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Before the U.S. House of Representatives
Committee on Science, Space and Technology
Subcommittee on the Environment and Subcommittee on Energy
Hearing to Examine the U.S. Energy Information Administration's Report: Analysis of the Impacts of EPA's Clean Power Plan
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OVERVIEW AND SUMMARY

Good morning, Chairman Weber and Chairman Bridenstine, Ranking Member Grayson, Ranking Member Bonamici, and Members of the Subcommittees. Thank you for the opportunity to testify on several topics related to the EPA's proposed Clean Power Plan to regulate carbon dioxide emissions from the nation's existing fossil-fueled power plants.

Clearly, a reliable and efficient electric industry is critically important for Americans. It is also true that the U.S., as the world's largest economy and the world's historically largest emitter of carbon pollution, is poised to take seriously its role in controlling such emissions. Because the U.S. electric industry produces one out of every 15 tons of CO_2 emitted anywhere in the world, EPA's proposal to control carbon emissions from power plants will make a difference in reducing global emissions and in addressing the threats of climate change.

We do not yet know what the EPA's final rule will look like. EPA has always listened to comments on its proposals and made changes in response to them. Senior EPA officials have made it clear that will occur in this case, too. Those officials have also said that EPA's final rule will retain the proposal's flexibility, which will allow states to minimize impacts on consumers while also helping to reduce CO_2 emissions. This fact is important for understanding the potential implications of the Clean Power Plan for consumers and the U.S. economy.

EIA has recently analyzed the potential impacts of the Clean Power Plan. Like all forecasts of future events, EIA's assessment is a product of its assumptions and methodology. EIA routinely identifies these assumptions, to provide guidance about EIA's analysis and to enable policy makers and the public to apply the results appropriately. I want to explain various caveats related to this particular forecast to explain what it does and doesn't say.

- EIA's forecasting model (NEMS) does not incorporate various benefits that will occur as a result of the Clean Power Plan. NEMS is a model of energy production and use and does not purport to be a comprehensive model of the U.S. economy. For example, EIA's analysis does not include the impact of improving human health and lowering health-care costs, or of avoiding impacts of climate change and the costs that communities will incur in addressing its impacts in the future. EIA's assessment therefore cannot be viewed as reflecting the Clean Power Plan's impacts on the economy.
- Practically speaking, the presumptive outlook for economic conditions in the U.S. after 2020 should incorporate controls on CO_2 emissions from the power sector. This is consistent with decisions of the U.S. Supreme Court and the President that EPA should regulate CO_2 emissions under the Clean Air Act. EIA's long-standing practice is to base its reference-case outlook on federal and state laws and regulations that are in final form; therefore, EIA's long-term base-case outlooks do not incorporate the assumption of CO_2 emissions regulation. EIA's reference-case outlook in the 2015 Annual Energy Outlook ("AEO") thus likely overstates the role of power plants with high CO_2 emissions and understates the role of low- or no-carbon power sources (like natural gas, nuclear, and renewable energy) in the years after 2020. The EIA's

new Clean Power Plan proposal might reasonably be considered the baseline outlook, with the other scenarios offering insights about what the impacts might be with alternative compliance policy designs.

- EIA's analytic methodology and assumptions have various attributes that affect how the model's results should be interpreted. Like many other long-term assessment models, EIA's methodology does not do a particularly good job of capturing the effects of technological innovation and disruptive technologies. That is significant in light of important changes currently underway in the electric industry, and EIA itself includes a relevant caveat: "EIA recognizes that projections over a 25-year horizon are inherently uncertain and subject to changing policy objectives, supply disruptions, the emergence of disruptive technologies, and other future developments." Based on historical experience, we know that most before-the-fact estimates of the cost of compliance with new environmental regulations in the electric sector end up overstating costs when compared to the actual costs incurred by the industry, especially when market-based compliance mechanisms are relied upon (as anticipated by the EPA's Clean Power Plan). Once an environmental regulation is in place, the electric industry and environmental-compliance markets end up delivering environmental improvements at much lower cost than previously expected. We also know that disruptive technologies that are not understandably anticipated in normal forecasts can lead to unexpected changes (and cost reductions) in the industry. This has occurred with the advent of hydraulic fracturing and directional drilling for natural gas, which began to become more common in the natural gas industry after mid-2007. EIA's 2008 AEO, for example, included a long-term forecast of natural gas prices that ended up being much higher than actual prices (to date) as well as much higher than prices forecast in subsequent AEO editions that began to incorporate expectations about deployment of advanced gas-production technology and the associated changes in market conditions. Understandably, it is difficult to anticipate the timing, costs, and other implications of game-changing technologies, and EIA's assessment of the Clean Power Plan may underestimate the impacts of such things as advanced electricity-storage technologies and smart-grid technologies, and systems which, in combination with renewable energy power generation technologies, may end up providing cost-effective around-the-clock provision of zero-carbon electric energy supply.

- EIA's assumptions about energy efficiency may understate its value in mitigating cost impacts of the Clean Power Plan. In practice, the actual experience of some states (such as the states participating in the Regional Greenhouse Gas Initiative ("RGGI")) that have adopted aggressive energy efficiency programs as part of their existing power-sector carbon-control programs indicates much more positive outcomes that EIA's analysis would suggest. These states have used novel approaches to fund the deployment of energy efficiency (e.g.,, using the majority of revenues obtained from the sale of CO_2 allowances as a source of incremental funding for energy efficiency programs). This has tended to lead to lower demand for electricity, lower CO_2-emissions reductions, and lower electricity bills for consumers. EIA's results also seem inconsistent with recent analyses conducted by the grid operator in the PJM region and by other independent studies which conclude that aggressive energy efficiency lowers overall compliance costs associated with CO_2-emission reductions from the power sector.

- EIA's assessment highlights the value of market-based, multi-state approaches to reducing CO_2 emissions. These results are consistent with those of other modeling in suggesting that states may be able to lower their costs of compliance through cooperation with other states. EIA has noted that "Cooperation among regions also lowers electric power sector resource costs, which include investment costs (new capacity, transmission, retrofits, and energy efficiency) and operating expenditures (operating and maintenance, fuel, and power purchases)."

