U.S. ENERGY INFORMATION ADMINISTRATION REPORT: ANALYSIS OF THE IMPACTS OF THE EPA'S CLEAN POWER PLAN

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT &
SUBCOMMITTEE ON ENERGY

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

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WEDNESDAY, JUNE 24, 2015

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENVIRONMENT &
SUBCOMMITTEE ON ENERGY
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittees met, pursuant to call, at 10:05 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Jim Bridenstine [Chairman of the Subcommittee on Environment] presiding.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States

House of Representatives

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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Subcommittees on Environment and Energy

U.S. Energy Information Administration Report:
Analysis of the Impacts of the EPA's Clean Power Plan

Wednesday, June 24, 2015
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witnesses

Dr. Howard Gruenspecht, Deputy Administrator, U.S. Energy Information Administration

Mr. Stephen Eule, Vice President for Climate and Technology, U.S. Chamber of Commerce

Dr. Susan Tierney, Senior Advisor, Analysis Group, Inc.

Dr. Kevin Dayaratna, Senior Statistician and Research Programmer, The Heritage Foundation

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEES ON ENVIRONMENT AND ENERGY

HEARING CHARTER

U.S. Energy Information Administration Report: Analysis of the Impacts of EPA's Clean Power Plan

Wednesday, June 24, 2015
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

PURPOSE

The Environment and Energy Subcommittees will hold a joint hearing entitled *U.S. Energy Information Administration Report: Analysis of the Impacts of the EPA's Clean Power Plan* on Wednesday, June 24, 2015 in Room 2318 of the Rayburn House Office Building. The hearing will examine the U.S. Energy Information Administration's recent report *Analysis of the Impacts of the Clean Power Plan.*[1] This report was requested by Chairman Lamar Smith in August 2014.[2] Witnesses will provide testimony on analyses of impacts of the EPA's Clean Power Plan, including on the recent EIA analysis and other independent analyses that they have conducted regarding the cost and impact of the rule.

WITNESS LIST

- **Mr. Howard Gruenspecht**, Deputy Administrator, U.S. Energy Information Administration
- **Mr. Stephen Eule**, Vice President for Climate and Technology, U.S. Chamber of Commerce
- **Dr. Susan Tierney**, Senior Advisor, Analysis Group, Inc.
- **Dr. Kevin Dayaratna,** Senior Statistician and Research Programmer, The Heritage Foundation

BACKGROUND

On June 2, 2014, EPA proposed the Clean Power Plan with the intent of regulating carbon emissions from existing source electricity generating units.[3] Under Section 111(d) of the Clean Air Act, EPA proposes that states formulate implementation plans to limit carbon

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[1] U.S. EIA, Analysis of the Impacts of the Clean Power Plan, May 22, 2015, available at: http://www.eia.gov/analysis/requests/powerplants/cleanplan/.

[2] Letter from Hon. Lamar Smith, Chairman, H. Comm. on Science, Space, and Technology, to Hon. Adam Sieminski, Administrator, U.S. Energy Information Administration, Aug. 13, 2014, *available at* http://www.eia.gov/analysis/requests/powerplants/cleanplan/pdf/powerplant.pdf at p. 74.

[3] Clean Power Plan Proposed Rule, U.S. EPA, available at: http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule (last visited Feb. 17, 2015).

emissions.[4] The scope and manner in which the rule has been conceived by the agency has been met with considerable opposition from the states and industry groups.[5] It is anticipated that the EPA will issue its final rule for the Clean Power Plan this summer.

The Clean Power Plan would require states to meet requirements for carbon emissions from electricity generating units.[6] EPA proposes that states meet these requirements through four building blocks: improving the efficiency of coal steam electric generating units on an average of six percent, using combined cycle natural gas units up to a 70 percent capacity factor, constructing more zero and low-emitting power sources, and implementing energy efficiency measures to limit annual electricity demand by 1.5 percent annually.[7]

On August 13, 2014, Chairman Lamar Smith sent a letter requesting that the EIA "analyze the impacts of the [Clean Power Plan]" under various specifications for analysis.[8] Chairman Smith requested that EIA conduct this analysis due to the fact that EPA had not considered a number of broad economy-wide impacts of the regulation.[9] EIA agreed to conduct this analysis in accordance with the parameters requested by the Chairman.

On May 22, 2015, EIA released its report, *Analysis of the Impacts on the Clean Power Plan*. According to the report, EIA analyzed the impacts of the Clean Power Plan using the Annual Energy Outlook 2015 (AEO2015) as the reference case. Additionally, EIA analyzed the impact of the rule in the context of the AEO2015 High Economic Growth and High Oil and Gas Resource cases – each of which make certain assumptions on the growth of the economy and access to large amounts of domestic oil and gas resources.[10] EIA states that these cases were used "in order to examine indicators of the proposed rule's impacts on energy markets under varying assumptions regarding economic growth, electricity demand, and fuel prices."[11] The EIA's report uses the National Energy Modeling System or NEMS, the standard modeling system used by the agency to determine its long-term projections of the U.S. energy sector through the year 2040.[12]

EIA also provided analysis of the Clean Power Plan under the following additional scenarios: 1) extension of the Clean Power Plan regulation to reduce CO2 emissions from electricity generating units by 45% relative to 2005 levels by 2040; 2) treatment of future nuclear capacity similar to the treatment of renewable capacity; 3) sensitivities for expenditures and effectiveness of energy efficiency programs; 4) sensitivities for the cost and effectiveness of heat

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[4] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 34,830 (June 18, 2014).
[5] Michael Grunwald, *Inside the War on Coal*, Politico, May 2015, available at: http://www.politico.com/agenda/story/2015/05/inside-war-on-coal-000002.
[6] U.S. EPA, EPA Fact Sheet: Clean Power Plan National Framework for States, *available at* http://www2.epa.gov/sites/production/files/2014-05/documents/20140602fs-setting-goals.pdf.
[7] *Id.*
[8] Letter from Hon. Lamar Smith, Chairman, H. Comm. on Science, Space, and Technology, to Hon. Adam Sieminski, Administrator, U.S. Energy Information Administration, Aug. 13, 2014, *available at* http://www.eia.gov/analysis/requests/powerplants/cleanplan/pdf/powerplant.pdf at p. 74.
[9] *Id.*
[10] U.S. EIA, Analysis of the Impacts of the Clean Power Plan, May 22, 2015, *available at* http://www.eia.gov/analysis/requests/powerplants/cleanplan/ .
[11] *Id.*
[12] *Id.*

rate improvement measures; 5) no availability of markets for CO2 captured from electric power plants for enhanced oil recovery (EOR); 6) an alternative compliance phase-in trajectory during the 2020-2029 period; 7) alternative accounting rules for emissions from biomass generation; 8) national compliance cooperation; and 9) limited interregional trade.[13]

Within these parameters, EIA found numerous impacts of EPA's proposed Clean Power Plan. The agency reports that the Clean Power Plan would reduce CO2 emissions from the power sector between 29% and 36% relative to 2005 emissions levels by 2030.[14] The total amount of CO2 emissions reduction from the power sector would be between 1,553 and 1,727 million metric tons of carbon across all of the cases analyzed by EIA.[15] EIA further determined that the predominant strategy for complying with CO2 emissions reductions would be achieved by switching from coal-fired to natural gas-fired power generators.[16] Additionally, EIA found that renewable energy sources would not begin to play a role in CO2 reduction until approximately 2020.[17] Moreover, EIA found that if EPA were to treat nuclear power as a renewable energy source for purposes of compliance regulations with the Clean Power Plan, the rule would result in increased nuclear power generation.[18]

EIA also found that the Clean Power Plan would have a significant impact in retiring a large number of coal-fired power plants. Under current regulatory conditions, EIA projects that 40 gigawatts of coal-fired electricity generation will retire by 2040 as a result of additional EPA rules such as the Mercury Air Toxics Rule.[19] EIA found that an additional 50 gigawatts of coal-fired generation would be forced to retire for a total of 90 gigawatts. These coal-fired plants would mostly be retired by 2020 when the regulatory requirements of the rules begin to go into effect.[20] Additionally, EIA found that the Clean Power Plan would have an adverse impact on projected U.S. coal production. According to EIA projections, the agency found that coal production in 2020 and 2025 would be 20% and 32% lower, respectively, compared to baseline projections.[21] By 2040, EIA found that coal production would remain 20% lower than current projections.[22]

EIA's report also found that electricity prices would increase under the Clean Power Plan. The agency's analysis concludes that the regulations would raise electricity prices by approximately 3% to 7% annually above baseline increases that are already projected to occur by 2040.[23] The impact of increased electricity prices is not distributed evenly throughout the various regions of the United States. EIA found that in certain regions the increases in electricity prices would be even greater than the average projections. For example, the report states that Texas, Florida, Mississippi Delta, Tennessee Valley, Southwest, Southern Plains, and Eastern

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[14] U.S. EIA, Analysis of the Impacts of the Clean Power Plan, May 2015, *available at* http://www.eia.gov/analysis/requests/powerplants/cleanplan/pdf/powerplant.pdf
[15] *Id.*
[16] *Id.*
[17] *Id.*
[18] *Id.*
[19] *Id.*
[20] *Id.*
[21] *Id.*
[22] *Id.*
[23] *Id.*

Wisconsin regions would experience electricity price increases greater than 7% by 2020 as a result of the Clean Power Plan regulation.[24]

Additionally, EIA analysis found that the costs of the Clean Power Plan regulations would lead to a reduction of 0.17% to 0.25% in cumulative gross domestic product (GDP) projections over 2015-2040 ranges.[25]

Additional Reading:

The full EIA report, "Analysis of the Impacts of the Clean Power Plan" is available at http://www.eia.gov/analysis/requests/powerplants/cleanplan/pdf/powerplant.pdf.

[24] U.S. EIA, Analysis of the Impacts of the Clean Power Plan, May 2015, *available at* http://www.eia.gov/analysis/requests/powerplants/cleanplan/pdf/powerplant.pdf
[25] *Id.*

Chairman BRIDENSTINE. The Subcommittee on the Environment and the Subcommittee on Energy will come to order.

Without objection, the Chair is authorized to declare recesses of the Subcommittee at any time.

Welcome to today's hearing titled "U.S. Energy Information Administration Report: Analysis of the Impacts of the EPA'S Clean Power Plan." I recognize myself for five minutes for an opening statement.

Today's hearing focuses on the EPA's Clean Power Plan and the tremendous costs that it will place on the economy and the American people upon final implementation. I am particularly concerned about how this regulation will affect access to affordable and reliable electricity, and in fact, today the House will be voting on H.R. 2042, the Ratepayer Protection Act of 2015, which would prevent states from having to implement a state plan, or be subject to a federal plan, in order to comply with the Clean Power Plan if the Governor determines that such a plan would negatively affect ratepayers through increased rates. I am a cosponsor of this bill, and I anticipate its passage later today and encourage my colleagues to support the bill.

I would like to thank Chairman Lamar Smith for requesting that the Energy Information Administration conduct this very important study at the heart of today's hearing. I look forward to hearing from the EIA about what their analysis reveals about the impacts of the Clean Power Plan.

A few weeks ago, this Committee heard from industry groups on what will happen should the Clean Power Plan be finalized. We learned that the total compliance costs of the rule could be as high as $366 billion by 2030, according to a study by NERA Economic Consulting.

Additionally, the regulation is projected to cause steep electricity price increases in 43 states including my own State of Oklahoma. Moreover, the Committee also heard testimony that the EPA is using questionable legal authority to promulgate the Clean Power Plan under section 111 of the Clean Air Act. In fact, Laurence Tribe, a leading environmental and constitutional law professor and a mentor to President Obama, recently referred to the method by which this rule was enacted as "burning the Constitution."

I understand that some of our witnesses here today have analyzed the supposed benefits of the EPA claims—some of the benefits that EPA claims the rule provides and have actually found that the costs outweigh the benefits. Additionally, the EPA's analysis of the benefits of the Clean Power Plan rely heavily on the "social cost of carbon," a value determined by the government to be the cost of carbon in the atmosphere. The social cost of carbon, as we will hear today, is a value determined without transparency with a very questionable economic model. The fact that this Administration would rely so heavily upon the social cost of carbon for its rulemaking calls into question the entire purpose of these rules. So we have a rule that will be extremely costly, relies on dubious assumptions, and this Committee has also heard testimony at previous hearings that the results in reductions in carbon emissions and global temperature decreases which, according to the EPA's own models, will be negligible on a global scale. So according to the

EPA, the results of this will be negligible on a global scale, according to the EPA's own models. This is a continuation of this Administration's war on the poor.

I will once again remind my colleagues that while we might be able to absorb electricity rate increases, many of our constituents do not have that ability. This is especially true in my home State of Oklahoma, which relies heavily on coal for electricity generation and as a result enjoys electricity prices which are far below the national average. Coal, and to an extent even natural gas, are the sources of fuel this rule will phase out, and this is the true intention of this Administration's agenda. This rule will impose tremendous costs on the American people with very few benefits, and it is my hope this hearing highlights how misguided the Clean Power Plan truly is.

I thank all of our witnesses for testifying today and specifically thank the Energy Information Administration for conducting this important report. The Clean Power Plan and the impact that it will have on the American people is an important matter that this Committee should investigate. I look forward to the testimony of all of our witnesses as we examine the implications of this regulation.

[The prepared statement of Chairman Bridenstine follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENVIRONMENT
CHAIRMAN JIM BRIDENSTINE

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Chairman BRIDENSTINE. I now recognize the Ranking Member, the gentlewoman from Oregon, for an opening statement.

Ms. BONAMICI. Thank you very much, Mr. Chairman, and thank you to our witnesses for being here today to discuss the EPA's Clean Power Plan and the Energy Information Administration's analysis of the proposed rule.

Just at the outset, I want to explain I have another hearing today. It does not indicate my lack of interest in this very important subject but I'll be coming and going.

So the mission of EPA is simple: to protect human health and the environment. The goal of the Clean Power Plan is equally simple: to cut carbon emissions from the largest source, the energy sector, so that we can lessen the effects of climate change on our states, our country, and on our planet.

The need to reduce greenhouse gas emissions is broadly accepted, and the consequences of inaction recognized, including in public comments on the proposed rule submitted by 14 states, including my home State of Oregon. In those comments, the states highlight the negative effects they are experiencing from the changing climate. They outline the harm of increased wildfires, severe drought, heatwaves, rising seas, and more severe weather events. They state that these impacts are directly harming the health and welfare of residents in our states and causing significant economic damage. These 14 states are supportive of EPA's Clean Power Plan, indicating that the proposed rule represents the most significant component of our national effort to reduce carbon emissions throughout our economy. And the good news is that they have not been waiting for the federal government to take action. In 2007, in fact, when I was in the Oregon legislature, the Oregon legislature set an ambitious goal of reducing statewide emissions 75 percent below 1990 levels by 2050. A companion bill set the goal of having up to 25 percent of energy generated through renewable sources by 2025. I'm proud to say that in 2010, Oregon achieved its first milestone. It stopped the growth of greenhouse gas emissions and began cutting carbon pollution.

Some contend that environmental regulations might hurt the economy, and we heard that in the opening statement. This hasn't been the case in Oregon. Through the implementation of energy efficiency and renewable energy policies, Oregon has produced more than 2,000 full-time jobs, added more than $2 billion to the state's economy, and customers have saved on their energy bills.

