to expect in 2030, it would be both more reasonable and more equitable in setting final 2030 goals to anticipate increased penetration by then of low and no carbon resources in those states with large amounts of coal but relatively few natural gas power plants, and to reduce the redispatch component in states with large amounts of both thermal and combined-cycle fossil generation.

**4. The risk of excessive Federal enforceability.**

In light of EPA's proposal to go "beyond the fence" of power plants for its BSER and thus the implication of activities and regulation beyond the scope of the Clean Air Act, it is particularly important for EPA to avoid requiring states to cede jurisdiction over aspects of their plans that involve state or other non-EPA authorities and jurisdictions. Such excessive federal enforceability could give EPA and third parties the ability to seek to change activities over which they have no current jurisdiction (or expertise) through litigation. This outcome should be avoided. EPA should leave all state jurisdictional and non-Clean Air Act jurisdictional policy and regulatory determinations fully under state or other authority and not attempt to make them federally enforceable through its 111(d) rulemaking process. Instead, EPA should rely on a generic equivalent of the SIP calls under the NAAQS, under which EPA – and only EPA -- may find a state plan deficient in terms of its effectiveness in reducing emissions, as laid out in the plan, and call for a revised plan to better achieve the specified levels of emission reductions.

The recommendations presented above are summarized in the following table:

Table 2

| Problem | EPA Solution |
|---|---|
| **1. Emission reduction trajectory fails to reduce power sector CO2** | |
| Excessive short-run emission reductions induce carbon-intensive long-run responses from BES | Spread emission reductions over decade, with substantial state discretion over trajectory, to allow time for low-carbon solutions to be developed for BES |
| **2. Inadequate time for policy makers and stakeholders to craft effective solutions that work for the BES** | |
| Energy efficiency programs, renewable portfolio standards, and dispatch-modifications through carbon prices or emission restrictions are (a) insufficient to achieve needed levels of system emission reductions, (b) incapable by themselves of respecting system constraints, (c) contentious and difficult policies for state legislatures and PUCs to authorize by 2016 or 2017, and (d) require even broader market and regulatory policy changes to support BES. | Spread emission reductions over decade, with substantial state discretion over trajectory to allow time for policy development for 111(d) and for BES support.<br><br>Encourage and provide ample inter-temporal flexibility in state plans<br>i. Phased compliance<br>ii. Sequential policy instruments<br>iii. Ample inter-temporal compliance flexibility |
| The BES use of fossil fuel cannot be controlled with precision due to the many factors and constraints that determine its outcome – excessively precise mass-based regimes are likely to fail. | Encourage and provide ample inter-temporal flexibility in state plans<br>i. Phased compliance<br>ii. Sequential policy instruments<br>iii. Ample inter-temporal compliance flexibility<br><br>Provide budget reset opportunities in the event of fundamental changes in BES that require materially increased emissions (nuclear plant failure or retirement) |
| **3. New natural gas is not treated appropriately in rule** | |
| Natural gas is the dominant new BES resource and is the likely response even to a true “glide path” emission reduction trajectory. | Establish policy guidance that will encourage state plans to incent gas for renewable integration rather than for baseload power production.<br><br>i. Allow states to estimate and apply lifetime avoided new gas CO2 emissions against their “portfolio” obligations. |
| New gas regulated only under 111(b) will distort power markets and create excessive discrimination among similarly situated resources, and further incent excessive amounts of new “baseload gas” | Provide guidance to states to include new gas in mass-based programs and to increase the state’s mass budget proportionately |
| **4. Specific BSER flaws** | |
| The BSER elements are unrealistic and | Reduce Element 1 to no more than 3% |

| | |
|---|---|
| unreasonable, and should be revised:<br><br>Element 1 – fewer available than EPA assumes<br>Element 2 – creates long-run problems and carbon-intensive solutions<br>Element 3 –<br>i. renewable potential, system impacts and needs, net GHG reduction impact not accurately assessed.<br><br>ii. nuclear retirements purely arbitrary; nuclear retirements not avoidable by state action of any sort; impact of nuclear retirements / failure change BES emission reduction capabilities; nuclear construction is highly risky, rule penalizes success. Nuclear should not be included in BSER.<br><br>Element 4 – Highly optimistic, ignores and will discriminate against emerging competitive distributed technologies<br><br>All: unfair in application to states, arbitrary and unreasoned burdens. | Phase in Element 2 over time, allow states to modify that phase-in themselves in light of unique circumstances, allow states to count life-time avoided new gas as predicated by Element 2 against their compliance obligation.<br><br>Allow states to estimate renewable potential, including imported renewable potential, and incorporate in BSER<br><br>Remove nuclear from BSER entirely<br><br>Apply a minimum estimate threshold of renewable energy, new CCGT penetration and energy efficiency to all states for 2030 to set more comparable final goals across states, to result in less dramatic differences in 2030 goals among states on the basis of current levels or estimates of those resources. |
| **5. Federal enforceability and other flaws** | |
| Excessive federal enforceability would give EPA and third parties the ability to litigate over specific components of state implementation plans, which are not properly under federal jurisdiction and should not be litigable under the Clean Air Act. | EPA should leave all state jurisdictional and non-Clean Air Act jurisdictional policy and regulatory determinations fully under state or other authority and not attempt to make them federally enforceable in and through its rulemaking process. Instead, EPA should rely on a generic equivalent of the SIP calls under the NAAQS, under which only EPA may find a state plan deficient and call for a revised plan. |