- It is reasonable to expect that EPA's final rule will increase flexibility and lower cost. EIA is aware of the fact that the final rule may differ from the proposed rule, and incorporates this caution as part of presenting the results of its analysis to the Committee.

Fortunately, the EPA's proposed regulation allows flexibility that states will be able to use to minimize impacts on consumers and maintain a reliable electric system. Based on studies I have co-authored, I believe that the impacts on electricity rates from well-designed carbon-pollution control programs will be modest in the near term, and can be accompanied by long-term benefits in the form of lower electricity bills and positive economic value to state and regional economies.

- States have diverse tools to reduce CO_2 emissions cost-effectively. States have a long track record of using various regulatory and other policy tools to encourage utility programs and investments that minimize the cost of electric service. State officials are keenly focused on protecting electricity customers and will focus on that objective as they determine how to reduce carbon pollution. States are well equipped through long-standing utility-ratemaking principles, practices, and programs to help protect low-income customers.

- Market-based mechanisms – and in particular, multi-state, mass-based and market-based approaches that cover both existing power plants and new ones – will allow for lower-cost compliance. These will provide incentives to reduce CO_2 emissions efficiently, to control emissions seamlessly as part of normal electric system dispatch, to simplify verification of the savings from energy efficiency, to provide proper investment incentives, and to retain low-carbon resources (e.g., existing nuclear units) in the mix.

- Since the EPA proposed its Clean Power Plan last June, many observers have raised concerns that its implementation might jeopardize electric-system reliability. Such warnings are common whenever there is major change in the industry and play an important role in focusing the attention of the industry on taking the steps necessary to ensure reliable electric service. (This occurred with the recent EPA Mercury and Air Toxics Standard ("MATS"), which has been successfully implemented without reliability problems.) Standard industry reliability mechanisms provide a strong foundation for assuring reliability while the nation reduces CO_2 emissions. Given the significant shifts already underway in the electric system, the industry would need to adjust its operational and planning practices to accommodate changes even if EPA had not proposed the Clean Power Plan. Some of the reliability concerns raised by stakeholders about the Clean Power Plan presume inflexible implementation, are based on worst-case scenarios, and assume that policy makers, regulators, and market participants will stand on the sidelines until it is too late to act. There is no historical basis for these assumptions. In the end, the industry, its regulators, and the States are responsible for ensuring electric-system reliability while reducing carbon pollution from power plants as required by law. These responsibilities are compatible, and need not be in tension as long as all parties act in a timely way and use the many reliability tools at their disposal. These issues will be solved by the dynamic interplay of actions by regulators, entities responsible for reliability, and market participants – with many solutions proceeding *in parallel*.

- Based on our analyses, the grid operators in the nation's two largest electrical regions – the PJM and MISO regions– are well positioned to assure reliability while the states and the industry reduce CO_2 emissions from power plants. These regions are already adapting to changes in the industry and doing so successfully from a reliability point of view, even as older power plants retire and are replaced by new resources. The flexibility that EPA has granted states in designing Clean Power Plan implementation plans leaves the door wide open for states to propose in their plans the specific mechanisms needed to ensure that Clean Power Plan compliance does not compromise system reliability.

INTRODUCTION AND BACKGROUND

By way of introduction, I am a former state cabinet officer (Secretary of Environmental Affairs) and regulator (Commissioner of the Department of Public Utilities and Director of the state's energy facilities siting board) in Massachusetts. I was appointed to those positions by governors of both parties. I also served as Assistant Secretary for Policy at the U.S. Department of Energy. I have direct familiarity with administration of federal and state environmental and energy laws. As a consultant for a wide variety of clients (including state governments, private companies, grid operators, utilities, large consumers, energy project developers, foundations, tribal governments), I also have studied the implications of federal and state energy and environmental laws on energy markets, electric-system reliability, local economies, and consumers. As an academic, I have written a book and articles on complex forecasting models used by government agencies to analyze the implications of public policies on consumers and on the economy. As a government decision-maker and policy analyst, I have conducted complex studies and relied on modeling results provided by others to make public policy decisions. I have a deep appreciation for the strengths and weaknesses of different modeling tools for different purposes. I have also participated actively on industry panels (including serving as head of the policy subgroup of the National Petroleum Council's study on shale gas development, a member of the Secretary of Energy's Advisory Board on Shale gas risk, the chair of the External Advisory Council of the National Renewable Energy Laboratory (NREL), a co-chair of the NAESB Gas-Electric Harmonization Committee, and a co-chair of the Bipartisan Policy Center's project on cyber security and the electric grid). And as a co-lead convening author of the National Climate Assessment's chapter on energy production and use, I am deeply aware of the state of knowledge about the implications of a changing climate on American energy facilities and markets, and consumers' demand for energy in the years ahead.

My testimony today focuses in particular on the implications of the EPA's Clean Power Plan. EPA proposed this regulation in June 2014 under the authority given to the agency by Congress in the Clean Air Act ("Act") and following upon the 2007 ruling of the U.S. Supreme Court in *Massachusetts v. the Environmental Protection Agency* that greenhouse gases ("GHG") meet the definition of an "air pollutant" under the Act. The American power sector represents the nation's

largest source of greenhouse gas emissions. Americans are already feeling the damaging effects of climate change. The U.S.'s cumulative CO_2 emissions exceed those of any other country, and our power sector produces one out of every 15 tons of energy-related CO_2 emissions produced anywhere in the globe. Taking action to reduce emissions from the U.S. power sector will have a material impact on reducing global emissions and mitigating the costly impacts of climate change. The U.S., as the world's largest economy and the world's historically largest emitter of carbon pollution, is poised to take seriously its role in controlling such emissions and to do so in ways that assure reliable and affordable supply of power to consumers.