Fortunately, Oregon does not stand alone in its success of cutting carbon pollution and strengthening its economy, and I'm looking forward to learning more from Dr. Tierney about her examination of the states involved in RGGI, the Regional Greenhouse Gas Initiative.

Turning back to the focus of today's hearing, EIA's analysis of the Clean Power Plan, we find additional support for the idea that we can achieve meaningful carbon reductions with a minimal effect on the economy. EIA's analysis shows that under the Clean Power Plan, carbon pollution will be reduced by 34 percent by 2030 and we will reach the same level of GDP just 15 days later than we would if the proposed rule was not implemented. Furthermore, the EIA's analysis does not take into account the health benefits associated with the proposed rule. If those values, the EPA estimates at between $49 and $84 billion in 2030, were factored in, we'd likely see increased expansion of the economy.

EIA's analysis also highlights the important role that renewable energy technologies will play in cutting carbon emissions. Again, contrary to the opinion that regulations harm the economy, new and innovative technologies are born from regulatory incentives, and are a key component of achieving reductions in carbon emissions.

The Clean Power Plan provides flexibility to states. I'm looking forward to learning more about how states can meet their obligations under the proposed rule. Additionally, I'd like to get a better understanding of the assumptions EIA used in its modeling and what additional information their model can and cannot tell us about the potential to reduce carbon emissions under the EPA's Clean Power Plan.

Finally, I'd like to end by reiterating that past attempts to undermine environmental regulation with inaccurate and exaggerated claims have been proven wrong time and time again. We were told the lights would go out and that the economy would crash. We'll likely hear those arguments again today, but since the passage of the Clean Air Act in the 1970s, the United States' economy has tripled in size.

The Clean Power Plan represents a critical first step in our efforts to reduce harmful pollution and combat the harm we're seeing because of climate change. American ingenuity will allow us to be global leaders in these efforts and in the creation of the clean energy economy. We can and must do better for current and future generations.

Thank you, Mr. Chairman, and again thank you to our witnesses for being here this morning, and I yield back the balance of my time.

[The prepared statement of Ms. Bonamici follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON OVERSIGHT
MINORITY RANKING MEMBER SUZANNE BONAMICI

Thank you, Mr. Chairman, and thank you to our witnesses for being here today to discuss the EPA's Clean Power Plan and the Energy Information Administration's analysis of the proposed rule.

The mission of EPA is simple—to protect human health and the environment. The goal of the Clean Power Plan is equally simple—to cut carbon emissions from the

largest source, the energy sector, so that we can lesson the effects of climate change on our states, our country, and our planet.

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Thank you, Mr. Chairman, and again thank you to our witnesses for being here this morning.

I yield back the balance of my time.

Chairman BRIDENSTINE. I thank Ms. Bonamici for her opening statement.

With unanimous consent, I'd like to submit for the record the report, the Energy Information Administration report titled "Analysis of the Impacts of the Clean Power Plan." Without objection, so ordered.

[The information appears in Appendix II]

Chairman BRIDENSTINE. I'd now like to turn it over to the Ranking—or I'm sorry, the Chairman of the Subcommittee on Energy, Mr. Weber from Texas.

Mr. WEBER. Thank you. Good morning, and welcome to today's joint Subcommittee hearing examining the EPA's regulation for existing power plants, known as the Clean Power Plan.

Today, we will hear from the Energy Information Administration regarding their recent analysis of the EPA's plan, as well as a panel of expert analysts with experience assessing EPA regulations. So to our expert analysts, I want to say thank you for being here.

The Energy Information Administration, or EIA, is housed at the Department of Energy, and provides economic analysis on energy use around the world. EIA was designed to serve as a nonpartisan analytical organization so policymakers could make sound decisions based on reliable economic data.

Accordingly, after the Obama Administration's Clean Power Plan was released, Chairman Lamar Smith requested that the EIA conduct economic modeling to determine the impact the rule would have on the American economy if it was fully implemented. The EIA's analysis shows that the EPA's rule could cause significant damage to the economy, increasing electricity prices, causing job losses, and limiting economic growth long into the future. And might I add, at a time when the President is pushing for TPP in an effort to get on top of the world economy, this seems to be antithetical that we are actually going to hurt our own economy. By increasing the cost of electricity, the Clean Power Plan would make it harder for the American people to start a business or make ends meet. A family of four could see thousands of dollars in increased costs per year as the Clean Power Plan is implemented, with costs peaking in 2025 when the average family will see an increase in cost of over $1,700 per year. Now, folks, where is that money going to come from? It is a little less than 150 bucks a month. They're not going to spend it in other sectors of the economy.

You know, the Obama Administration admits that these regulations will not stop climate change. Data produced by the EPA show that the Clean Power Plan would eliminate less than one percent of global carbon emissions. Let me repeat that: Data produced by the EPA show that the Clean Power Plan would eliminate less than one percent of global carbon emissions. But what the EIA's report and many other independent assessments of the Clean Power Plan confirm is that eliminating affordable, reliable power will increase the energy prices for who? The American people. Higher energy prices will increase costs across the Nation from electricity to gasoline to food. To echo my colleague's comments earlier, the other Chairman of the Environmental Committee, that's going to hurt the poor. Higher costs will drive companies out of business, kill good jobs, and leave even more Americans unemployed.

The Obama Administration claims these regulations will lead to new, innovative energy technologies but innovation simply will not occur in an overregulated, lagging economy. And might I add that where the permits lag, the economy even lags worse. Driving the

American economy over a cliff is not going to kick-start energy innovation. It's just not going to do it.

I want to thank Dr. Gruenspecht and all of our witnesses for testifying to the Committee today, and I look forward to a review of the impact of EPA's proposal. From our witnesses' prepared testimony alone, it's clear that the EPA's Clean Power Plan will have a significant impact on the American economy, and not in a good way. We simply cannot afford to hijack economic growth by regulating affordable energy out of business. Instead, the federal government should focus on investing in research and development, and breaking down the regulatory barriers that stop the development of innovative technology in its tracks. Getting the federal government out of the way will make more affordable, reliable power available to America's job creators and thereby grow our economy.

Mr. Chairman, I yield back.

[The prepared statement of Mr. Weber follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENERGY
CHAIRMAN RANDY K. WEBER

Good morning and welcome to today's Joint Subcommittee hearing examining the EPA's regulation for existing power plants, known as the Clean Power Plan. Today, we will hear from the Energy Information Administration regarding their recent analysis of the EPA's plan, as well as a panel of expert analysts with experience assessing EPA regulations.

The Energy Information Administration, or EIA, is housed at the Department of Energy, and provides economic analysis on energy use around the world. EIA was designed to serve a non-partisan analytical organization, so policy makers could make sound decisions based on reliable economic data.

Accordingly, after the Obama Administration's Clean Power Plan was released, Chairman Smith requested that the EIA conduct economic modeling to determine the impact the rule would have on the American economy if it was fully implemented.

The EIA's analysis shows that the EPA's rule could cause significant damage to the economy, increasing electricity prices, causing job losses, and limiting economic growth long into the future. By increasing the cost of electricity, the Clean Power Plan would make it harder for the American people to start a business or make ends meet.

A family of four could see thousands of dollars in increased costs per year as the Clean Power Plan is implemented, with costs peaking in 2025 when the average family will see an increase in cost of over $1700 per year.

The Obama Administration admits that these regulations will not stop climate change. Data produced by the EPA show that the Clean Power Plan would eliminate less than one percent of global carbon emissions.

But what the EIA's report and many other independent assessments of the Clean Power Plan confirm is that eliminating affordable, reliable power will increase the energy prices for the American people. Higher energy prices will increase costs across the nation —from electricity to gasoline to food. Higher costs will drive companies out of business, kill good jobs, and leave even more Americans unemployed. The Obama Administration claims these regulations will lead to new, innovative, energy technologies. But innovation simply does not occur in an overregulated, lagging economy.

Driving the American economy over a cliff is not going to kick start innovation in energy technology. I want to thank Mr. Gruenspecht and all our witnesses for testifying to the Committee today, and I look forward to a review of the impact of EPA's proposal.

From our witnesses prepared testimony alone, it's clear that the EPA's Clean Power Plan will have a significant impact on the American economy.

We can't afford to high-jack economic growth by regulating affordable energy out of business. Instead, the federal government should focus on investing in research and development, and breaking down the regulatory barriers that stop the development of innovative technology in its tracks.

Getting the federal government out of the way will make more affordable, reliable power available to America's job creators and grow our economy.

Chairman BRIDENSTINE. Well, I'd like to thank the Chairman of the Subcommittee on Energy for his words at this joint hearing of our two Committees.

I'd like to now recognize the Ranking Member of the Subcommittee on Energy, Mr. Grayson, for his opening statement.

Mr. GRAYSON. Thank you, Chairman Bridenstine and Chairman Weber, for holding this joint hearing, and thank you to our witnesses for agreeing to participate this morning.

Today, we will be discussing the Energy Information Administration's recent analysis of the Environmental Protection Agency's Clean Power Plan. We've been hearing already before the witnesses start to testify about economics, the economy, the American economy, what effect this will have on jobs and so on. Let's talk about some basic economic principles.

These power plants that we have now are generating our power that are not renewable are creating pollution. Pollution is an externality. It's basically like dumping your trash in your neighbor's backyard. That's what these plants are doing right now.

Now, they could be dumping their trash in their own backyard. That's often what the Clean Power Plan will require them to do through carbon sequestration and so on. But right now they're dumping their trash in the neighbor's backyard. Why? Because they don't want the trash in their backyard, and it would cost money to them to make any other arrangement except to dump it in the neighbor's backyard.

What is the effect of that? Enormous. Carbon pollution causes tremendous difficulties, not only the traditional well-known difficulty called global warming, climate disruption, and so on, but also impacts on our health and impacts on our immediate environment, the neighborhoods. We see heatwaves, we see droughts, we see smog, we see extreme hurricanes and flooding more and more. We have more ticks and mosquitoes in our neighborhoods spreading Lyme disease and West Nile virus. Already, 126 million Americans live in areas where pollution is so bad that it doesn't meet the government standards established 43 years ago. Forty-three years ago.

So I don't think we need to be asking ourselves what can we do to make it possible for industry to dump more trash over the fence into the neighbor's yard. I think we should be asking ourselves what do we need to do to internalize those externalities? What do we need to do to make sure that industries that pollute, that damage the environment are forced to clean themselves up, and there's no study that I can picture that will tell me otherwise because we're talking about basic logic and basic principles here.

Now, fundamentally, the Clean Power Plan seeks to protect the health and safety of our citizens while fostering the growth of new and emerging sectors of our economy. The Clean Power Plan incentivizes the development and deployment of innovative new energy technologies, and seeks to reduce respiratory illnesses and the onset of disease resulting from air pollution. According to Bloomberg New Energy Finance's recent Global Trends report, an estimated 103 gigawatts of renewable power capacity, including

large hydropower projects, were built in 2014 alone. Furthermore, renewables were 48 percent of the net power capacity added worldwide in 2014 alone. In total, the world invested $270 billion in renewable technologies. And if we're speaking about the economy and jobs, this is an economic opportunity that America should seek to capture, not shun.

Clearly, the world is pursuing clean energy technologies with us or without us. Any effort to undermine those investments, including by stopping the Clean Power Plan from moving forward, is incredibly short-sighted and short-changes our workers and our health. America needs new energy solutions, and it should position itself as an industry leader in pursuit of these technologies. We know that the electricity and power system is changing even as we speak. America faces a future with low, or even negative, growth in electricity demand, resulting in a negative impact on utilities that count profit by the volume of electricity sold. But that simply means that Americans don't need as much. That's what that means. It doesn't mean that jobs are being lost that cannot be recovered.

More people are generating their own electricity, their own energy on their own rooftops, and the entire system is shifting from central power generation to different combinations of centralized and distributed power generation. Predictive models, such as the Energy Information Administration's, provide an important tool for us to explore the possible impacts of different scenarios and what our energy future will look like under each. These models don't define the future, but they do help us to identify actions we can take that will have meaningful impacts. These insights can be used to focus efforts to address the energy industry challenges that are happening with or without the Clean Power Plan.

I thank each of these witnesses for being here today, and please keep in mind that we're talking about pollution. I hesitate to think that any of my colleagues would come out and say they're pro-pollution, but that's essentially what it means when you say that you're against clean power.

I yield back.

[The prepared statement of Mr. Grayson follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENERGY
MINORITY RANKING MEMBER ALAN GRAYSON

Thank you, Chairman Bridenstine and Chairman Weber, for holding this joint hearing, and thank you to our witnesses for agreeing to participate this morning.

Today, we will be discussing the Energy Information Administration's recent analysis of the Environmental Protection Agency's Clean Power Plan.

Fundamentally, the Clean Power Plan seeks to protect the health and safety of our citizens while fostering the growth of new and emerging sectors of our economy.

The Clean Power Plan incentivizes the development and deployment of innovative new clean energy technologies, and seeks to reduce respiratory illnesses and the onset of diseases resulting from air pollution.

According to Bloomberg New Energy Finance's recent Global Trends report, an estimated 103 gigawatts of renewable power capacity, excluding large hydropower projects, were built in 2014.

Further, renewables were 48 percent of the net power capacity added worldwide in 2014. In total, the world invested 270 billion dollars in renewable technologies. This is a financial market America should seek to capture.

Clearly, the world is pursuing clean energy technologies. Any effort to undermine those investments, including by stopping the Clean Power Plan from moving forward is short-sighted.

America needs new energy solutions, and it should position itself as an industry leader in the pursuit of these technologies.

We know our electricity system is experiencing a transformative moment. America faces a future with low, or even negative, growth in electricity demand, resulting in a negative impact on utilities that count profits by the volume of electricity sold. More people are generating their own energy, and the entire system is shifting from central power generation to different combinations of centralized and distributed power generation.

Predictive models, such as the Energy Information Administration's, provide an important tool for us to explore the possible impacts of different scenarios and what our energy future will look like under each. These models don't define the future, but they do help us identify actions we can take that will have meaningful impacts. These insights can be used to focus efforts to address the energy industry changes that are happening with, or without, the Clean Power Plan.

I thank each of our witnesses for being here today, and I look forward to hearing more about how EIA's analysis will impact the discussion surrounding America's energy future.

Thank you, Mr. Chairman, I yield back my remaining time.

Chairman BRIDENSTINE. Thank you, Mr. Grayson.

I now recognize the Chairman of the full Committee, Mr. Smith.

Chairman SMITH. Thank you, Mr. Chairman, and also I thank the other Chairmen who are here as well, Mr. Bridenstine and Mr. Weber.

The Environmental Protection Agency is seeking to pursue the most aggressive regulatory agenda in its 44-year history. One of the many regulations the agency looks to promote is the so-called Clean Power Plan. The President's power plan is nothing more than a power grab to give the government more control over Americans' daily lives. These regulations stifle economic growth, destroy American jobs, and increase energy prices. That means everything will cost more, from electricity to gasoline to food.