Respectfully submitted,

Steven B. Corneli
Senior Vice President
Policy & Strategy

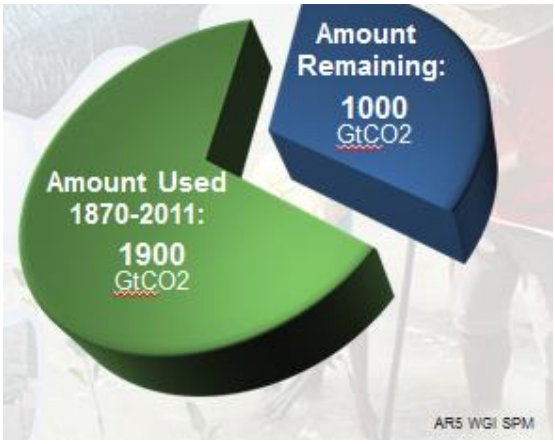
Walter Stone
Vice President, Environment

**Appendix**:

**IPCC Figure: Global CO2 budget remaining relative to 2 degree Celsius target**

*(See n. 19 above)*

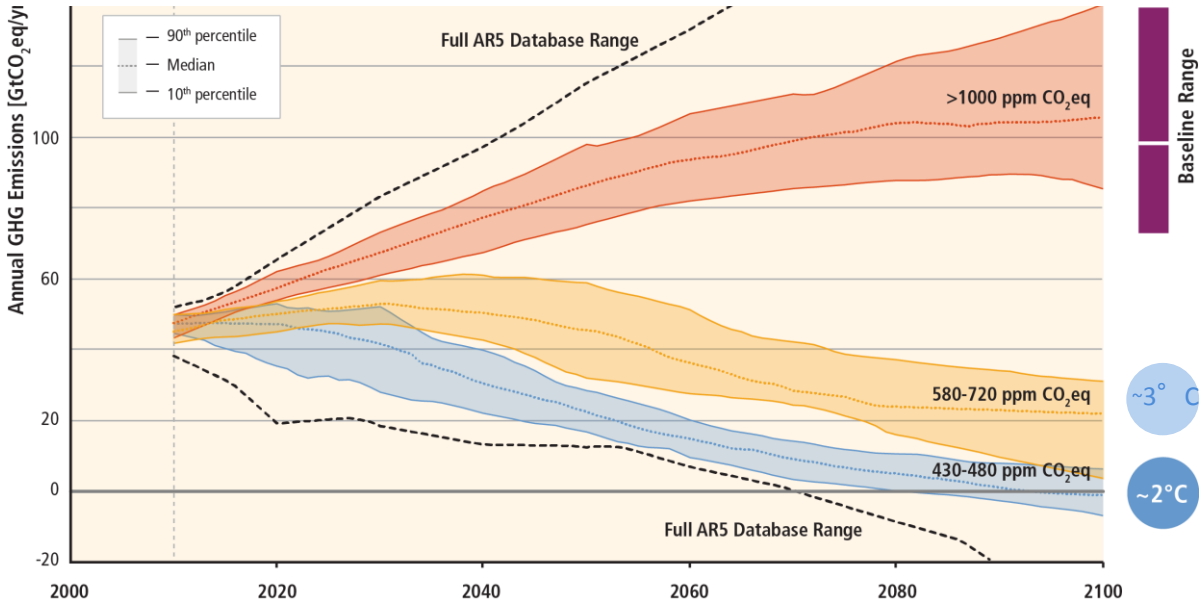
*(Source: IPCC AR5 Synthesis presentation, slide 34: [http://www.ipcc.ch/report/ar5/syr/](http://www.ipcc.ch/report/ar5/syr/))*




**IPCC Figure: Global CO2 Pathways, 2000-2100**
**with corresponding atmospheric carbon concentrations and temperature change**

*(See n. 20 above)*

*(Source: IPCC AR5 Synthesis presentation, slide 20: [http://www.ipcc.ch/report/ar5/syr/](http://www.ipcc.ch/report/ar5/syr/))*