EIA'S ANALYSIS OF THE CLEAN POWER PLAN

As requested by Science Committee Chairman Smith, the EIA has recently assessed the potential impacts of the Clean Power Plan. Like all forecasts of future events, the results of EIA's assessment are a product of its assumptions and methodological features. EIA routinely identifies these assumptions to help provide guidance to enable policy makers and the public to apply the results appropriately. I want to explain various caveats to help navigate what EIA's assessment does and doesn't say.

EIA's Forecasting Model (NEMS) Does Not Incorporate Various Benefits that Will Occur as a Result of the Clean Power Plan. EIA's analysis of the Clean Power Plan relies upon its NEMS model, which is what EIA uses to prepare its Annual Energy Outlook. NEMS is a model of energy production and use, and does not purport to be a comprehensive model of the U.S. economy. Nor is it a cost-benefit analysis of the Clean Power Plan. For example, the EIA's assessment compares its 'base case' (the reference case in the 2015 AEO) to a set of cases reflecting alternative assumptions about implementation of the Clean Power Plan. NEMS projects certain impacts on: the level of power produced by coal, natural gas, nuclear energy, and renewables; demand for electricity; electricity prices; and CO_2 emissions. Although EIA reports an impact on the U.S. economy as a whole (i.e., on gross domestic product), results from NEMS cannot reasonably be interpreted as a comprehensive estimate of the net effects of implementing the Clean Power Plan on the economy. For example, EIA's analysis does not address the impacts of lowering power plant emissions on

human health and health-care costs,[1] or on avoiding some impacts of climate change and communities' future costs in addressing those impacts. Therefore, the costs that EIA's analysis associates with the Clean Power Plan do not take into account the effect of certain health, environmental and other economic benefits, and therefore cannot be viewed as either reflecting net benefits (or net costs) to the economy.

A recent scholarly study points out that "Carbon dioxide emissions standards for US power plants will influence the fuels and technologies used to generate electricity, alter emissions of pollutants such as [sulfur] dioxide and nitrogen oxide, and influence ambient air quality and public health. [This study is] …an analysis of how three alternative scenarios for US power plant carbon standards could change fine particulate matter and ozone concentrations in ambient air, and the resulting public health co-benefits. The results underscore that carbon standards to curb global climate change can also provide immediate local and regional health co-benefits, but the magnitude depends on the design of the standards. A stringent but flexible policy that counts demand-side energy efficiency towards compliance yields the greatest health benefits of the three scenarios analysed."[2]

This suggests that EIA's analyses understate the net benefits of the Clean Power Plan. And as EIA explains, its review "is not a cost-benefit analysis"[3] of the Clean Power Plan.

The Presumptive Base-Case Scenario of Economic Conditions After 2020 Should Incorporate Controls on CO_2 Emissions from the U.S. Power Sector: EIA's assessment suggests that the full impact of the Clean Power Plan is the change relative to the base case (EIA's 2015 AEO's reference case), which by design does not take into account the fact that for at least the past two years, EPA

[1] "Consistent with EIA's statutory mission and expertise, this analysis focuses on the implications for the energy system and the economy of reducing CO_2 emissions under the proposed Clean Power Plan. It does not consider any potential health or environmental benefits from reducing CO_2 emissions from existing electric generating units covered by the proposed Clean Power Plan. It is not a cost-benefit analysis." EIA, "Analysis of the Impacts of the Clean Power Plan," May 2015 (hereafter "EIA Analysis"), page 8..
http://www.eia.gov/analysis/requests/powerplants/cleanplan/?src=home-b3.

[2] Charles T. Driscoll, Jonathan J. Buonocore, Jonathan I. Levy, Kathleen F. Lambert, Dallas Burtraw, Stephen B. Reid, Habibollah Fakhraei, and Joel Schwartz, "US power plant carbon standards and clean air and health co-benefits," *Nature Climate Change*, **5**, 535–540 (2015), doi:10.1038/nclimate2598, published 04 May 2015.
http://www.nature.com/nclimate/journal/v5/n6/full/nclimate2598.html.

[3] EIA Assessment, page 8.

has been proceeding to take action under the Clean Air Act to control emissions from the power sector and has been doing so at the explicit direction of the President.[4] This starting-point assumption reflects EIA's long-standing practice to base its reference-case outlook only on federal and state laws and regulations that are in final form.[5] Therefore, even though EPA has indicated its intention to take action under the Clean Air Act's Sections 111(b) and 111(d), to control CO_2 emissions from new and from existing power plants, respectively, EIA's long-term base-case outlooks do not incorporate that assumption. Given the Supreme Court's finding in *Massachusetts v. EPA* that CO_2 is an air pollutant under the Clean Air Act and EPA, a reasonable conclusion might be to suggest that the EIA's reference-case outlook overstates the role of power plants with high CO_2 emissions and understates the role of low- or no-carbon power sources (like natural gas, nuclear, and renewable energy) in the years after 2020. By contrast, users of EIA's assessment of the proposed Clean Power Plan might reasonably look to that 'policy case' as the baseline outlook, with the other scenarios offering insights about what the impacts might be with alternative policy designs adopted by the EPA and/or the states. In fact, EIA's analysis does examine various "what if" scenarios to look at the change in CO_2 emissions, energy prices, energy use, and so forth, under different sets of assumptions. The results of these other scenarios are more valuable for comparisons across each other, than to compare to a reference case without the Clean Power Plan in place. The insights gleaned from those alternative scenarios suggest that market-based approaches adopted by groups of states and for wider regions can provide more efficient compliance approaches with lower cost to consumers.[6]

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[4] The President put forward his "Climate Action Plan" (June 2013) and the related "Presidential Memorandum -- Power Sector Carbon Pollution Standards" (June 13, 2013), with the latter specifying that EPA proceed to take the actions under the existing authorities of the Clean Air Act: using Section 111(b) to establish emission standards for new power plants and using Section 111(d) to establish emission standards for existing power plants. The Presidential Memorandum directed that to the "greatest extent possible," EPA would have to engage with the states, tailor regulations and guidelines to reduce costs, develop approaches that allow the use of market-based instruments, performance standards, and other regulatory flexibilities, enable continued reliance on a range of energy sources and technologies, and ensure that the standards are developed and implemented in a manner consistent with reliability and affordable-power objectives.