Today we will hear from witnesses who have analyzed the costs and benefits of the EPA's Clean Power Plan. Their analysis clearly demonstrates that the costs far outweigh any minor environmental benefits. The EPA claims their regulations will slow global climate change and reduce carbon emissions. But heavy-handed regulations and arbitrary emission targets will do lasting damage to our economy, all for little environmental benefit. In fact, EPA's data show that the Clean Power Plan regulation would eliminate less than one percent of global carbon emissions and it would reduce sea-level rise by only 1/100th of an inch, the thickness of three sheets of paper. Even if all of the carbon emissions in the United States were reduced to zero, world temperatures would decrease by only .2 degrees Celsius, and the temperature increases avoided as a result of the Clean Power Plan would be only .003 degrees Celsius, only three thousandths of a degree.

These measures will impose tremendous costs on every American. The Clean Power Plan will have an even greater impact on those who live on fixed incomes, such as the elderly and the poor, who are the most vulnerable to price increases for some of our most basic necessities like food and electricity.

I thank the Energy Information Administration for conducting its analysis of the impacts of the Clean Power Plan, and for testifying before the Committee today. This important study shows what many have said since the regulation was proposed: that regulating

carbon emissions in the manner put forward by the Administration will raise the cost of electricity and negatively impact our Nation's economy.

Today, the whole House will consider H.R. 2042, the Ratepayer Protection Act. This bill allows states to decide whether the so-called Clean Power Plan is in the best interest of the state, given the tremendous costs it will impose on American families.

Our panel this morning includes experts who have conducted extensive analysis of the costs and benefits of EPA's regulations. I look forward to all our witnesses' testimony on how the Clean Power Plan will affect the American people.

The EPA should not saddle the American people with extensive and burdensome regulations, especially if the regulations have little environmental impact.

Mr. Chairman, also let me apologize to the witnesses. I'm a member of the Judiciary Committee, and our markup of a bill that I cosponsored began 30 minutes ago, so I'm going to need to excuse myself to head over there, but I hope to be back, and certainly this will be a very informative and necessary hearing to have. I yield back.

[The prepared statement of Chairman Smith follows:]

PREPARED STATEMENT OF COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
CHAIRMAN LAMAR S. SMITH

Thank you Chairman Weber and Chairman Bridenstine for holding today's hearing.

The Environmental Protection Agency is seeking to pursue the most aggressive regulatory agenda in its 44 year history. One of the many regulations the agency looks to promote is the so-called Clean Power Plan.

The president's "Power Plan" is nothing more than a "Power Grab" to give the government more control over Americans' daily lives. These regulations stifle economic growth, destroy American jobs, and increase energy prices. That means everything will cost more—from electricity to gasoline to food.

Today we will hear from witnesses who have analyzed the costs and benefits of EPA's Clean Power Plan. Their analysis clearly demonstrates that the costs far outweigh any minor environmental benefits.

The EPA claims their regulations will slow global climate change and reduce carbon emissions. But heavy-handed regulations and arbitrary emission targets will do lasting damage to our economy, all for little environmental benefit.

In fact, EPA's data show that the Clean Power Plan regulation would eliminate less than one percent of global carbon emissions. And it would reduce sea level rise by only 1/100th of an inch, the thickness of three sheets of paper.

Even if all of the carbon emissions in the United States were reduced to zero, world temperatures would decrease by only 0.2 degrees Celsius. Also, according to an analysis conducted by NERA Economic Consulting, the temperature increases avoided as a result of the Clean Power Plan would be only 0.003 degrees Celsius: three one-thousandths of one degree.

These measures will impose tremendous costs on every American. The Clean Power Plan will have an even greater impact on those who live on fixed incomes, such as the elderly and the poor, who are the most vulnerable to price increases for some of our most basic necessities like food and electricity.

I thank the Energy Information Administration for conducting its analysis of the impacts of the Clean Power Plan, and for testifying before the Committee today. This important study shows what many have said since the regulation was proposed: that regulating carbon emissions in the manner put forward by the Administration will raise the cost of electricity and negatively impact our nation's economy.

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Our panel this morning includes experts who have conducted extensive analysis of the costs and benefits of EPA's regulations. I look forward to all our witnesses' testimony on how the Clean Power Plan will affect the American people.

The EPA should not saddle the American people with extensive and burdensome regulations, especially if the regulations have little environmental impact.

Chairman BRIDENSTINE. Thank you, Mr. Chairman.

I now recognized the Ranking Member of the full Committee for a statement, Ms. Johnson.

Ms. JOHNSON. Thank you very much, Mr. Chairman, and thanks to all of our witnesses for being here this morning.

EPA's Clean Power Plan, like the rest of President Obama's Climate Action Plan, is the bold step forward our Nation needs to address the impacts of climate change. Severe drought, record temperatures, and an increase in heavy rain events are just a few examples of what Americans are confronting now and can expect to see more frequently in the coming years. The scientific evidence confirms that we need to act now to lessen these impacts.

Leaders in the faith community—and I recently met with all the heads of the conventions of the African American Baptist, Methodist and Evangelical sectors of the religious community—that are crying out for attention to address climate change and they are starting a national movement. The recently issued encyclical by Pope Francis notes that climate change represents one of the principal challenges facing humanity and that the poor will be disproportionately affected by its impacts. We know now, and it has been said this morning, that the poor and elderly will be greatly impacted except that the cost that was mentioned, I'm talking about the healthcare that they will suffer these effects. Pope Francis also states that there is an urgent need to develop policies so that in the next few years, the emission of carbon dioxide and other highly polluting gases can be drastically reduced.

I hope that we, in Congress, will stop obstructing EPA's efforts—they're only functioning to protect the American people's health—and instead listen to our scientists, to our religious leaders, and to the American people by supporting policies that will cut carbon pollution. To that end, power plants are the largest source of carbon pollution, and cutting emissions from this sector will be the key to any solution. That is why I support the Clean Power Plan.

It sets reasonable limits that take into account the characteristics of each state. It is based on strategies already in use such as improving energy efficiency and encouraging the deployment of renewables. And finally, it provides the states with flexibility. EPA is not prescribing a specific set of measures. States will choose what goes into their plans, and they can work alone or as part of a multistate effort to achieve meaningful reductions.

Today we will be discussing the Energy Information Administration's analysis of the Clean Power Plan, and I suspect that some Members and witnesses will be making the same old argument that EPA regulations are killing the economy and jobs. On the contrary. We know that this just isn't true. It isn't what EIA's analysis shows. Rather, as history has shown us time and again, stricter pollution limits have invariably led to innovation and to the creation of new technologies that end up creating jobs while protecting our environment. I am confident American industry will continue

this record of innovation and job creation as new environmental standards like the Clean Power Plan are adopted.

The bottom line is that the costs and risks of inaction are too high for us to continue to drag our feet or put our heads in the sand. I'm looking forward to today's discussion and hearing more about how we achieve the carbon targets in the Clean Power Plan.

I thank you, and I yield back.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
RANKING MEMBER EDDIE BERNICE JOHNSON

Thank you, Mr. Chairman, and thank you to our witnesses for being here this morning.

EPA's Clean Power Plan, like the rest of President Obama's Climate Action Plan, is the bold step forward our nation needs to address the impacts of climate change. Severe drought, record temperatures, and an increase in heavy rain events are just a few examples of what Americans are confronting now and can expect to see more frequently in the coming years.

The scientific evidence confirms that we need to act now to lessen these impacts. Leaders in the faith community have also been calling on us to address climate change. The recently issued encyclical by Pope Francis notes that climate change "represents one of the principal challenges facing humanity" and that the poor will be disproportionately affected by its impacts. Pope Francis also states that "there is an urgent need to develop policies so that, in the next few years, the emission of carbon dioxide and other highly polluting gases can be drastically reduced."

I hope that we, in Congress, will stop obstructing EPA's efforts and instead listen to our scientists, to our religious leaders, and the American people by supporting policies that will cut carbon pollution.

To that end, power plants are the largest source of carbon pollution, and cutting emissions from this sector will be the key to any solution. That is why I support the Clean Power Plan.

It sets reasonable limits that take into account the characteristics of each state. It is based on strategies already in use such as improving energy efficiency and encouraging the deployment of renewables. And finally, it provides the states with flexibility. EPA is not prescribing a specific set of measures. States will choose what goes into their plans, and they can work alone or as part of a multi-state effort to achieve meaningful reductions.

Today we will be discussing the Energy Information Administration's analysis of the Clean Power Plan, and I suspect that some Members and witnesses will be making the same old argument that EPA regulations are killing the economy and jobs.

We know that this just isn't true, and it isn't what EIA's analysis shows. Rather, as history has shown us time and again, stricter pollution limits have invariably led to innovation and the creation of new technologies that end up creating jobs while protecting our environment. I am confident American industry will continue this record of innovation and job creation as new environmental standards like the Clean Power Plan are adopted.

The bottom line is that the costs and risks of inaction are too high for us to continue to drag our feet or put our heads in the sand. I'm looking forward to today's discussion and hearing more about how we achieve the carbon targets in the Clean Power Plan.

Thank you and I yield back the balance of my time.

Chairman BRIDENSTINE. Thank you, Ms. Johnson.

Now I'll introduce our witnesses, and then after introducing all of you, we'll just go to your testimonies.

Our first witness today is Dr. Howard Gruenspecht, Deputy Administrator of the U.S. Energy Information Administration. Before joining EIA, Dr. Gruenspecht served as Director of Economic Electricity and Natural Gas Analysis in the Department of Energy's Office of Policy. Dr. Gruenspecht received his bachelor's degree from McGill University and his Ph.D. in economics from Yale University.

Our second witness is Mr. Stephen Eule, Vice President for Climate and Technology at the U.S. Chamber of Commerce's Institute for 21st Century Energy. Prior to joining the Chamber, Mr. Eule was the Director of the Office of Climate Change Policy and Technology at the Department of Energy. In addition, he has served as a Subcommittee Staff Director here at the Science Committee. Welcome back. Dr. Eule received his bachelor's degree in biology from Southern Connecticut State College and his master's degree in geography from George Washington University.

Our third witness today is Dr. Susan Tierney, Senior Advisor for Analysis Group, Inc. Under the Clinton Administration, Dr. Tierney served as the Assistant Secretary for Policy at the DOE. Dr. Tierney received her bachelor's degree in art history from Scripps College and her master's degree and Ph.D. in regional planning and public policy from Cornell University.

Our final witness is Dr. Kevin Dayaratna, Senior Statistician and Research Programmer for The Heritage Foundation's Center for Data Analysis. At CDA, Dr. Dayaratna instituted the Heritage Energy Model to quantify and help policymakers understand the long-term economic effects of energy policy proposals. Dr. Dayaratna received his bachelor's degree in applied mathematics from the University of California at Berkeley and his master's degree in business and his master's degree and Ph.D. in mathematical statistics from the University of Maryland.

In order to allow time for discussion, please, I would ask that you limit your testimony to five minutes, and your entire written statement will be made a part of the record.

I now recognize Dr. Gruenspecht for five minutes to present his testimony.

TESTIMONY OF DR. HOWARD GRUENSPECHT,
DEPUTY ADMINISTRATOR,
U.S. ENERGY INFORMATION ADMINISTRATION (EIA)

Dr. GRUENSPECHT. Chairmen Bridenstine and Weber, Ranking Members Bonamici and Grayson, full Committee Ranking Member Johnson, Members of the Subcommittees, I appreciate the opportunity to appear before you today to provide testimony on the Energy Information Administration's analysis requested by Chairman Smith of the proposed Clean Power Plan rule issued by the Environmental Protection Agency in June of 2014.

By law, EIA'S data, analyses and forecasts are independent of approval by any other federal officer or employee. Therefore, our views should not be construed as representing those of the Department of Energy or other federal agencies.

So EIA's analysis considers the proposed Clean Power Plan rule starting from several baseline cases with varying assumptions regarding economic growth, electricity demand, and fuel prices. It also includes several policy sensitivity cases. Consistent with EIA's statutory mission and expertise, our report focuses on implications for the energy system and the economy and does not consider any potential health or environmental benefits. It is not a cost-benefit analysis. EIA also recognizes that there's considerable uncertainty and many challenges involved in projecting the impacts of the pro-

posed Clean Power Plan. So the final rule may differ from the proposed rule in material ways.

The proposed rule applies to individual states. However, the electricity system doesn't respect state boundaries. EIA's modeling generally uses 22 regions in our framework as compliance regions for the analysis. Actual compliance mechanisms will be defied by state compliance proposals and may have different characteristics than what we've done.

The long-term projections system used for this analysis does not contain a power flow model or assess the reliability of bulk power transmission systems in detail. And lastly, because of the shift away from coal towards intermittent renewables and natural gas generation in our analysis, natural gas-fired capacity will increase in importance for providing grid reliability. The analysis does not consider how deliverability of natural gas to power plants might be impacted by extreme cold conditions in regions where natural gas is used for heating during the winter months.

So let me now turn briefly to some key results. So the proposed Clean Power Plan would reduce projected power sector carbon dioxide emissions. Reductions range from 484 to 625 million metric tons relative to baseline. That's a reduction of about between 29 and 36 percent relative to the 2005 emission level of the power sector.

Switching from coal-fired generation to natural gas-fired generation is the predominant compliance strategy as implementation begins but renewables play a growing role in the mid-2020s and beyond. That's shown in figures 1 and 2 of the testimony.

The Clean Power Plan has a significant effect on projected retirements and additions of electric generation capacity, shown in figures 3 and 4. Projected coal plant retirements over the 2014–40 period, which were 40 gigawatts in the reference case, and that's mostly before 2017, increase to 90 gigawatts, nearly all by 2020 in the base policy case.

Turning to additions, projected renewable capacity additions increase in all cases with the proposed rule. Under favorable natural gas supply conditions, the proposed rule also increases additions of natural gas capacity. Nuclear capacity is also added in the sensitivity case where new nuclear receives the same treatment as new renewables in compliance calculations. So coal production is significantly reduced by Clean Power Plan implementation as shown in figure 5.

Retail electricity prices and expenditures rise under the Clean Power Plan, as shown in figure 8. The price increases mostly occur in the early 2020s with national average prices averaging three to seven percent higher from 2020 to 2025 in the Clean Power Plan cases versus respective baseline cases.

Electricity bills, which reflect both the electricity price and the amount of electricity purchased, also rise with Clean Power Plan implementation but those increases are smaller in percentage terms than the price changes as a combination of energy efficiency programs pursued for compliance purposes and higher electricity prices tend to reduce electricity use. Economic activity indictors including gross domestic product, industrial shipments and consumption are reduced relative to baseline under the Clean Power Plan.

Across the cases that start from the reference case, the reduction in cumulative GDP—that's over all the years, 25 years—ranges from .17 percent to .25 percent with the higher end reflecting a tighter policy beyond 2030.

So let me conclude, while EIA does not take policy positions, its data analysis and projections are meant to assist policymakers in their deliberations.

Mr. Chairman and distinguished Members of the Subcommittees, this concludes my testimony, and I'd be happy to answer any questions you might have.

[The prepared statement of Dr. Gruenspecht follows:]

STATEMENT OF HOWARD GRUENSPECHT

DEPUTY ADMINISTRATOR

ENERGY INFORMATION ADMINISTRATION

U.S. DEPARTMENT OF ENERGY

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT

AND

SUBCOMMITTEE ON ENERGY

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

JUNE 24, 2015

Chairmen Bridenstine and Weber, and Ranking Members Bonamici and Grayson, and Members of the Subcommittees, I appreciate the opportunity to appear before you today to provide testimony on the Energy Information Administration's (EIA) analysis of the proposed Clean Power Plan rule for existing fossil-fueled electric generating units issued by the Environmental Protection Agency in June 2014. This analysis was undertaken in response to a request by Chairman Smith.