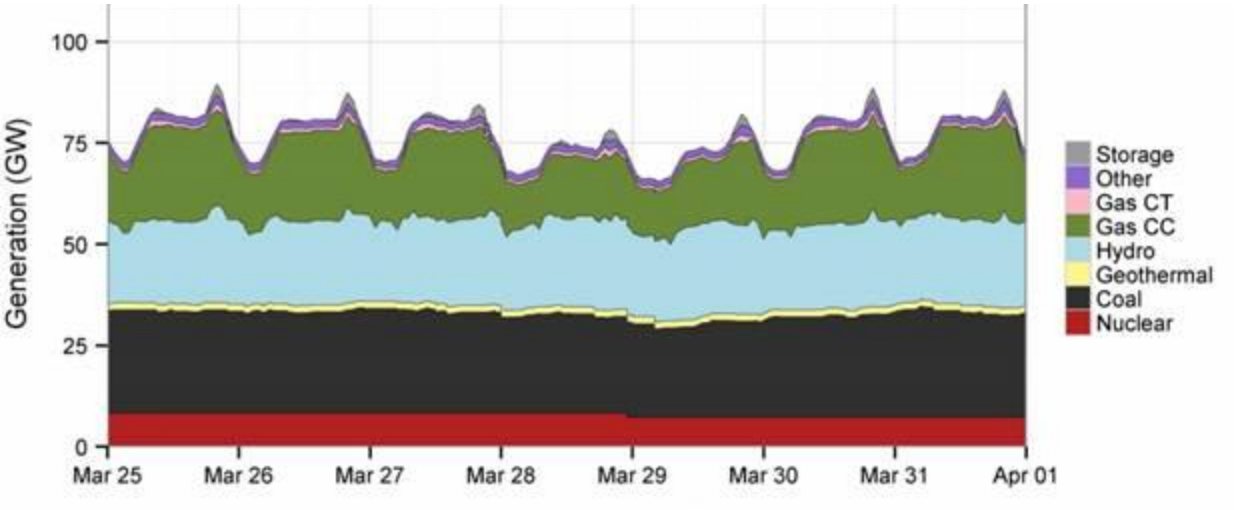


**Generation profile with and without high penetration of solar and wind resources**

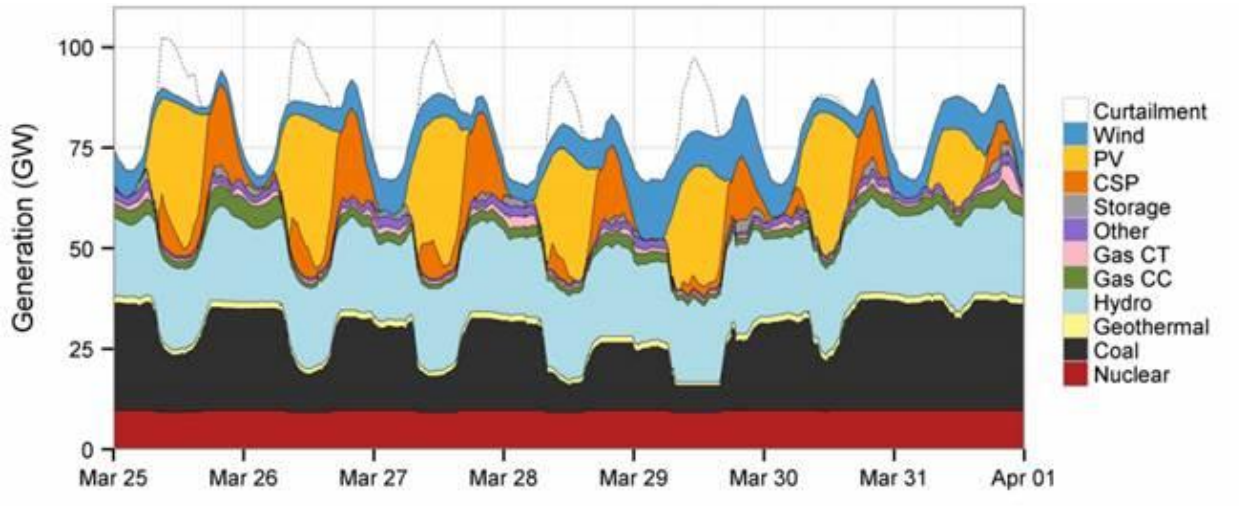
*(See n. 30 above)*

*(Source: Western Wind and Solar Integration Study, Phase 2,* http://www.nrel.gov/docs/fy13osti/55588.pdf)

No Renewables




High Solar (25% Solar, 8% Wind)




Note that between the two figures, wind and solar generation significantly displace combined-cycle natural gas generation in the monthly load profile, while gas CT generation only slightly increases, providing the ramping capacity supportive of a renewables-centric power system.