[5] EIA has indicated that the cut-off date for including new and finalized policies into the 2015 Annual Energy Outlook assumptions was October 2014. EIA Assessment, page 9.

[6] EIA Assessment, page 71.

EIA's Analytic Methodology and Assumptions have Various Attributes that Affect How the Model's Results Should be Interpreted. Like many other long-term assessment models, EIA's methodology does not do a particularly good job of capturing the effects of technological innovation and disruptive technologies. That is important in light of important changes currently underway in the electric industry, and EIA itself includes a relevant caveat: "EIA recognizes that projections over a 25-year horizon are inherently uncertain and subject to changing policy objectives, supply disruptions, the emergence of disruptive technologies, and other future developments. It is not possible for EIA to account for all uncertainties; for practical reasons this study examines a limited set of sensitivities through alternative scenario analysis."[7]

EIA's model does not fully reflect the types of innovations that can reasonably be expected to occur in the U.S.'s energy systems – that is, in states' innovations relative to designing and implementing policies and in the private sector's innovations in developing, adopting and deploying advanced technologies. Such innovations will result from the flexibility and economic incentives built into the design of the Clean Power Plan. Based on historical experience, we know that most before-the-fact estimates of the cost of compliance with new environmental regulations in the electric sector end up overstating costs when compared to the actual costs incurred by the industry, especially when market-based compliance mechanisms are relied upon (as anticipated by the EPA's Clean Power Plan).[8] Once an environmental regulation is in place, the electric industry and environmental-

[7] EIA Assessment, page 9.

[8] A recent retrospective review of various studies of the effectiveness of the sulfur-dioxide ("SO_2") emissions-trading policy reviewed actual costs of the program relative to predicted costs prior to the program's implementation as well as "how the costs of achieving environmental objectives through cap and trade compare with those of a "counterfactual" (hypothetical alternative) command-and-control regulatory approach….In addition to being less costly than traditional command-and-control policies would have been, the program's costs were significantly below estimates generated by government and industry analysts in the debate leading up to the passage of the [Clean Air Act]. In 1990, the U.S. Environmental Protection Agency (EPA) estimated the cost of implementing the Acid Rain Program (with allowance trading) at $6.1 billion. In 1998, the Electric Power Research Institute (EPRI), an industry organization, and Resources for the Future (RFF), an independent think tank, estimated that total implementation costs would be $1.7 and $1.1 billion respectively (based in part on actual figures for the first few years of the program…). In sum, the SO2 allowance-trading system's actual costs, even if they exceeded the cost-effective ideal for a cap-and-trade system, were much lower than would have been incurred with a comparable traditional regulatory approach, and were much lower than the trading system's predicted costs. There is broad agreement that the SO2 allowance-trading system provided a compelling demonstration of the cost advantages of a market-based approach." Gabriel Chan, Robert Stavins, Robert Stowe, and Richard Sweeney, "The SO2 Allowance Trading System

compliance markets end up delivering environmental improvements at much lower cost than previously expected.

We also know that disruptive technologies that are not understandably anticipated in most forecasts can lead to unexpected changes and cost reductions in the industry. This has occurred with the advent of hydraulic fracturing and directional drilling for natural gas, which became more common in the natural gas industry after mid-2007.[9] EIA's AEO published in June 2008 included a long-term forecast of natural gas prices that ended up being much higher than actual prices (to date) as well as much higher than prices forecast in subsequent AEO editions that began to incorporate the industry's deployment of advanced gas-production technology and the associated changes in market conditions.[10]

It is, of course, difficult to anticipate the timing, costs and other implications of game-changing technologies in a long-term forecast. But knowing that such occur, it is possible if not likely that

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and the Clean Air Act Amendments of 1990: Reflections on Twenty Years of Policy Innovation," Harvard Environmental Economics Program, January 2012. http://www.hks.harvard.edu/fs/rstavins/Monographs_&_Reports/SO2-Brief.pdf.

[9] See, for example, the 2011 report of the National Petroleum Council, "Prudent Development: Realizing the Potential of North America's Abundant Natural Gas and Oil Resources." "Extraordinary events have affected energy markets in the years since the NPC reported on the 'Hard Truths' about energy in 2007. That study concluded that the world would need increased energy efficiency and all economic forms of energy supply. This is still true today, but since then, significant technology advances have unlocked abundant natural gas and oil resources. These greatly expanded resources have already benefited our country economically. Increased supplies of natural gas have resulted in lower prices and helped revitalize many U.S. industries. Further, increased use of natural gas can reduce emissions and improve America's energy security." Cover Letter to Energy Secretary Chu from the NPC's North American Resource Development Study Leadership Group, September 15, 2011.

[10] The following information on EIA's outlook for natural gas prices are drawn from EIA's 2008 Annual Energy Outlook ("AEO") (which did not yet capture the full effects of the "shale gas revolution") and EIA's 2013 AEO, which incorporated learnings from several years of experience/trends in the natural gas industry after 2008.

Natural Gas Price: Henry Hub Spot Price ($/MMBtu)				
	Price in 2010	Price in 2015	Price in 2020	Price in 2025
ACTUAL observed price	$4.37 (nominal)	N/A	N/A	N/A
EIA AEO 2008	$7.59 (nominal $) ($6.90 in 2006 $)	$7.30 (nominal $) ($5.87 in 2006 $)	$8.37 (nominal $) ($5.95 in 2006 $)	$10.13 (nominal $) ($6.39 in 2006 $)
EIA AEO 2013	$4.37 (nominal $) ($4.46 in 2011 $)	$3.44 (nominal $) ($3.12 in 2011 $)	$5.18 (nominal $) ($4.13 in 2011 $)	$6.95 (nominal $) ($4.87 in 2011 $)
Nominal-dollar price estimates were calculated using GDP deflators and GDP assumptions applicable to each AEO. Actual Henry Hub price data for 2010 comes from EIA: http://www.eia.gov/dnav/ng/hist/rngwhhda.htm.				