EIA is the statistical and analytical agency within the U.S. Department of Energy. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. By law, EIA's data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The views expressed in our reports, therefore, should not be construed as representing those of the Department of Energy or other federal agencies.

ANALYSIS OVERVIEW AND FOCUS

The starting point for EIA's analysis of the Clean Power Plan is the 2015 edition of EIA's *Annual Energy Outlook*. EIA's analysis considers the proposed Clean Power Plan in the context of the AEO2015 High Economic Growth and High Oil and Gas Resource cases as well as the Reference case in order to examine indicators of the proposed rule's impacts on energy markets under varying assumptions regarding economic growth, electricity demand, and fuel prices. The report also includes numerous sensitivity cases, many of which address additional questions raised in Chairman Smith's request.

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 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. There is considerable uncertainty and many challenges are involved in projecting the impacts of the proposed Clean Power Plan.

- The Clean Power Plan is still a proposed rule; the final rule may differ from the proposed rule in material ways
- The proposed rule applies to individual states; however, the electricity system does not respect state boundaries. EIA's modeling generally uses the 22 Electricity Market Module (EMM) regions in its National Energy Modeling System (NEMS) as Clean Power Plan compliance regions in this analysis. The model assigns each EMM region interim and final emission performance goals that are consistent with EPA's proposed state-level goals
- The regional compliance patterns presented in this analysis are model outputs from NEMS, while actual compliance mechanisms will be defined by state compliance proposals and may have different characteristics
- The construction of new generation to comply with the Clean Power Plan may necessitate upgrades to, and expansion of, electric power transmission systems. NEMS allows increases in interregional transmission transfer capability. However, NEMS does not contain a power-flow model or assess the reliability of bulk power transmission systems in detail
- NEMS does not consider how deliverability of natural gas to power plants using that fuel might be impacted by extreme cold conditions in regions where natural gas is a primary fuel for residential and commercial heating and local natural gas distribution companies typically have the first call on available firm natural gas transmission capacity. Because of the shift away from coal towards intermittent renewables and natural gas generation, natural gas-fired capacity will increase in importance for providing grid reliability.

Additional context and caveats are provided in EIA's report, which has been provided to the Committee and is publicly available on EIA's website. Let me now turn briefly to some of the results of the analysis. For convenience, the Appendix table provides summary descriptions of the 3 baseline and 5 policy cases discussed in this testimony.

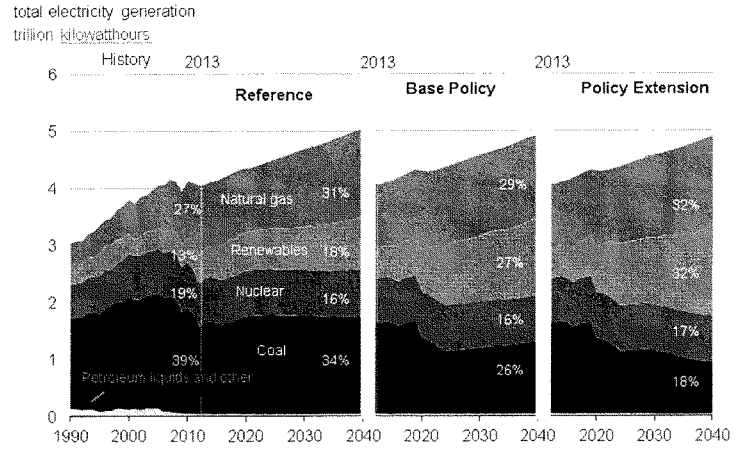
ANALYSIS RESULTS

The proposed Clean Power Plan would reduce projected power sector CO_2 emissions

Reductions in projected emissions in 2030 relative to baseline projections for that year range from 484 to 625 million metric tons. Projected power sector emissions in 2030 ranges from 1,553 to 1,727 million metric tons across the cases, reflecting a reduction of between 29% and 36% relative to the 2005 emissions level of 2,416 million metric tons.

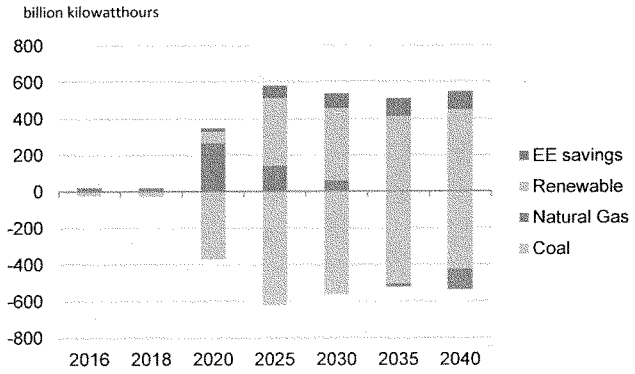
Switching from coal-fired generation to natural gas-fired generation is the predominant compliance strategy as implementation begins, with renewables playing a growing role in the mid-2020s and beyond (Figures 1 and 2)

Figure 1. Electricity generation, AEO2015 Reference case (past and projected); Clean Power Plan Base Policy (CPP) and Policy Extension (CPPEXT) cases (projected only)



Source: EIA, Annual Energy Outlook 2015 and Analysis of Impacts of the Clean Power Plan, May 2015

Figure 2. Change in generation and energy efficiency savings under the Clean Power Plan Base Policy case relative to AEO2015 Reference case

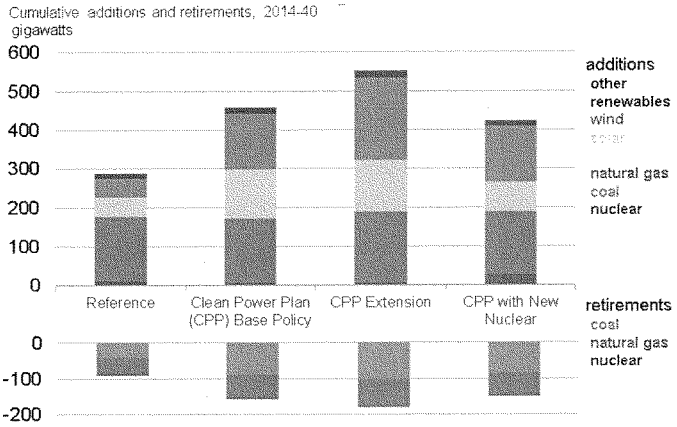


If new nuclear power generation were to be treated in the same manner as new renewable generation in compliance calculations, the Clean Power Plan would also result in increased nuclear generation.

The Clean Power Plan has a significant effect on projected retirements and additions of electric generation capacity (Figures 3 and 4). Projected coal plant retirements over the 2014-40 period, which are 40 GW in the AEO2015 Reference case (most before 2017), increase to 90 GW (nearly all by 2020) in the Base Policy case (CPP). Retirements of inefficient units fueled by natural gas or oil, generally involving primary steam cycles, are also projected to rise.

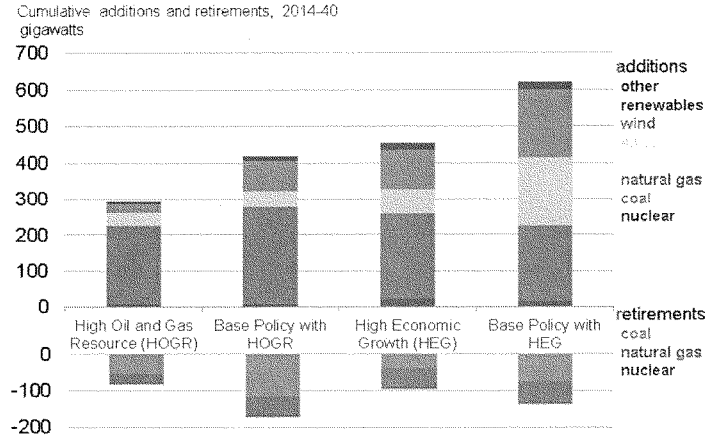
Turning to capacity additions, which are dominated by natural gas and renewables over the 2014-40 period in the AEO2015 Reference case, the Clean Power Plan significantly increases projected renewable capacity additions in all cases. Under favorable natural gas supply conditions, the Clean Power Plan also increases additions of generation capacity fueled by natural gas (CPPHOGR). Nuclear capacity is also added in a sensitivity case in which new nuclear generation receives the same treatment as new renewable generation in compliance calculations (CPPNUC).

Figure 3. Cumulative capacity changes 2014-40 for AEO2015 Reference case and 3 cases implementing the proposed Clean Power Plan rule



Source: EIA, Annual Energy Outlook 2015 and Analysis of Impacts of the Clean Power Plan, May 2015

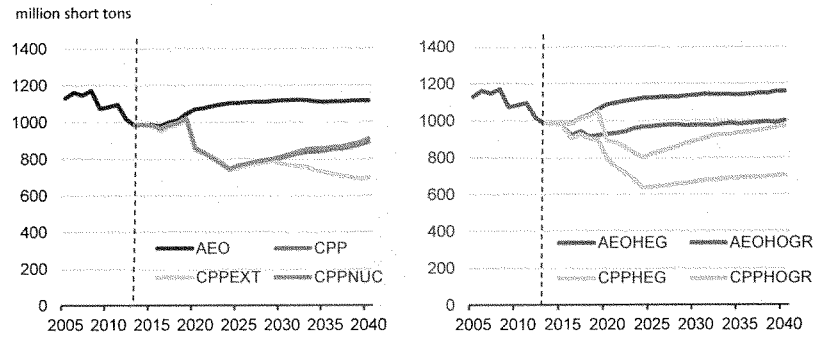
Figure 4. Cumulative capacity changes, 2014-40 for AEO2015 High Oil and Gas Resource and High Economic Growth baselines and cases implementing the proposed rule from each one



Source: EIA, Annual Energy Outlook 2015 and Analysis of Impacts of the Clean Power Plan, May 2015

Coal production and minemouth steam coal prices are lower compared with the AEO2015 Reference case in the early years following Clean Power Plan implementation (Figure 5). In the Base Policy case (CPP) projected U.S. coal production in 2020 and 2025 is 20% and 32% lower relative to the AEO2015 baseline level in those years, respectively. This decline in coal production affects all major coal producing regions (West, Interior, and Appalachia). Expanded generation from renewables, rising natural gas prices, and static emission rate targets in the post-2030 period in the Base Policy case (CPP) allow existing coal-fired plants to operate at higher utilization rates, which rise, on average, from a low of 60% in 2024 to 71% in 2040. As a result, coal production edges higher but still remains 20% below the AEO2015 Reference case level in 2040.

Figure 5. Total U.S. coal production in baseline and Clean Power Plan cases, 2005-40



Source: U.S. Energy Information Administration.

The Clean Power Plan's effect on natural gas production and prices is very sensitive to baseline supply conditions (Figures 6 and 7). The Clean Power Plan increases natural gas use significantly relative to baseline at the start of Clean Power Plan implementation, but this effect fades over time as renewables and efficiency programs increasingly become the dominant compliance strategies. While there are significant differences in projected natural gas prices across baselines, with persistently lower prices in the High Oil and Gas Resource case, the Clean

Power plan itself does not significantly move natural gas prices with the exception of an initial impact expected during the first 2-3 years after the start of implementation.

Figure 6. Natural gas production in baseline and Clean Power Plan cases, 2005-40

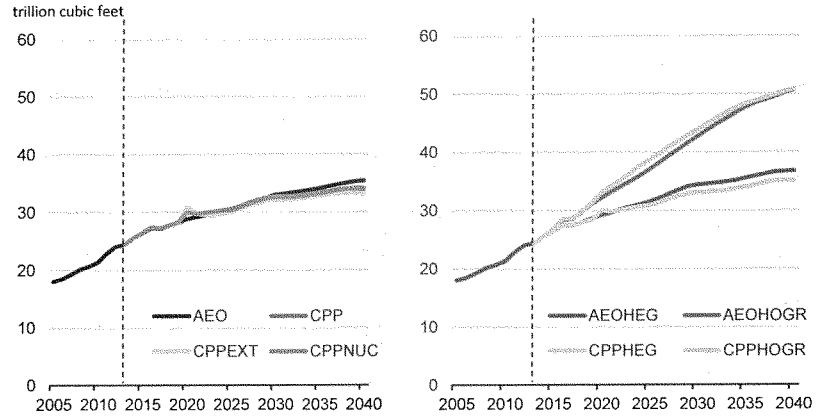
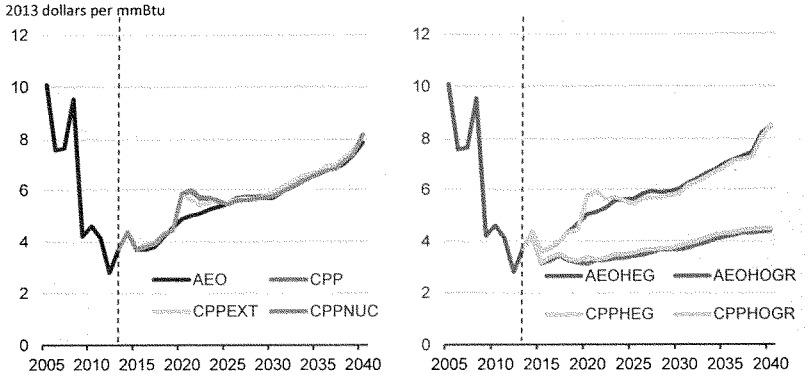


Figure 7 Henry Hub spot price for natural gas in baseline and Clean Power Plan cases, 2005-40



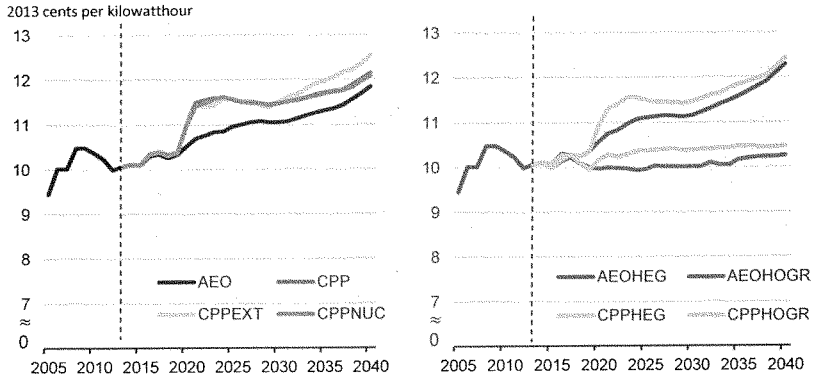
Source: U.S. Energy Information Administration.

Heat rates for coal-fired generators that remain in use, defined as the energy content of coal (in Btu) per kWh of net generation, improve modestly under the Clean Power Plan.

Retail electricity prices and expenditures rise under the Clean Power Plan. Retail electricity prices increase most in the early 2020s, in response to initial compliance measures. Increased investment in new generating capacity as well as increased use of natural gas for generation lead to electricity prices that are 3% to 7% higher on average from 2020-25 in the Clean Power Plan cases, versus the respective baseline cases (Figure 8). While prices return to near-baseline levels by 2030 in many regions, prices remain at elevated levels in some parts of the country. In Florida and the Southeast, the Southern Plains, and the Southwest regions the projected electricity prices in 2030 are roughly 10% above baseline in the Base Policy case (CPP). Some regions experience electricity prices below baseline for particular time periods, but no region has such an outcome for the entire projection period.

Electricity bills, which reflect both the electricity price and the amount of electricity purchased, also generally rise with Clean Power Plan implementation, but expenditure changes are smaller in percentage terms than price changes as the combination of energy-efficiency programs pursued for compliance purposes and higher electricity prices tends to reduce electricity consumption relative to baseline.

Figure 8. All sectors average retail electricity price in baseline and Clean Power Plan cases, 2005-40



Source: U.S. Energy Information Administration.

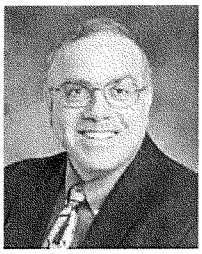
Economic activity indicators, including real gross domestic product (GDP), industrial shipments, and consumption, are reduced relative to baseline under the Clean Power Plan. Across cases that start from the AEO2015 Reference case, the reduction in cumulative GDP over 2015-40 ranges from 0.17%-0.25%, with the high end reflecting a tighter policy beyond 2030. Implementing the Clean Power Plan under baselines that assume high economic growth or high oil and gas resources result in somewhat smaller cumulative reductions in GDP over 2015-40.

CONCLUSION

As I noted at the outset, while EIA does not take policy positions, its data, analyses, and projections are meant to assist policymakers in their deliberations. Mr. Chairman and members of the committee, this concludes my testimony. I would be happy to answer any questions you may have.

APPENDIX TABLE: **Description of baseline cases and Clean Power Plan cases discussed in this testimony**

Case name	Description
Reference (AEO)	EIA's AEO2015 Reference case. AEO2015 presents annual projections of energy supply, demand, and prices through 2040. The Reference case is generally based on federal, state, and local laws and regulations as of October 2014.
Base Policy (CPP)	The Base Policy case models the proposed Clean Power Plan using the AEO2015 Reference case as the underlying baseline.
Policy Extension (CPPEXT)	The Policy Extension case extends CO_2 reduction targets beyond 2030, in order to reduce CO_2 emissions from the power sector by 45% below 2005 levels in 2040, using the AEO2015 Reference case as the baseline.
Policy with New Nuclear (CPPNUC)	The Policy with New Nuclear case models the Clean Power Plan assuming that generation from currently unplanned new nuclear capacity counts in compliance calculations. The baseline for the CPPNUC case is the AEO2015 Reference case.
Cases using alternative baselines	
High Economic Growth (AEOHEG)	EIA's AEO2015 High Economic Growth case, which reflects higher growth in U.S. gross domestic product (GDP) than the Reference case, resulting in higher electricity demand and fuel prices.
High Oil and Gas Resource (AEOHOGR)	EIA's AEO2015 High Oil and Gas Resource case, which reflects more-optimistic assumptions about domestic oil and natural gas supply prospects than the Reference case, resulting in lower natural gas prices.
Policy with High Economic Growth (CPPHEG)	The CPPHEG case models the proposed Clean Power Plan using the AEO2015 High Economic Growth case as the baseline.
Policy with High Oil and Gas Resource (CPPHOGR)	The CPPHOGR case models the proposed Clean Power Plan using the AEO2015 High Oil and Gas Resource case as the baseline.



Howard Gruenspecht: Dr. Gruenspecht is the Deputy Administrator of the U.S. Energy Information Administration (EIA), the statistical and analytical agency within the U.S. Department of Energy (USDOE). Over the past 35 years, Dr. Gruenspecht has worked extensively on energy-related environmental issues and economy-wide energy modeling. Before joining EIA in 2003, he was a Resident Scholar at Resources for the Future, an independent, non-partisan research organization. From 1991 to 2000, he held senior positions in USDOE's Office of Policy. Prior to his service at USDOE, Dr. Gruenspecht served as a senior staff economist at the White House Council of Economic Advisers, with primary responsibilities in the areas of environment, energy, regulation, and international trade. His other professional experience includes service as a faculty member at the Tepper School of Business at Carnegie-Mellon University (1981-88), economic adviser to the chairman of the U.S. International Trade Commission (1988-90), and assistant director for economics and business on the White House Domestic Policy staff (1978-79). Dr. Gruenspecht has a Ph.D. in economics from Yale University and a B.A. from McGill University.

Chairman BRIDENSTINE. Thank you, Dr. Gruenspecht.
Mr. Eule, you are recognized for five minutes.

TESTIMONY OF MR. STEPHEN EULE,
VICE PRESIDENT FOR CLIMATE AND TECHNOLOGY,
U.S. CHAMBER OF COMMERCE

Mr. EULE. Thank you, Chairmen Bridenstine and Weber, Ranking Members Johnson, Bonamici and Grayson, and Members of the Subcommittees, as the 17th French mathematician Blaise Pascal famously observed, "The justest man in the world is not allowed to be a judge in his own cause."

Chairman Smith is to be commended, therefore, for requesting EIA to take an independent look at the impacts of EPA's Clean Power Plan.

The study just issued by EIA is the most recent contribution to a growing list of analyses that tell a very different story from the one EPA has been telling. The details are in my written testimony, but in short, using the Administration's own numbers and methods, EIA's analysis shows that over the 2020–2030 compliance period, the Clean Power Plan will, one, cost the economy well more than $1 trillion in lost wealth, an amount that exceeds the Administration's own estimated social cost of carbon benefits; two, cause consumers and businesses to spend hundreds of billions of dollars more for electricity; and three, jeopardize reliability of the Nation's electricity system, all for no discernible environmental benefit.

While the United States is supposed to be cutting its emissions, China, India, and other large economies will continue to burn fossil fuels with abandon. With well over a billion people still lacking access to electricity, who can blame them?

As much as EPA might like to think otherwise, its new rule won't change this reality but it could put U.S. industry at a severe competitive disadvantage. Even green Europe is learning that sky-high energy prices, largely policy-driven, are ruining its competitiveness and turning energy-intensive industries into endangered species. Now EPA wants to do the same thing here.

Let's start with the economy. After nearly 400 pages of analysis, EPA's economic analysis amounts to this: compliance costs of the Clean Power Plan will be less than $10 billion a year. End of story. What EPA fails to address is the rule's impacts on the broader economy. This is really an inexcusable oversight. EIA's analysis provides needed contact. It estimates that the cumulative economic costs to achieve the emissions cuts proposed by EPA will reach $1.2 trillion, or about $110 billion each year. That works out to a cost of about $200 for each ton of CO_2 reduced, an astonishing amount when you consider that today you can buy a ton of CO_2 in Europe's carbon market for about 8 bucks. The Administration argues that the environmental value of these emission cuts would turn such economic losses into gains. Does it? EIA's analysis shows the answer is a resounding no. Even when taking into account the alleged social costs of carbon benefits the U.S. would receive, the net drag on the economy over the compliance period slips hardly at all from $1.23 trillion to $1.16 trillion. In short, the Clean Power Plan fails and fails badly. The Administration's own test is a climate policy.

EPA also boasts that while the price consumers pay for electricity may increase under its plan, by 2030, the electricity bills would be about eight percent lower than otherwise. EIA's analysis does not support this claim, finding instead that large rate increases will leave consumers with bigger electricity bills. As a result of these rate hikes, consumers will pay an additional $140 billion more for electricity over the compliance period. With no environmental benefits to speak of, the Clean Power Plan would place entirely needles economic burden on businesses and families, especially low-income families struggling in the sluggish economy.

One area where EPA and EIA agree is that in just five years, the Clean Power Plan will wipe out about 30 percent of the Nation's current coal-fired generation fleet. Such a draconian shutdown of existing generating capacity is unprecedented and raises serious concerns about the ability of the electric power system to handle such a rapid loss of baseload generation. The North American Electric Reliability Corporation recently concluded that replacing this lost capacity would present a significant reliability challenge. And as Federal Energy Regulatory Commission Member Phillip Moeller recently pointed out, grid reliability should not be left to an agency, EPA, with limited expertise on the subject. Thirty-two states echo these sentiments in their comments to EPA. In light of all this, EPA's continued refusal to look more closely into grid reliability is extremely troubling.

In conclusion, no matter how one slices and dices the data, EIA's analysis leaves little room for doubt that EPA's Clean Power Plan is fatally flawed as a climate policy and as an energy policy, even on the Administration's own terms. Maybe the idea of hijacking well-established state authority, turning the entire U.S. electricity system on its head, jeopardizing the reliability of the grid, raising energy costs on struggling families, and causing a trillion-dollar loss in wealth is appealing to EPA. For the rest of the country, it's a decidedly bad deal.

Thank you.

[The prepared statement of Mr. Eule follows:]

Statement of the U.S. Chamber of Commerce

ON: U.S. Energy Information Administration Report: Analysis of the Impacts of the EPA's Clean Power Plan

TO: U.S. House of Representatives
Committee on Science, Space, & Technology,
Subcommittee on Environment
and
Subcommittee on Energy

DATE: June 24, 2015

1615 H Street NW | Washington, DC | 20062

Thank you, Chairman Bridenstine, Chairman Weber, Ranking Member Bonamici, Ranking Member Grayson, and members of the Energy and Environment Subcommittees. I am Stephen D. Eule, vice president of the Institute for 21st Century Energy (Energy Institute), an affiliate of the U.S. Chamber of Commerce, the world's largest business federation representing the interests of more than three million businesses of all sizes, sectors, and regions, as well as state and local chambers and industry associations, and dedicated to promoting, protecting, and defending America's free enterprise system.

The mission of the Institute is to unify policymakers, regulators, business leaders, and the American public behind common sense energy strategy to help keep America secure, prosperous, and clean. In that regard we hope to be of service to this Committee, this Congress as a whole, and the administration.

Summary

There are many aspects of the EIA analysis of EPA's Clean Power Plan that are worthy of comment, but for the purposes of this testimony I will limit myself to three main points:

1. EIA's assessment of EPA's plan demonstrates that the economic costs exceed the climate benefits by a wide margin;
2. EIA's assessment shows that contrary to EPA's claim, both electricity prices and electricity expenditures will be higher under EPA's plan; and
3. EPA's rule will harm the U.S. coal industry and jeopardize the reliability of the nation's electricity system.

Background

Since the Environmental Protection Agency (EPA) first proposed its new rule for regulating carbon dioxide emissions from electricity generating stations in June 2014, known as the Clean Power Plan, the agency has touted its alleged environmental and economic benefits based on little more than its own analysis. For example, the agency assures states that the rule's aggressive technology assumptions are achievable, electricity rates will be minimally impacted, and electricity grid reliability will not be an issue.

As the 17th century French mathematician Blaise Pascal famously observed, "The justest man in the world is not allowed to be judge in his own cause," and what goes for men and women should go for regulatory agencies, too.

House Science Committee Chairman Smith is to be commended, therefore, for requesting the Energy Information Administration (EIA) to take an independent look at the economic and energy market effects of EPA's Clean Power Plan. The resulting Analysis of the

Impacts of the Clean Power Plan just released by EIA is the most recent edition to a growing list of analyses[1] that tell a very different story from the one EPA has been telling.

EIA was tasked with using its National Energy Modeling System to analyze EPA's proposal. The "Base Policy" scenario EIA designed hews closely to the Clean Power Plan, including interim goals and compliance around EPA's four building blocks:

1. Reducing the carbon intensity of coal plants by an average of 6% through heat rate improvements;
2. "Re-dispatching" generation from coal-fired power plants to natural gas combined cycle plants so that these plants operate, where possible, at a 70% capacity factor;
3. Further substituting emissions from fossil fuel plants by preserving 5.8% of existing nuclear capacity, completing new nuclear capacity under construction, and increasing renewable electric generating capacity to achieve a regional average of renewable portfolio standards; and
4. Reducing demand from fossil fuel plants through enhanced demand-side energy management.

EIA's "Policy Extension" scenario includes the Clean Power Plan, which EPA says would result in a 30% reduction in power sector carbon dioxide emissions compared to the 2005 level by 2030 and a 45% reduction in power sector emissions by 2040. Although this approach mirrors the Obama Administration's longer-term goals for the U.S.—remember, the administration wants U.S. emission to plunge 80% by 2050—the focus of this testimony will be on the comparison between EIA's Base Policy scenario and its Reference, or "business as usual," scenario for the 2020 to 2030 compliance period. Also note that for consistency, all dollar figures in the testimony are in real 2014 dollars.

It is also worth pointing out that EPA proposes to regulate carbon dioxide emissions from existing power plants through authorities it claims under a rarely-used authorities section, 111(d), of the Clean Air Act. Whether EPA actually has the authorities it claims has been questioned by a growing number of experts, including such legal luminaries as Harvard University Law School constitutional law Professor Laurence H. Tribe.

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[1] See for example:
NERA Economic Consulting. 2014. Potential Energy Impacts of the EPA Proposed Clean Power Plan. Prepared for the American Coalition for Clean Coal Electricity *et al*. Available at http://americaspower.org/sites/default/files/NERA_CPP%20Report_Final_Oct%202014.pdf;
North American Electric Reliability Corporation. 2015. *Potential Reliability Impacts of EPA's Proposed Clean Power Plan: Phase I*. Available at http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/Potential%20Reliability%20Impacts%20of%20EPA%E2%80%99s%20Proposed%20Clean%20Power%20Plan%20-%20Phase%20I.pdf; and
Management Information Services, Inc. 2015. *Potential Impact of Proposed EPA Regulations on Low Income Groups and Minorities*. Prepared for the National Black Chamber of Commerce. Available at http://nbccnow.org/wp-content/uploads/2015/06/NBCC_ozone__FInal.pdf.

Economic Costs

Under EIA's Base Policy scenario—which covers only carbon dioxide emissions from fossil fuel combustion, not total greenhouse gases—EIA forecasts that U.S. power sector carbon dioxide emission would plunge below the Reference baseline by 14% in 2020 and 28% in 2025 before settling in at about 27% in 2030. Small cuts also are recorded for other sectors of the economy, bringing total carbon dioxide reductions over the compliance period to nearly 6.2 gigatons below EIA's baseline, or an average of about 561 million metric tons carbon dioxide ($MMTCO_2$) each year. (Table 1 below provides a summary of the data referred to in this section.)

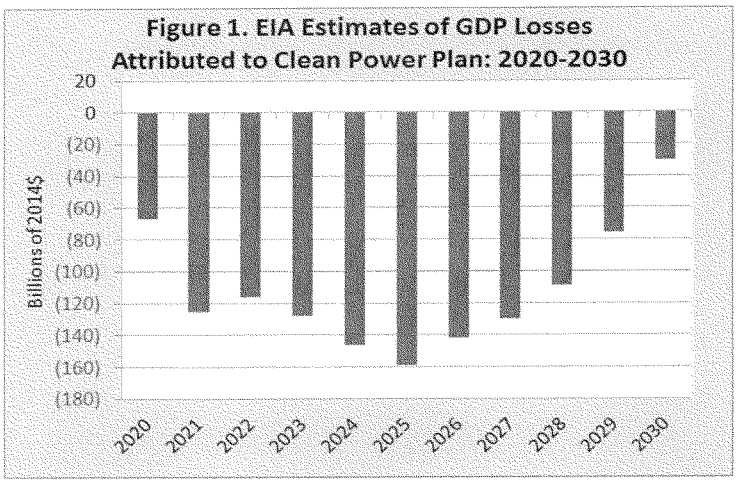
This cumulative figure of 6.2 gigatons in 2030 is a very large number, exceeding the total amount of all net U.S. greenhouse gas emission in 2013. As large as it is, however, the most recent forecast from the International Energy Agency suggests that in 2030 carbon dioxide emissions from China will offset this entire 11 years of reductions in a little more than 7 months.