EIA's assessment of the Clean Power Plan's impacts may underestimate the value of such things as electricity-storage technologies and smart-grid technologies which, in combination with renewable-energy power-generation technologies, may end up providing cost-effective around-the-clock provision of zero-carbon electric energy supply.

EIA's Results Assumptions about Energy Efficiency May Understate its Value in Mitigating Cost Impacts of the Clean Power Plan. Surprisingly, EIA's analysis indicates that more-aggressive energy efficiency programs will lead to higher costs for consumers as compared to the base-case Clean Power Plan scenario. This runs counter to the actual experience of some states (such as the states participating in the Regional Greenhouse Gas Initiative ("RGGI")) that have adopted aggressive energy efficiency programs as part of their existing power-sector CO_2-control programs. These states have used novel approaches to fund the deployment of energy efficiency (e.g., using the majority of revenues obtained from the sale of CO_2-allowances as a source of incremental funding for energy efficiency programs). This has tended to lead to lower demand for electricity, lower CO_2-emissions reductions, and lower electricity bills for consumers.[11]

[11] At the end of 2011, I co-authored a study that was the first comprehensive analysis of the economic impacts of the RGGI program on electricity customers in the participating states and on the economies of those states. (See; Paul J. Hibbard, Susan F. Tierney, Andrea M. Okie, and Pavel G. Darling, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States: *Review of the Use of RGGI Auction Proceeds from the First Three-Year Compliance Period,* November 15, 2011.) We carefully assessed and quantified the economic impacts of RGGI's first three years. Our analysis found that in the near term, CO_2 allowances tended to increase electricity prices by less than one percent, but over time – as the RGGI states invested a substantial amount of the CO_2-allowance proceeds on energy efficiency programs that led to lower electricity use and lower electricity prices – the program resulted in lower consumer payments for electricity. Because the overall electric system avoided having to run some of the more expensive power plants, there were lower wholesale prices with RGGI in place than had RGGI not been implemented. All consumers benefitted from this effect, while those consumers who actually implemented energy-efficiency measures had even lower electricity bills as their electricity consumption went down. Across the ten RGGI states, electricity expenditures were approximately $1.1 billion lower with RGGI, reflecting an average net present value of benefits of $25 for residential consumers, $181 for commercial consumers, and $2,493 for industrial consumers. Since we published our study at the end of 2011, the RGGI program has continued in operation. In 2014, my colleagues and I examined what had happened after 2011. We found that there is now a tighter cap with fewer allowed CO_2 emissions each year, and the prices of CO_2 allowance prices are higher. (Paul Hibbard, Susan Tierney, and Andrea Okie, "EPA's Clean Power Plan: States' Tools for Reducing Costs and Increasing Benefits to Consumers," Chapter 4 (Program Design Considerations: Review of the Regional Greenhouse Gas Initiative), July 2014, pages 17-28.) We found that the states increased the share of their auction proceeds they spent to fund energy-efficiency programs, and we concluded that one would expect to see continued positive economic benefits from the RGGI program.

EIA's results also seem inconsistent with recent analyses conducted by the grid operator in the PJM region[12] and by other independent studies[13] which conclude that energy efficiency lowers overall compliance costs associated with CO_2-emission reductions from the power sector.

EIA's Assessment Highlights the Value of Market-Based, Multi-State, Mass-Based Approaches to Reducing CO_2 Emissions from the Power Sector. EIA's analysis examines the implications of states' voluntarily adopting a multi-state approach to implementing the Clean Power Plan. In this sensitivity analysis, which EIA calls the "CPPUS case" with national cooperation, EIA assumes that there is broad interregional cooperation among the policies adopted by the states. EIA's results are consistent with those of other modeling in suggesting that states may be able to lower their costs of compliance through cooperation with other states:

> Compared with the Base Policy case, the CPPUS case results in more renewable capacity and generation as areas with abundant, economic supplies can increase the contribution of zero-carbon electricity supplies. This, in turn, reduces the need to switch from coal to natural gas and invest in energy efficiency. Cooperation among regions also lowers electric power sector resource costs, which include investment costs (new capacity, transmission, retrofits, and energy efficiency) and operating expenditures (operating and maintenance, fuel, and power purchases).[14]

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[12] PJM recently conducted analyses of the changes in system-wide production costs assuming various designs of states' compliance plans: "Adding more energy efficiency and renewable energy and retaining more nuclear generation would likely lead to lower CO_2 prices; this could result in fewer megawatts of fossil steam resources at risk of retirement because lower CO_2 prices may reduce the financial stress on fossil steam resources under this scenario." "PJM Interconnection Economic Analysis of the EPA Clean Power Plan Proposal: Executive Summary and Frequently Asked Questions" March 2, 2015, included as an attachment to the statement of Michael J. Kormos, Executive Vice President – Operations, PJM Interconnection, before the Federal Energy Regulatory Commission, Docket No. AD15-4-000, "Technical Conference on Environmental Regulations and Electric Reliability, Wholesale Electricity Markets, and Energy Infrastructure," March 11, 2015. http://www.ferc.gov/CalendarFiles/20150213081650-Kormos,%20PJM.pdf.

[13] For example, modeling by a team from the Bipartisan Policy Center ("BPC") found that "State choice of energy efficiency policies will significantly impact the cost: Effective end-use energy efficiency policies are important for cost containment. Demand reductions dramatically reduce system cost because they both reduce the need for additional capacity and lower fuel costs due to reduced demand…State policy choices will impact generation mix, investments, cost, and CO_2 emissions. … Despite projected wholesale electricity price increases in some states/scenarios, end-use [energy efficiency] may keep customer bills from increasing. Mass-based policies limit generation shifts and emissions leakage between states." Jennifer Macedonia, Blair Beasley, Tracy Terry, Meghan McGuinness, and Stuart Iler, "Insights from Modeling the Proposed Clean Power Plan," Bipartisan Policy Center, April 2015. http://bipartisanpolicy.org/blog/tag/environmental-protection-agency/.

[14] EIA Assessment, page 21.

It is Reasonable to Expect that EPA's Final Rule will Increase Flexibility and Lower Cost: EIA has attempted to estimate the impacts of the proposed Clean Power Plan, which is understandable because it is the only regulatory framework currently available from the EPA. Senior EPA officials have indicated in countless public statements that in light of the many stakeholder comments presented to the agency, EPA's final rule will undoubtedly be a different document from the one published last June. EIA is aware of the fact that the final rule may differ from the proposed rule,[15] and incorporates this caution as part of presenting the results of its analysis to the Committee.

EPA's PROPOSED CLEAN POWER PLAN: FLEXIBILITY WILL HELP LOWER COSTS

Fortunately, the EPA's proposed regulation allows flexibility that states will be able to use to implement the Clean Power Plan in ways that can minimize impacts on consumers and respects their expectations for a reliable electric system. Based on studies I have co-authored,[16] I believe that the impacts on electricity rates from well-designed carbon-pollution control programs will be modest in the near term, and can be accompanied by long-term benefits in the form of lower electricity bills and positive economic value to state and regional economies.

States Have Diverse Tools to Comply with the Clean Power Plan Cost-Effectively: There are sound reasons to be confident that electricity consumers can and will benefit from states' plans to lower the

[15] EIA Assessment, page 9.

[16] Susan Tierney, Paul Hibbard and Craig Aubuchon, "Electric System Reliability and EPA's Clean Power Plan: The Case of MISO," June 8, 2015; Susan Tierney and Paul Hibbard, "Carbon Control and Competitive Wholesale Electricity Markets: Compliance Paths for Efficient Market Outcomes," May 2015; *Susan* Tierney, Paul Hibbard and Craig Aubuchon, "Electric System Reliability and EPA's Clean Power Plan: The Case of PJM," March 16, 2015; Susan Tierney, Paul Hibbard and Craig Aubuchon, "Electric System Reliability and EPA's Clean Power Plan: Tools and Practices," February 2015; Paul Hibbard, Andrea Okie and Susan Tierney, "EPA's Clean Power Plan: States' Tools for Reducing Costs and Increasing Benefits to Consumers," July 14, 2014; *Susan* Tierney, "Greenhouse Gas Emission Reductions From Existing Power Plants Under Section 111(d) of the Clean Air Act: Options to Ensure Electric System Reliability," May 8, 2014; Paul J. Hibbard and Susan F. Tierney, "Carbon Control and the Economy: Economic Impacts of RGGI's First Three Years." *Electricity Journal*, December 2011; Paul J. Hibbard, Susan F. Tierney, Andrea M. Okie, Pavel G. Darling, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States: *Review of the Use of RGGI Auction Proceeds from the First Three-Year Compliance Period*, November 15, 2011.

carbon intensity of their electric systems: [17]

- First, states have a long track record of using various regulatory and other policy tools to encourage utility programs and investments that minimize the cost of electric service. State officials (including utility regulators) are keenly focused on protecting electricity customers and will focus on that objective as they design carbon-reduction plans.
- Second, under the proposed Clean Power Plan, states will have the flexibility, experience and tools to prepare and implement State Plans that fit their circumstances, minimize costs, and provide benefits to customers. Although states differ in many ways – including their electric systems, regulatory culture, and electric-industry structure – all states have programs, policies and practices that will allow them to develop plans that align well with their different circumstances.
- Third, market-based mechanisms offer unique opportunities to minimize costs while also reducing carbon pollution from existing power plants. States can implement such market-based programs within state boundaries or collaborate with other states to develop and implement workable multi-state programs. Multi-state, market-based mechanisms can also respect the practicalities of reliable electric system operations, and can be seamlessly integrated into both traditionally regulated and competitive electric-industry settings. Market-based mechanisms provide opportunities for states to capture the economic value of carbon-emission allowances, and direct those revenues for consumer and public benefit.
- Fourth, states are well equipped through long-standing utility-ratemaking principles, practices, and programs to help protect low-income customers.

Although states will have the responsibility to develop their own plans, EPA is allowing them (and encouraging them) to voluntarily develop plans that align with the boundaries of regional electric systems. Multi-state, mass-based and market-based approaches that cover both existing power

[17] The following list of points is excerpted from the following report: Paul Hibbard, Andrea Okie and Susan Tierney, "EPA's Clean Power Plan: States' Tools for Reducing Costs and Increasing Benefits to Consumers," July 14, 2014.

plants and new ones will allow for lower-cost compliance.[18] These will provide incentives to reduce CO_2 emissions efficiently, to simplify verification of the savings from energy efficiency programs, to provide appropriate investment incentives, and to retain low-carbon resources (e.g., existing nuclear units) in the mix.

Market-based Compliance Mechanisms Can Provide Lowest-Cost Pathways to Reducing CO_2 Emissions: Experience with market-based emissions-trading approaches indicates that overall environmental compliance costs of emissions-trading programs are lower than original estimates and lower than alternative command-and-control programs. Recent modeling of multi-state market-based approaches indicates the economic advantages of such an approach relative to single-state and/or non-market-based approaches from a cost-of-compliance point of view. Such modeling has been conducted by the Bipartisan Policy Center, for example, and by PJM with inputs from state regulators on the set of scenarios to analyze.[19]

The successful track record of market-based, regional emission-allowance trading programs – beginning with the 1990 Clean Air Act Amendment's Title IV cap-and-trade program for sulfur dioxide ("SO_2") emissions from power plants – has fundamentally shifted the way that emission-control programs can be designed and administered. Such an approach aligns well with competitive

[18] Susan Tierney and Paul Hibbard, "Carbon Control and Competitive Wholesale Electricity Markets: Compliance Paths for Efficient Market Outcomes," May 2015. http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/clean_power_plan_markets_may_2015_final.pdf.