It is telling that EPA does not discuss the impacts of its proposed rule on gross domestic product (GDP). In its nearly 400-page Regulatory Impact Analysis, the handful of references to GDP that do occur concern energy intensity and the use of implicit price deflators to convert figures into 2011 dollars. Nowhere in this document is there any discussion of how its rule will affect GDP.

In contrast, EIA data show that cutting emissions as rapidly and deeply as EPA proposes would come at a tremendous economic cost, both in total and in a relation to each ton of carbon dioxide reduced. When compared against EIA's baseline Reference scenario, cumulative economic costs over the Clean Power Plan's 2020 to 2030 compliance period are an estimated $1.23 *trillion* in lost GDP, with a peak annual loss of $159 billion in 2025 (Figure 1). This amounts to an average annual GDP hit over the compliance period of $112 billion.

It is often argued, however, that the value of the carbon dioxide emission reductions, as measured by the Social Cost of Carbon (SCC), would turn even such ugly losses as these into gains. The SCC represents an attempt to measure the health, property, agricultural, ecosystem, and other supposed impacts of emitting a ton of carbon dioxide. If the SCC is valued at, say, $48 for the year 2020, a 10 ton increase in carbon dioxide emissions during that year would yield a social cost of $480 while a 10 ton decrease would yield a social benefit of $480.

It's also important to note that because greenhouse gases are well mixed in the atmosphere, these impacts are considered to be global in nature (unlike air pollutants, whose impacts largely are local). This means the climate costs or benefits would be felt primarily outside of the United States.



Whether it is even possible to measure the SCC with any precision remains a matter of no little controversy. Nevertheless, the Interagency Working Group on Social Cost of Carbon charged by the Obama Administration with estimating the SCC states in a May 2013 report that the purpose of the SCC is "to allow agencies to incorporate the social benefit of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions." The president's Council of Economic Advisors also asserts that estimating the SCC is a "critical step in formulating policy responses to climate change," and further that it "provides a benchmark that policymakers and the public can use to assess the net benefits of emissions reductions stemming from a proposed policy."

The U.S. Chamber has been very clear that applying the SCC as a major tool in justifying regulation is unprecedented and represents a worrisome departure from how the federal government develops and employs these kinds of metrics. While the SCC has been referenced in the cost-benefit analyses of some rulemakings, including EPA's Clean Power Plan, it is far from clear that the use of such a metric to defend regulatory action is authorized by any law. Moreover, none of the SCC calculations have gone through any rulemaking process of the type one would normally expect for this kind of far-reaching analytical tool, nor have they been subject to the rigors of notice, public comment, and data quality. They also have never been subject to any kind of Congressional review or approval. The Administrative Procedure Act and Executive Order 12866 require this kind of openness and transparency in the promulgation of regulations, as well as the use of a high level of scientific and technical data quality. As a consequence of all of these procedural failures, not to mention the questionable accuracy of the SCC values themselves, the SCC calculation should be subject to greater transparency, notice, public comment, data quality, and accountability to Congress.

Nevertheless, for our purposes here we will set aside these lingering and very legitimate doubts about the SCC's value as an analytical tool and stipulate that the IWG's SCC estimates are spot on. The IWG created a range of estimates using a 2.5% discount rate, a 3% discount rate, and a 5% discount rate and one representing the 95th percentile of the three SCC estimates at a 3% discount rate. The central SCC at the 3% discount rate will be the focus of this analysis.

Assuming the administration's SCC estimates are accurate—again, a huge assumption and one extremely generous to EPA's contentions —are the resulting climate benefits of EPA's Clean Power Plan large enough to offset the economic losses EIA forecasts using the administration's own metrics? No, not even close.

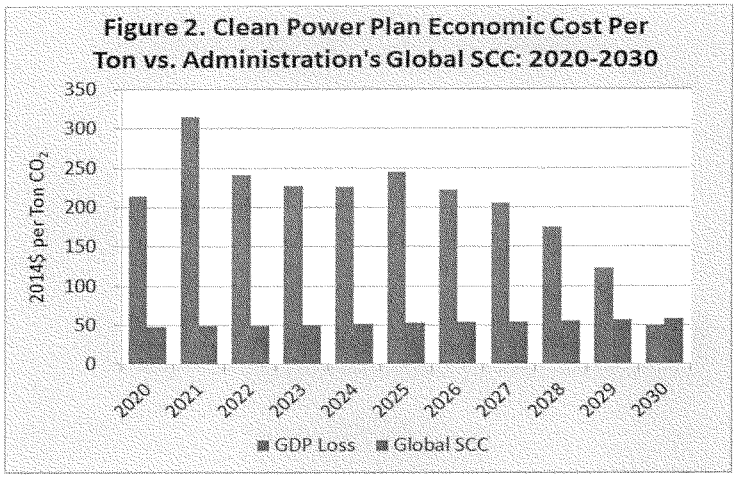
The chart in Figure 2 shows the economic cost per ton of carbon dioxide calculated for each year through 2030 (blue bars) and the administration's Global SCC estimate for that year (red bars). The first thing that jumps out is how high the per-ton costs of decreasing carbon dioxide emissions under EPA's plan really are. From 2020 to 2030, EIA estimates it will cost an *average* of $199 in lost economic growth for each ton of carbon dioxide reduced, reaching a high of $316 per ton in 2021.

Figure 2 compares the economic cost-per-ton figures against the administration's controversial Global SCC estimates. To produce a *net* climate benefit, the SCC benefit must be greater than the economic cost per ton of emission reduction. As the chart in Figure 2 shows, that is certainly not the case here. Indeed, over the compliance period, the average annual per-ton economic loss is a stunning 3.7 times bigger than the claimed SCC benefit.

Even once these SCC benefit estimates, contentious as they are, are taken into account, there still remains a huge net cumulative economic loss of $899 billion, with an average annual net loss of $83 billion. This works out to a shockingly large net economic cost per ton of carbon dioxide reduction of $146.

It was observed earlier that most of the claimed climate benefits from decreasing emissions would occur beyond U.S. borders, meaning the SCC benefits claimed for the United States must be lower than the Global SCC.

Although the Interagency Working Group tasked with developing the SCC baulked at creating a "domestic SCC" (for reasons that are not entirely clear), it did note in its 2010 report that after apportioning the benefits globally, the domestic SCC would be a small fraction of the Global SCC, concluding: "[W]ith a 2.5 or 3 percent discount rate, the U.S. benefit is about 7-10 percent of the global benefit, on average, across the scenarios analyzed. Alternatively, if the fraction of GDP lost due to climate change is assumed to be similar across countries, the domestic benefit would be proportional to the U.S. share of global GDP."



The green bars in Figure 3 below show what the Global SCC looks like after it has been adjusted applying the GDP-share method described above and using the Department of Agriculture's international macroeconomic data set of projected global GDP by country. The results are a Domestic SCC falling within a range of about $10 to $12 per ton over 2020 to 2030.

Applying this Domestic SCC to GDP cost figures calculated earlier, the cumulative net economic loss declines only modestly, moving from $1.23 trillion to $1.16 trillion for an average net annual loss of $105 billion and an average per-ton emissions reduction cost of $188.

These results were arrived at using the administration's central SCC at the 3% discount rate. One arrives at the same conclusion, however, regardless of which SCC—the 2.5%, 3%, 5%, or 3%/95th percentile—is used. The net economic losses over the 2020-2030 period range from $230 billion to $1.13 trillion using the Global SCC and from $1.02 to $1.21 trillion using the Domestic SCC, the latter of which is more pertinent to U.S. policy.[2]

To reiterate, the Chamber does not endorse the administration's use of the SCC in regulatory analysis for the reasons cited earlier. The purpose of this exercise is to demonstrate that even on the administration's own terms and using the administration's own methods, data, and highly contentious SCC, the Clean Power Plan fails the administration's own test as a climate policy.

[2] The net economic losses over the 2020-2030 period for the Policy Extension scenario range from $205 billion to $1.1 trillion using the Global SCC and from $1.01 to $1.20 trillion using the Domestic SCC.

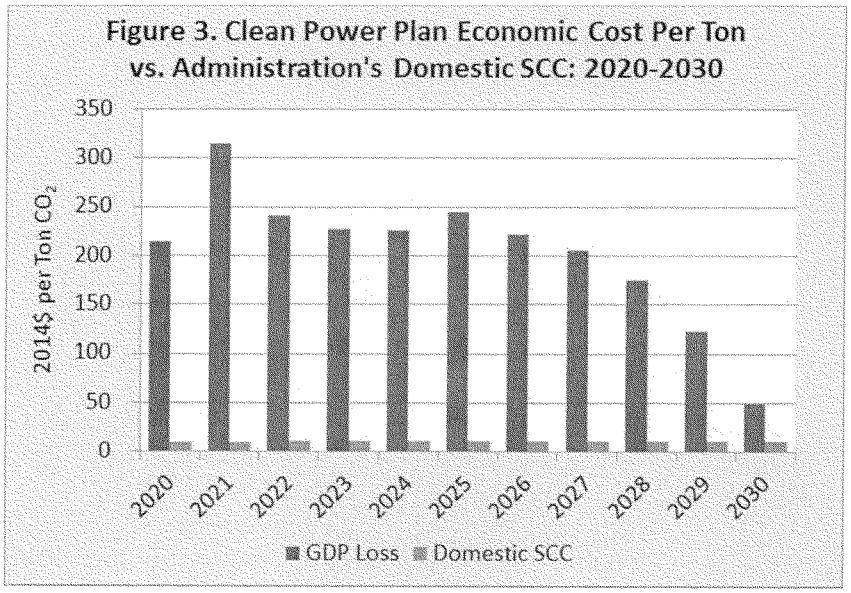


Table 1. EIA Reference Scenario vs. Base Policy Scenario: Costs & Benefits Summary

Carbon Dioxide	2020-2030 Total	2020-2030 Annual Average
	(Million Metric Tons)	
Power Sector Emissions	(5,806)	(528)
Total Emissions	(6,167)	(561)
Costs & Benefits	**2020-2030 Total (Billion 2014$)**	**2020-2030 Per Ton Average (2014$)**
	(Billion Chained 2014$)	(Chained 2014$)
GDP	(1,229)	(199)
Global SCC	330	53
Net GDP	(899)	(146)
U.S. SCC	69	11
Net GDP	(1,160)	(188)

Electricity Costs

EPA's Regulatory Impact Analysis boasts that while the price consumers pay for electricity may increase under the Clean Power Plan, their electricity costs will decrease because of significantly lower demand driven by building block four requiring enhanced demand-side energy management.

EPA's target of a 1.5% annual energy efficiency improvement would be incredibly difficult to achieve, something 17 states brought to the attention of EPA in their comments on the rule. EPA estimated that under State Compliance Option 1—which is the approach EIA modeled—by 2030 power generation would be 11.1% lower than it would have been in the absence of the Clean Power Plan (Table 2).

In contrast, EIA's report notes that "Demand-side energy efficiency plays a moderate role in compliance" compared to the other building blocks. EIA thus projects a more modest decline in electricity output by 2030 of 2.6% compared to the Reference case. This not only reflects a more realistic view of the potential for energy efficiency improvements, it also explains why EPA's claim that electricity *bills* will be lower in 2030 even as electricity *rates* will be higher under the Clean Power Plan is exceedingly unlikely.

Table 2 shows EPA estimates that electricity rates will climb an average of 6.5% in 2020, 2.9% in 2025, and 3.1% in 2030. (Within these averages are broad ranges of increases, with some regions of the country getting socked with percentage rate increases the double digits in 2020 (for New England, New York, Oklahoma, and Texas, for example) and more than 5% in 2025 and 2030 (for Florida, Oklahoma, and the Upper Midwest, for example).)

EPA says not to worry because by 2025, the typical electricity *bill* will be 5.3% lower and by 2030 8.4% lower. Consumers, therefore, will benefit in the end, at least according to EPA.

EIA's analysis does not back up EPA's claim. EIA estimates that electricity demand will decline in the Base Policy case compared to the Reference case, but the price increases overwhelm these declines, leaving consumers with bigger, not smaller, electricity bills. Using EIA's data, we calculate that average household electricity expenditures will be 3.8% higher in 2020, 2.8% *higher* in 2025, and 1.3% *higher* in 2030. For 2030, this represents a nearly 10 percentage point difference of opinion between EPA and EIA.

These price increases are expected to come on top of increases that are already projected in EIA's Reference case, which estimates that "business as usual" policies will lead to a 9.5% jump in the cost per Btu for electricity between 2015 and 2030. Under EPA's Clean Power Plan, EIA estimates the 2030 rate will jump to 14% above the 2015 level.

Rate increases such as these will have real economic consequences. We estimate that all consumers across all sectors will pay an additional $141 billion more for electricity over the compliance period ($164 billion from 2020 to 2040) (Table 3).[3]

Table 2. Electricity Demand, Prices & Expenditures: Policy Case vs. Reference Case

Metric	EPA Regulatory Impact Analysis (Option 1 State)	EIA Analysis of CPP (Base Policy)
	(Percent Change)	
Electricity Generation in:		
2020	(3.0)	(1.1)
2025	(7.8)	(2.7)
2030	(11.1)	(2.6)
Electricity Prices in:		
2020	6.5	4.9
2025	2.9	5.6
2030	3.1	4.0
Electricity Expenditures in:		
2020	3.2	3.8
2025	(5.3)	2.8
2030	(8.4)	1.3

Seeing as EIA's analysis shows economic losses exceeding the supposed climate benefits, pursuing the Clean Power Plan amounts to placing an entirely needless burden on families—especially low-income families—and businesses still struggling with a sluggish economy. Adding insult to injury, the burdens on businesses would be equally harmful, and in the case of trade exposed industries such as manufacturing, increased electricity costs serve to drive industry and associated jobs to other countries that have not imposed similar restrictions. This circumstance would not even reduce carbon emissions and instead simply *move* them from the U.S. to our international competitors.

[3] For EIA's Policy Extension scenario, which more closely aligns the administration's goals, the total increase in electricity expenditures would be $129 billion from 2020 to 2030 and $237 billion from 2020 to 2040.

Table 3. Cumulative Increase in Electricity Expenditures Under CPP

Sector	Compliance Period (2020-2030)	2020-2040
	(Billion 2014$)	
U.S. Total	141	164
Residential	61	77
Commercial	50	47
Industrial	29	39
Transportation	0.3	0.6

The Clean Power Plan Will Jeopardize Grid Reliability

EPA and EIA both agree that the Clean Power Plan will alter the U.S. generation mix. EPA's Clean Power Plan is the second of a one-two punch to the coal-fired base load power plants that form the backbone of the electricity grid, with the first being EPA's "Utility MACT" rule.

EIA's analysis indicates that without the Clean Power Plan, by 2016, 11% of the nation's current (2015) coal-fired generating capacity will be shuttered, and this will rise to 13% in 2020 and 14% in 2030, mostly because of Utility MACT.

Under EPA's Clean Power Plan, however, EIA projects that by 2020 fully 29% of the nation's current coal-fired fleet will be closed, and this rises to 31% in 2030. Such a sudden shutdown of existing generating capacity is unprecedented, and it raises serious concerns not only about the dizzying speed with which this rule will harm communities across the country that mine coal and depend on coal for power generation, but also about the ability of the electric power system to handle such a rapid loss of base load generating capacity. Based on little evidence, the agency makes the incredible contention that although its rule, by the agency's own estimate, will shutter an additional 49 gigawatts of base load coal-fired power plants by 2020, it will not adversely impact reliability.

In contrast, the North American Electricity Reliability Corporation—the independent organization responsible for ensuring grid reliability—concluded that the number of estimated retirements identified by EPA may be too conservative, and that replacing this generation

presents a significant reliability challenge.[4] And as Federal Energy Regulatory Commission member Philip Moeller has pointed out, grid reliability should not be left to an agency—EPA—with limited expertise on the subject, saying: "Just as the commission does not have expertise in regulating air emissions, I would not expect the EPA to have expertise on the intricacies of electric markets and the reliability implications of transforming the electric generation sector."[5] At least 29 states raised similar reliability concerns in their regulatory comments.

A change in the generation mix of this magnitude this quickly will have repercussions for ratepayers, as we noted in the previous section. A recent study by IHS Energy (underwritten in part by the Energy Institute) helps explain why. It found that the current diversified generation portfolio "lowers the cost of generating electricity by more than $93 billion per year" and that today's diverse fuel mix "produces lower and less volatile power prices compared to a less diverse case with no meaningful contributions from coal and nuclear power and a smaller contribution from hydroelectric power."[6]

The rest of the world has no compunction about using coal. Even green Europe—where natural gas costs about three times as much as it does here—is rediscovering the benefits of coal and has been increasing imports of U.S. coal. Europe is learning that its exorbitant energy prices, largely policy-driven, are ruining its competitiveness and turning energy-intensive industries into endangered species.

More and more, we're seeing European companies fleeing sky-high energy costs and shifting production to the United States. And why not? Affordable and reliable fuel and electricity, supplied by a diverse mix of coal, nuclear, and now natural gas, give American industry an enormous economic edge, driving a manufacturing revival in areas of the country desperately in need of jobs and investment.

In light of these widely-voiced concerns, EPA's continued refusal to look more deeply into grid reliability, an issue posing substantial economic and public safety implications, is extremely troubling.

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[4] North American Electric Reliability Corporation. 2015. *Potential Reliability Impacts of EPA's Proposed Clean Power Plan: Phase I*. Available at http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/Potential%20Reliability%20Impacts%20of%20EPA%E2%80%99s%20Proposed%20Clean%20Power%20Plan%20-%20Phase%20I.pdf.

[5] Written Testimony of Phil Moeller. 2014. Committee on Energy and Commerce, Subcommittee on Energy and Power, United States House of Representatives. *Hearing on FERC Perspective: Questions Concerning EPA's Proposed Clean Power Plan and other Grid Reliability Challenges*. Available at http://www.ferc.gov/about/com-mem/moeller/moeller-12-02-14.pdf.

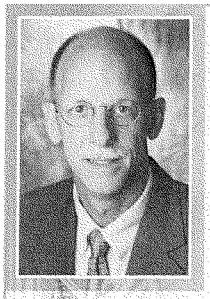
[6] IHS Energy. 2014. *The Value of US Power Supply Diversity*. Available at: http://www.energyxxi.org/power-diversity.

Conclusion

No matter how one slices and dices the data, EIA's analysis leaves little room for doubt that EPA's Clean Power Plan is badly flawed as a climate policy and as an energy policy, even on the administration's own terms.

Maybe creating a huge new bureaucracy to implement carbon dioxide regulations that would highjack well-established state authority, disrupt the entire U.S. electricity sector, jeopardize the reliability of the electric grid, cripple a strategic industry, raise electricity costs on struggling families, and yield an estimated net loss in wealth of $899 billion to $1.16 trillion is appealing to EPA. But for the rest of the country, it's a decidedly bad deal.

The Chamber has said repeatedly that the Clean Air Act is the wrong vehicle for regulating greenhouse gas emissions. EIA's analysis proves it.



Stephen D. Eule

Vice President for Climate and Technology
Institute for 21st Century Energy
U.S. Chamber Of Commerce

Stephen D. Eule is vice president for climate and technology at the U.S. Chamber of Commerce's Institute for 21st Century Energy (Energy Institute). Eule is an experienced voice on the nexus between energy, climate change, and technology. He travels around the world to speak with business, governments, think tanks, and the media in a variety of forums.

Eule oversees the collection and analysis of data on energy and climate and the impact of technology in the energy industry. He represents the U.S. Chamber in the UN Framework Convention on Climate Change and helped found the Major Economies Business Forum on Energy Security and Climate Change, a coalition of national cross-sector business organizations from major economies for which the Energy Institute acts as secretariat.

Eule also is responsible for the Energy Institute's two annual and authoritative energy security reports—the Index of U.S. Energy Security Risk and the International Index of Energy Security Risk. These risks indices represent the first and most comprehensive efforts to quantify energy security risks over time and across a wide range of measures. They have been cited by the International Energy Agency and are used by universities and think tanks across the world.

Previously, Eule was director of the Office of Climate Change Policy & Technology at the Department of Energy (DOE). There he oversaw the development of the U.S. Climate Change Technology Program Strategic Plan in 2006, ran President Bush's Climate VISION program, and testified before Congress on DOE climate and energy programs. Internationally, Eule represented DOE as part of the U.S. government delegations to the Intergovernmental Panel on Climate Change, the G20, and other multilateral forums. He was lead chapter author on the U.S. Climate Action Report—2006 and contributes to other government publications.

His prior experience includes a decade working in various public policy positions. He was a subcommittee staff director on the House Science Committee and served as legislative director for Rep. Nick Smith (R-MI). In addition, Eule was an environmental analyst in the Washington, D.C., office of New Jersey Gov. Christine Todd Whitman (R-NJ). Earlier, he worked for eight years as an Orkand Corporation consultant to the Energy Information Administration and worked at the Heritage Foundation.

Eule earned a Master of Arts degree in geography from The George Washington University and a Bachelor of Science degree in biology from Southern Connecticut State College.

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The mission of the U.S. Chamber of Commerce's Institute for 21st Century Energy is to unify policymakers, regulators, business leaders, and the American public behind a common sense energy strategy to help keep America secure, prosperous, and clean. Through policy development, education, and advocacy, the Institute is building support for meaningful action at the local, state, national, and international levels.

The U.S. Chamber of Commerce is the world's largest business federation representing the interests of more than 3 million businesses of all sizes, sectors, and regions, as well as state and local chambers and industry associations.

Chairman BRIDENSTINE. Thank you, Mr. Eule.
Dr. Tierney, you're recognized for five minutes.

TESTIMONY OF DR. SUSAN TIERNEY,
SENIOR ADVISOR, ANALYSIS GROUP, INC.

Dr. TIERNEY. Good morning, Chairmen Bridenstine and Weber, Ranking Members Johnson and Bonamici, it's great to be here today, and thank you very much, Members of the Subcommittee.

I want to talk for a minute about the EIA's model and give you several points about the context in which policymakers can take its results into consideration.

First, as you know, the EIA's model is not a comprehensive macroeconomic model of the economy; it is an energy model. It does not incorporate the costs associated with public health. It does not incorporate the costs associated with addressing climate change for many—for all of the communities around the country. It does not address impacts on human health. Therefore, it can't be viewed as an assessment of the Clean Power Plan's impacts on the economy.

Second, EIA's longstanding practice is to look at environmental laws only that are in final form. As a result of that, there are many aspects of the changing outlook for the economy which are not reflected in this, including the EIA's overstating in its base case the emissions from coal plants and understating the power generation contributions from natural gas, nuclear and renewable energy. Therefore, in some ways the EIA's Clean Power Plan policy assessment could be considered the baseline as the Nation moves to address greenhouse gas emissions from the power sector.

Third, like many long-term assessments, EIA's method does not do a particularly good job of addressing innovation and disruptive technologies. Based on historical experience, we know that before the fact estimates of environmental compliance programs have consistently under—overestimated the cost associated with such compliance. Once environmental regulations are in place, the ingenuity of the American economy kicks into gear and delivers those results much more economically than anticipated.

Additionally, we know that disruptive technologies occur. In the Chairman's State of Oklahoma, we know that EIA did not anticipate the effect of fracking and its lowering of costs of natural gas, so we know that EIA's outlook understandably does not anticipate disruptive technology changes. Those always introduce changes into the cost of energy, and we can expect them here associated with such things as renewables, storage, and smart grid technology.

EIA's assumptions about energy efficiency understate its value in mitigating cost impacts of the Clean Power Plan. In practice, we have seen that in the ten-state region of the Northeast that adopted the Regional Greenhouse Gas Initiative, energy efficiency was a core strategy that enabled customer bills to go down as a result of adopting a carbon-control program in that area. I'm happy to talk more about how that occurred.

Just several other points. The EPA's proposed regulation will allow flexibility that states will use to address impacts on consumers. It is entirely reasonable to expect that EIA's final rule will

be more flexible and lower the cost compared to what the proposal has been.

As a former state utility regulator, I know that states are very well equipped to address the cost impacts and to use a variety of tools to encourage utilities to minimize costs and to protect low-income consumers. That's part of their core job and they do it well.

Third, market-based mechanisms including multistate map-based approaches are ones that we can count on for reducing the cost of compliance. States are looking at how to adopt such approaches. They work seamlessly with the electric industry's structure. They can be adopted without the reliability changes that many have anticipated.

Let me just mention that last point. People have identified reliability as a problem. I have just written three different reports on different parts of the country analyzing the implications of the Clean Power Plan for reliability. Clearly, this industry is equipped, well equipped to use its normal tools, its day-to-day tools to assure that the lights will not go out as a result of this. Many of the reliability concerns that some observe are based on worst-case scenarios and assume that no one will take action to address issues before problems occur, and there is absolutely no historical basis for that.

Thank you very much.

[The prepared statement of Dr. Tierney follows:]

Testimony of Susan F. Tierney, Ph.D.,
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
June 24, 2015

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

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[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]

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[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

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[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

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[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.

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[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.

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Dr. Tierney, a Senior Advisor at Analysis Group, is an expert on energy economics, regulation and policy, particularly in the electric and gas industries. She has consulted to businesses, government, Indian tribes, environmental groups, and other organizations on energy markets, economic and environmental regulation and strategy, and energy projects. Her expert witness and consulting services have involved energy market analyses, wholesale and retail market design, contract disputes, resource planning and procurements, regional transmission organizations, the siting of electric and gas infrastructure projects, electric system reliability, ratemaking for electric and gas utilities, clean energy resources, climate change policy, and other environmental policy and regulation. She has participated as an expert in civil litigation cases and in regulatory proceedings before state and federal agencies.

Previously, she served as the Assistant Secretary for Policy at the U.S. Department of Energy. She was the Secretary for Environmental Affairs in Massachusetts, Commissioner at the Massachusetts Department of Public Utilities, Chairman of the Board of the Massachusetts Water Resources Authority, and executive director of the Massachusetts Energy Facilities Siting Council.

Dr. Tierney has authored numerous articles and speaks frequently at industry conferences. She serves on a number of boards of directors and advisory committees, including chairing the External Advisory Council of the National Renewable Energy Laboratory (NREL) and the board of ClimateWorks Foundation. She is a director of the World Resources Institute, the Alliance to Save Energy, and the Energy Foundation. She is a member of the China Sustainable Energy Program's Policy Advisory Council, and the NYISO Environmental Advisory Council. She previously co-chaired the NAESB Gas-Electric Harmonization Committee; co-chaired the Bipartisan Policy Center's project on cyber security and the electric grid; co-chaired the National Commission on Energy Policy; chaired the Policy Subgroup of the National Petroleum Council's study of the natural gas and oil resource base in North America; was co-lead author of the energy chapter of the National Climate Assessment; served on the U.S. Secretary of Energy Advisory Board (and its Shale Gas Subcommittee); served on the Bipartisan Policy Center's energy project; was a member of the National Academy of Sciences panel on shale gas risk; served on the Alliance Commission for Energy Efficiency Policy; chaired the Electricity Innovations Institute; chaired the Massachusetts Ocean Commission; and was a director of several companies (EnerNOC, Inc.; Evergreen Solar, Inc.; Ze-gen, Inc.; Catalytica Energy Systems Inc.), and several non-profit organizations (Clean Air Task Force; Clean Air -- Cool Planet; the Electric Power Research Institute (EPRI)). She taught at the Department of Urban Studies and Planning at MIT and at the University of California at Irvine, and has lectured at Harvard University, Yale University, New York University, Tufts University, Northwestern University, and University of Michigan.

She earned her Ph.D. and M.A. degrees in regional planning at Cornell University and her B.A. at Scripps College.

Chairman BRIDENSTINE. Thank you, Dr. Tierney.
Dr. Dayaratna, you are recognized for five minutes.

**TESTIMONY OF DR. KEVIN DAYARATNA,
SENIOR STATISTICIAN AND RESEARCH PROGRAMMER,
THE HERITAGE FOUNDATION**

Dr. DAYARATNA. Chairman Bridenstine, Ranking Member Bonamici, Chairman Weber, Ranking Member Johnson, and Members of the Subcommittee, thank you for the opportunity to discuss the Clean Power Plan.

My name is Kevin Dayaratna. I'm the Senior Statistician and Research Programmer at The Heritage Foundation here in Washington, DC. The views I express in this testimony are my own and should not be construed as representing any official position of The Heritage Foundation.

For years, it has been a primary goal of the Obama Administration to fundamentally expand regulations across the energy sector of the economy. The Administration's primary justification for doing so is to limit carbon dioxide emissions as they believe that such emissions contribute to global warming.

There is broad economic consensus that any governmental policies to limit carbon dioxide emissions will have detrimental impacts throughout the economy. These negative impacts have not only been discussed by myself and colleagues at The Heritage Foundation but also notably by other experts in Washington, D.C., on both sides of the aisle.

As you know, the EIA's analysis of the Clean Power Plan is based on their use of the National Energy Modeling System. Likewise, over the course of my work at The Heritage Foundation, I've used the very same National Energy Modeling System to rigorously conduct a variety of simulations looking at similar policy proposals. Unfortunately, their policies will almost surely do far more harm than good by killing jobs, stifling the American economy, while having only negligible environmental benefits.

Let's take a closer look at these negative impacts. First, the plan kills jobs. Now, just using the results that the EIA has published, one can see the significant disruption that a Clean Power Plan will have on American jobs. According to their very own study, the economy would begin to lose jobs shortly after the plan's implementation and over the course of the following decade. The results also admit that by 2025, the plan will kill nearly 150,000 manufacturing jobs as well as nearly 200,000 jobs nationwide including in many of your own districts. I've conducted similar simulations of other policy proposals and have found that in many cases, all districts suffer, especially the Midwest.

Second, the plan stifles the American economy, hitting ordinary households quite hard. Because of the plan's regulations limiting the use of the least expensive and most efficient forms of energy, the mix of energy sources used would change dramatically toward more expensive and less efficient forms. As a result, the plan would increase annual electricity expenditures by up to $70 per household and perhaps by even more in coal-dependent areas of the country.

In terms of GDP, if you take the report's own computations and calculate the average income for a typical family of four, you notice

a significant impact. By the middle of the next decade, the Clean Power Plan would cost a family of four nearly $2,000 in a single year, which is close to a full semester's worth of tuition at a local junior college.