[19] PJM recently conducted analyses of the changes in system-wide production costs assuming various designs of states' compliance plans. Quoting from the PJM report, the "high-level insights from the economic analysis include:

- Fossil steam unit retirements (coal, oil and gas) probably will occur gradually. As the CO_2 emission limits decline
- State-by-state compliance options, compared to regional compliance options, likely would result in higher compliance costs for most PJM states. This is because there are fewer low-cost options available within state boundaries than across the entire region. However, results will vary by state given differing state targets and generation mixes. PJM modeled regional versus individual state compliance only under a mass-based approach.
- State-by-state compliance options would increase the amount of capacity at risk for retirement because some states likely would face higher CO_2 prices in an individual compliance approach."

"PJM Interconnection Economic Analysis of the EPA Clean Power Plan Proposal: Executive Summary and Frequently Asked Questions" March 2, 2015, included as an attachment to the statement of Michael J. Kormos, Executive Vice President – Operations, PJM Interconnection, before the Federal Energy Regulatory Commission, Docket No. AD15-4-000, "Technical Conference on Environmental Regulations and Electric Reliability, Wholesale Electricity Markets, and Energy Infrastructure," March 11, 2015.

power markets and overcomes many of the complexities associated with other emission-control program designs. Such a program design establishes one value on the margin for a ton of emissions and similarly affects all generating units covered by the program (regardless of age, type, location, etc.). In this way, emission-control requirements are set so as to price emissions on a fair and equal basis across resources that are competing head to head in energy markets. This creates conditions for cost-effective compliance without interfering with energy-market dynamics. This approach relies on market forces rather than administrative decisions to provide signals to generating-unit owners about their lowest-cost path to compliance and allows for an efficient overall cost of compliance.[20]

EPA'S PROPOSED CLEAN POWER PLAN WILL NOT JEOPARDIZE RELIABILITY

Since the EPA proposed its Clean Power Plan last June, many observers have raised concerns that its implementation might jeopardize electric-system reliability. Such warnings are common whenever there is major change in the industry and play an important role in focusing the attention of the industry on taking the steps necessary to ensure reliable electric service to Americans.

A prime example of this is the recent experience with the EPA's MATS rule. Prior to EPA's finalization of the rule and its implementation by the industry, countless observers raised concerns that MATS would threaten the ability of the industry to maintain reliability. But it did not, when MATS went into effect on May 16, 2015. As I have written elsewhere recently,[21] "Why not? First, the EPA stood by its commitment (made in November 2011 by then-Assistant EPA Administrator Gina McCarthy in testimony to the Federal Energy Regulatory Commission, the agency with responsibility for electric system reliability) that 'In the 40-year history of the Clean Air Act, EPA

[20] For example, the Acid Rain Program "is largely considered a successful cap-and-trade system. By 2007, the program had achieved its 2010 reduction goal at an estimated cost that was considerably lower than that of *command-and-control* regulations, which mandate that each power plant adopt a specific technology to reduce SO2 emissions or a standard that requires each power plant to emit below a specific fraction of SO2 emissions per unit energy produced." Juha Siikamäki, Dallas Burtraw, Joseph Maher, and Clayton Munnings, "The U.S. Environmental Protection Agency's Acid Rain Program," November 2012. http://www.rff.org/RFF/Documents/RFF-Bck-AcidRainProgram.pdf.

[21] Susan Tierney, "Déjà vu: Pushback to U.S. Clean Power Plan Reminiscent of 2011 Mercury Rule," May 14, 2015. http://www.wri.org/blog/2015/05/déjà-vu-pushback-us-clean-power-plan-reminiscent-2011-mercury-rule.

rules have never caused the lights to go out, and the lights will not go out in the future as a result of EPA rules.' Part of the reason for that is that the EPA is nowhere near as rigid or antibusiness as many observers like to portray it. The final EPA rule gave powerplant owners the ability to request an additional year of time to comply, and allowed yet another year in unusual cases where continued operation of a plant would be needed for reliability. [Also] the electric industry is already transitioning to rely less on coal, even without the MATS rule. Between 2011 and the end of 2014, 21.5 gigawatts GW) of coal-fired power plants retired. The fact that these retirements occurred before the MATS deadline indicates that something other than EPA's regulations is driving the least-efficient and oldest coal plants into retirement….Third, the electric industry is dynamic. The market has responded to signals that additional electric resources are needed to replace old ones. Many projects have come forward: new power plants, upgraded transmission facilities, rooftop solar panels, energy-efficiency measures and energy-management systems. These varied responses are the norm, collectively maintaining reliability and modernizing the power system along the way. That's why there were no blackouts on April 16th, despite all the dire warnings."

Standard Industry Reliability Mechanisms Are a Strong Foundation for Assuring Reliability While Reducing CO_2 Emissions: Given the significant shifts already underway in the electric system, the industry would need to adjust its operational and planning practices to accommodate changes even if EPA had not proposed the Clean Power Plan. As always, grid operators and utilities are already looking at what adjustments to long-standing planning and operational practices may be needed to stay abreast of, understand, and adapt to such changes in the industry.

The standard reliability practices that the industry and its regulators have used for decades are a strong foundation from which any reliability concerns about the Clean Power Plan will be addressed.[22] Some of the reliability concerns raised by stakeholders about the Clean Power Plan presume inflexible implementation, are based on worst-case scenarios, and assume that policy

[22] These standard industry practices are described in detail in the report I have recently co-authored: Susan Tierney, Paul Hibbard and Craig Aubuchon, "Electric System Reliability and EPA's Clean Power Plan: Tools and Practices," February 2015.
http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/electric_system_reliability_and_epas_clean_power_plan_tools_and_practices.pdf.

makers, regulators, and market participants will stand on the sidelines until it is too late to act. There is no historical basis for these assumptions.

In the end, the industry, its regulators and the States are responsible for ensuring electric-system reliability while reducing carbon pollution from power plants as required by law. These responsibilities are compatible, and need not be in tension as long as all parties act in a timely way and use the many reliability tools at their disposal.

These issues will be solved by the dynamic interplay of actions by regulators, entities responsible for reliability, and market participants – with many solutions proceeding *in parallel*. Indeed, this dynamic interplay is one reason why a recent survey of over 400 utility executives nationwide found that more than 60 percent felt optimistic about the Clean Power Plan and either supported EPA's proposed current emissions reduction targets or would make them more stringent.

The Outlook for Reliable Compliance in the PJM Region: Further, in a report focusing on the "PJM Interconnection"[23] – the grid operator for the nation's largest competitive wholesale power market, which touches 13 states and the District of Columbia – we found that:

- PJM is already adapting to changes underway in the electric industry, and doing so successfully from a reliability point of view. As a region with electric capacity totaling approximately 200 gigawatts ("GW"), PJM has seen some 12.5 GW of mostly-aging, coal-fired resources retire during the 2010-2014 period, due largely to economic and regulatory factors. Another 7.6 GW is expected to be retired over the next 3-4 years. These plants are being replaced with new resources – primarily natural gas-fired and wind projects – and there is a deep bench of additional new proposed projects ready to step in to meet future needs. PJM has effectively administered processes to manage this transition in a way that meets both reliability and efficiency objectives.

[23] *Susan* Tierney, Paul Hibbard and Craig Aubuchon, "Electric System Reliability and EPA's Clean Power Plan: The Case of PJM," March 16, 2015.
http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/electric_system_reliability_and_epas_clean_power_plan_case_of_pjm.pdf.

- PJM's own analysis of compliance options demonstrates that regional, market-based approaches can meet Clean Power Plan goals across PJM states at lowest cost, with retirements likely spread out over a number of years. PJM's recent modeling, performed at the request of the Organization of PJM States, evaluates a wide array of potential compliance approaches and identifies capacity at risk of retirement. In addition to stressing the benefits of a flexible and collaborative approach, the results indicate that expansion of energy efficiency and renewable resources can reduce the quantity of existing coal-fired units at risk of retirement.

- PJM and the PJM states have extensive authorities and experience with administrative mechanisms to address and successfully resolve potential reliability violations associated with the retirement of power plants. These mechanisms include extending unit operations through "reliability must run" contracts, accelerated procurements of demand and supply resources, temporary waivers of regulatory requirements if or when reliability is an issue, and fast-tracking resource siting and permitting when needed to meet short-run reliability challenges.

- PJM has demonstrated success with reliability challenges in the past, including retirements related to low natural gas prices and MATS, and stresses on the fleet during the winter 2014 Polar Vortex. In fact, for PJM, the Polar Vortex is a case study of how numerous planning, operational, and market tools can be (and are) deployed to ensure reliability in response to unexpected events. Moreover, during the more recent harsh 2015 winter when new record-breaking peak loads occurred, PJM's "reliability tool kit" functioned nicely and possibly even improved over the past year.

- PJM is well positioned to lower carbon pollution from existing power plants while relying on the reliability tools and operating procedures it uses with great success.

The Outlook for Reliable Compliance in the MISO Region: In another report, we analyzed the readiness of the 15-state area in the middle of the U.S served by the Midcontinent Independent System operator ("MISO") to comply with the Clean Power Plan. MISO is already undergoing

significant changes toward retiring older assets, and has a history of state cooperation and an array of planning tools in place that will assist in the transition. Our review concludes that:[24]

- The parties responsible for electric system reliability in the MISO region are well positioned to address collaboratively and constructively the reliability issues that might arise from the electric industry's compliance with the Clean Power Plan.

- With or without the Clean Power Plan, the MISO region has to address relatively near-term resource-adequacy issues. As a region historically – and still – highly dependent on coal for power generation, the MISO states' electric systems have been undergoing significant changes in recent years. Until recently, it has had significant surplus capacity. It has seen (and will likely see more) retirements of coal-fired generating units, increased reliance on natural gas to produce power, integration of significant quantities of electricity generated by wind, and significant expansion of the transmission system.

- Like all RTOs, MISO starts with a strong tool kit for managing the "Essential Reliability Services" needed to assure high-quality electric service. Performing various resource-adequacy and system-security functions to ensure continuous operational security of the electric system is MISO's normal job, which it carries out in conjunction with the states, investor-owned utilities, cooperatives and municipal electric systems, other market participants, and other reliability organizations.

- Given the electric industry structure in the MISO region, there is a strong culture and practice of planning that involves the local utilities and their regulators/boards along with MISO. Each set of actors plays different roles in assuring electric-system reliability. MISO establishes recommended resource-adequacy targets for the states and the industry, while the utilities develop packages of resources consistent with state planning requirements.

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[24] *Susan* Tierney, Paul Hibbard and Craig Aubuchon, "Electric System Reliability and EPA's Clean Power Plan: The Case of PJM," March 16, 2015. http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_clean_power_plan_miso_reliability.pdf. See also: Jeffrey Tomich, "MISO survey eases near-term concerns about effect of coal plant retirements," E&E News, Thursday, June 18, 2015 . http://www.eenews.net/assets/2015/06/18/document_ew_01.pdf.

- MISO supports this process through various assessments, including the MISO Transmission Expansion Planning process and its unique approach – the "Multi-Value Projects" process – for identifying transmission projects that support reliability, economic-efficiency and policy goals of the states, and which provide broad benefits to the region. The region also has a long history in which states rely upon integrated-resource planning ("IRP") to provide electricity supply. These IRP processes are a key tool through which utilities assemble their supply portfolios. Many states in the region use IRP processes in conjunction with the MISO markets, competitive-power procurements, and energy-efficiency programs for consumers. This set of tools will help the states and the industry with Clean Power Plan compliance.

- The MISO region and the states also have a history of constructive collaboration that is serving them well as they attempt to overcome the complicated issues they face in integrating major quantities of distant renewable resources, and as the states prepare to comply with the Clean Power Plan. MISO's and others' analyses suggest that the more the states collaborate on a regional, market-based approach, the more this approach will enable the region to comply at a lower cost while also ensuring reliability.

- Finally, the flexibility that EPA has granted states in designing Clean Power Plan implementation plans leaves the door wide open for states to propose in their plans the specific mechanisms needed to ensure that Clean Power Plan compliance does not compromise system reliability.

Thank you for the opportunity to present this testimony to the Subcommittees.