Third, the plan has only negligible environmental benefits. The whole goal of this plan is to reduce carbon dioxide emissions. What's interesting, however, is that by using the EPA model for the assessment of greenhouse gas-induced climate change and making the unjustifiably optimistic assumption of eliminating all carbon dioxide emissions from the United States completely, the result will be a reduction of around .2 degrees Celsius in global temperatures. As a result, even if the plan to actually meet the Administration's goals for CO_2 reduction, the impacts on global temperatures would be undeniably negligible. So all together, the negative impacts of the Clean Power Plan are significant, and the impact on the climate is trivial.

Thank you. I look forward to your questions.

[The prepared statement of Dr. Dayaratna follows:]

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CONGRESSIONAL TESTIMONY

The Economic Impact of the Clean Power Plan

Testimony before the Committee on Science, Space, and Technology

June 24, 2015

Kevin D. Dayaratna, PhD
Senior Statistician and Research Programmer
The Heritage Foundation

Chairman Smith and Members of the Committee, thank you for inviting me to testify. My name is Kevin Dayaratna. I am the Senior Statistician and Research Programmer at The Heritage Foundation. The views I express in this testimony are my own and should not be construed as representing any official position of The Heritage Foundation.

For years, it has been a primary goal of the Obama Administration to fundamentally expand regulations across the energy sector of the economy. The Administration's primary justification for doing so is to limit carbon-dioxide emissions as they believe such emissions contribute to global warming.[1]

Over the course of my work at The Heritage Foundation, I have rigorously used the National Energy Modeling System (NEMS), having conducted a variety of simulations looking at similar policy proposals ranging from a nationwide carbon tax to shutting down the coal industry. The Energy Information Administration's (EIA's) analysis of the Clean Power Plan (CPP), based on their use of NEMS, suggests that the Plan will have economic impact similar to that of these proposals.[2] These policies will almost surely do far more harm than good by stifling the American economy, killing jobs, and having negligible environmental benefits.

Impact of the Clean Power Plan on the Economy

There is broad economic agreement that any governmental policies to limit carbon-dioxide emissions will have detrimental economic impact throughout the nation. This fact has not only been discussed by myself and colleagues at The Heritage Foundation, but also by those within the EIA as well as other policy experts in Washington.[3] Below, for example, are nationwide impacts on manufacturing employment of the four primary policy simulations run by the EIA in their report, "An Analysis of the Clean Power Plan," with respect to current policy:[4]

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1. Barack Obama, "Press Conference by the President," White House, November 3, 2010, http://www.whitehouse.gov/the-press-office/2010/11/03/press-conference-president (accessed September 5, 2014).
2. Energy Information Administration, "EIA's Analysis of the Impacts of the Clean Power Plan," May 2015, http://www.eia.gov/analysis/requests/powerplants/cleanplan/ (accessed June 22, 2015).
3. Kevin D. Dayaratna, Nicolas D. Loris, and David W. Kreutzer, "The Obama Administration's Climate Agenda Will Hit Manufacturing Hard: A State-by-State Analysis," Heritage Foundation Backgrounder No. 2990, February 17, 2015, http://www.heritage.org/research/reports/2015/02/the-obama-administrations-climate-agenda-will-hit-manufacturing-hard-a-state-by-state-analysis; Kevin D. Dayaratna, Nicolas D. Loris, and David W. Kreutzer, "The Obama Administration's Climate Agenda: Underestimated Costs and Exaggerated Benefits," Heritage Foundation Backgrounder No. 2975, November 13, 2014, http://www.heritage.org/research/reports/2014/11/the-obama-administrations-climate-agenda-underestimated-costs-and-exaggerated-benefits; Nicholas D. Loris, Kevin Dayaratna, and David W. Kreutzer, "EPA Power Plant Regulations: A Backdoor Energy Tax," Heritage Foundation Backgrounder No. 2863, December 5, 2013, http://www.heritage.org/research/reports/2013/12/epa-power-plant-regulations-a-backdoor-energy-tax; David W. Kreutzer, Nicholas D. Loris, and Kevin Dayaratna, "Cost of a Climate Policy: The Economic Impact of Obama's Climate Action Plan," Heritage Foundation Issue Brief No. 3978, June 27, 2013, http://www.heritage.org/research/reports/2013/06/climate-policy-economic-impact-and-cost-of-obama-s-climate-action-plan; David W. Kreutzer and Kevin Dayaratna, "Boxer–Sanders Carbon Tax: Economic Impact," Heritage Foundation Issue Brief No. 3905, April 11, 2013, http://www.heritage.org/research/reports/2013/04/boxer-sanders-carbon-tax-economic-impact; Energy Information Administration, "EIA's Analysis of the Impacts of the Clean Power Plan"; and "Cap and Trade: Comparing Cost Estimates," Heritage Foundation Event, September 21, 2009, http://www.heritage.org/events/2009/09/cap-and-trade-comparing-cost-estimates.
4. Results were downloaded from the U.S. Energy Information Agency's AEO table browser, http://www.eia.gov/oiaf/aeo/tablebrowser/ (accessed June 19, 2015). CPP is the Base Policy, CPPEXT is their Policy Extension, CPPNUC is the Policy with New Nuclear, and CPPBIO195 is The Policy with Biomass CO2 as described in Energy Information Administration, "EIA's Analysis of the Impacts of the Clean Power Plan."

TABLE 1

Impact of CPP on Manufacturing Employment

Year	Clean Power Plan (CPP)	CPP Policy Extension	CPP Policy with New Nuclear	CPP Policy with Biomass CO2
2015	286	305	75	322
2016	2138	4158	2427	1912
2017	-6459	-11611	-4860	-6241
2018	-14155	-23810	-10702	-15341
2019	-13896	-20525	-12545	-12449
2020	8654	7610	7210	16662
2021	-70290	-68976	-65860	-68389
2022	-139813	-122008	-138573	-148435
2023	-136369	-111925	-140888	-150503
2024	-139986	-115816	-143368	-152080
2025	-140675	-128810	-139507	-150357
2026	-130968	-126581	-122157	-140440
2027	-117788	-110955	-106585	-122978
2028	-105695	-98972	-93891	-108804
2029	-98091	-90553	-87465	-99990
2030	-89137	-81328	-80171	-91528
2031	-80353	-76943	-70037	-81396
2032	-67469	-71557	-59403	-70850
2033	-54054	-63915	-45533	-61074
2034	-45254	-59247	-34110	-50250
2035	-42477	-58933	-28484	-46761
2036	-38531	-55550	-24520	-43862
2037	-34021	-54977	-22591	-41813
2038	-31057	-56072	-21809	-39718
2039	-30831	-52736	-19817	-37067
2040	-26193	-49930	-14829	-34037

Source: Author's calculations based on: U.S. Energy Information Administration, "Analysis of the Impacts of the Clean Power Plan: Macroeconomic," http://www.eia.gov/oiaf/aeo/tablebrowser/ (accessed June 22, 2015).

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Below are the projections of the CPP on overall employment as well as the country's gross domestic product (GDP):

TABLE 2

Impact of CPP on Overall Employment

Year	Clean Power Plan (CPP)	CPP Policy Extension	CPP Policy with New Nuclear	CPP Policy with Biomass CO2
2015	-1206	351	213	-641
2016	-16663	-26886	-13702	-16388
2017	-25772	-42481	-22476	-26703
2018	-25482	-44403	-27465	-28061
2019	4410	41489	-3067	1725
2020	-57755	-39261	-46097	-84366
2021	-282913	-183823	-264496	-350708
2022	-234329	-139465	-206054	-324371
2023	-189423	-114548	-165253	-258331
2024	-211365	-211166	-189392	-264084
2025	-378602	-452668	-330384	-390458
2026	-453460	-537445	-399994	-423004
2027	-479034	-536194	-427948	-425873
2028	-422989	-426819	-423660	-339371
2029	-277939	-264175	-314606	-192703
2030	-78506	-83221	-121551	9964
2031	140549	64148	107666	210083
2032	293762	187958	295578	345978
2033	375579	269927	408599	441223
2034	387955	281433	449509	439117
2035	329147	210174	404159	408356
2036	254502	113861	313233	305390
2037	179932	33920	222305	194901
2038	147323	1251	163421	111572
2039	110611	-15183	122604	58762
2040	90821	26032	127472	91934

Source: Author's calculations based on: U.S. Energy Information Administration, "Analysis of the Impacts of the Clean Power Plan: Macroeconomic," http://www.eia.gov/oiaf/aeo/tablebrowser/ (accessed June 22, 2015).

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TABLE 3

Impact of CPP on GDP

FIGURES IN 2009 CHAIN WEIGHTED U.S. DOLLARS

Year	Clean Power Plan (CPP)	CPP Policy Extension	CPP Policy with New Nuclear	CPP Policy with Biomass CO2
2015	-$226,562,000	-$3,906,000	-$31,250,000	-$224,609,000
2016	-$3,052,735,000	-$4,857,422,000	-$2,546,875,000	-$3,001,954,000
2017	-$4,068,360,000	-$7,039,063,000	-$3,580,078,000	-$4,035,157,000
2018	-$3,375,000,000	-$5,656,250,000	-$4,134,766,000	-$3,210,937,000
2019	-$2,232,422,000	-$7,986,329,000	-$2,347,657,000	-$3,605,469,000
2020	-$61,351,563,000	-$68,333,985,000	-$57,271,485,000	-$69,414,063,000
2021	-$116,789,062,000	-$104,718,750,000	-$110,716,796,000	-$130,425,781,000
2022	-$106,982,422,000	-$95,548,828,000	-$99,708,985,000	-$122,193,359,000
2023	-$117,937,500,000	-$102,208,984,000	-$113,904,296,000	-$131,744,140,000
2024	-$134,919,922,000	-$129,205,078,000	-$133,191,407,000	-$145,988,281,000
2025	-$147,900,391,000	-$152,810,547,000	-$143,474,610,000	-$151,742,188,000
2026	-$131,402,344,000	-$140,197,266,000	-$124,250,000,000	-$132,585,937,000
2027	-$119,218,750,000	-$126,933,594,000	-$111,230,469,000	-$116,541,015,000
2028	-$101,009,766,000	-$102,050,781,000	-$101,613,281,000	-$91,500,000,000
2029	-$69,599,609,000	-$68,685,547,000	-$72,375,000,000	-$59,783,203,000
2030	-$28,572,266,000	-$38,830,078,000	-$32,189,453,000	-$18,908,203,000
2031	$4,818,359,000	-$24,000,000,000	$5,240,234,000	$12,169,922,000
2032	$25,599,609,000	-$6,478,516,000	$33,091,797,000	$35,785,156,000
2033	$42,017,578,000	$7,806,640,000	$52,261,719,000	$46,839,843,000
2034	$45,316,406,000	$3,943,359,000	$59,785,156,000	$45,500,000,000
2035	$32,140,625,000	-$17,144,531,000	$48,419,922,000	$41,345,703,000
2036	$15,488,281,000	-$36,867,188,000	$32,669,921,000	$20,746,093,000
2037	$6,117,187,000	-$49,640,625,000	$20,839,844,000	$5,699,219,000
2038	$1,623,047,000	-$58,640,625,000	$10,347,656,000	-$12,435,547,000
2039	-$7,621,093,000	-$68,392,578,000	$701,172,000	-$20,111,328,000
2040	-$12,064,453,000	-$66,421,874,000	$1,589,844,000	-$16,769,531,000

Source: Author's calculations based on: U.S. Energy Information Administration, "Analysis of the Impacts of the Clean Power Plan: Macroeconomic," http://www.eia.gov/oiaf/aeo/tablebrowser/ (accessed June 22, 2015).

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There are a few important things to note here. First, we see a precipitous decline in employment in the subsequent decade. Although some of the policy situations note a slight uptick in employment after 2030, overall employment never truly recovers and neither do GDP nor household income.

Additionally, in their report, the EIA notes that these changes to GDP are "equivalent to changes of a few tenths of one percent from the baseline given the magnitude of GDP and disposable income accumulated over the 2015–2040 period."[5] Although this percentage is seemingly small, it does represent a significant impact on the economy, as illustrated by the impact of the plan on a family of four:

5. Energy Information Administration, "EIA's Analysis of the Impacts of the Clean Power Plan," p. 63.

TABLE 4

Impact of CPP on Annual Income for a Family of Four

FIGURES IN 2009 CHAIN WEIGHTED U.S. DOLLARS

Year	Clean Power Plan (CPP)	CPP Policy Extension	CPP Policy with New Nuclear	CPP Policy with Biomass CO2
2015	-$2.82	-$0.05	-$0.39	-$2.79
2016	-$37.69	-$59.97	-$31.45	-$37.06
2017	-$49.85	-$86.24	-$43.86	-$49.44
2018	-$41.04	-$68.77	-$50.27	-$39.04
2019	-$26.94	-$96.36	-$28.33	-$43.50
2020	-$734.69	-$818.31	-$685.83	-$831.24
2021	-$1,388.09	-$1,244.63	-$1,315.92	-$1,550.17
2022	-$1,262.11	-$1,127.22	-$1,176.30	-$1,441.56
2023	-$1,381.15	-$1,196.96	-$1,333.92	-$1,542.84
2024	-$1,568.59	-$1,502.15	-$1,548.49	-$1,697.27
2025	-$1,707.23	-$1,763.90	-$1,656.14	-$1,751.57
2026	-$1,506.12	-$1,606.93	-$1,424.14	-$1,519.69
2027	-$1,357.02	-$1,444.84	-$1,266.09	-$1,326.54
2028	-$1,141.93	-$1,153.70	-$1,148.76	-$1,034.42
2029	-$781.57	-$771.31	-$812.74	-$671.34
2030	-$318.75	-$433.18	-$359.10	-$210.94
2031	$53.41	-$266.02	$58.08	$134.89
2032	$281.98	-$71.36	$364.51	$394.17
2033	$460.00	$85.47	$572.15	$512.79
2034	$493.16	$42.91	$650.62	$495.16
2035	$347.74	-$185.49	$523.87	$447.33
2036	$166.62	-$396.60	$351.45	$223.18
2037	$65.44	-$531.03	$222.93	$60.97
2038	$17.27	-$623.87	$110.09	-$132.30
2039	-$80.64	-$723.70	$7.42	-$212.81
2040	-$126.98	-$699.11	$16.73	-$176.50

Source: Author's calculations based on: U.S. Energy Information Administration, "Analysis of the Impacts of the Clean Power Plan: Macroeconomic," http://www.eia.gov/oiaf/aeo/tablebrowser/ (accessed June 22, 2015).

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These calculations clearly illustrate the detrimental impact that the CPP will have on the American households. In 2025 for example, the average family of four will lose nearly $2,000 in income.

Electricity Prices

The EIA's analysis of the CPP suggests that residential electricity prices will increase as a result of the policy. The table below illustrates comparisons of annual household electricity expenditures based on the EIA's four primary simulations regarding the CPP compared to their reference case:[6]

6. Results were downloaded from the U.S. Energy Information Agency's AEO table browser, http://www.eia.gov/oiaf/aeo/tablebrowser/ (accessed June 19, 2015).

TABLE 5

Impact of CPP and Three Other Variants on Electricity Expenditures

FIGURES IN 2009 CHAIN WEIGHTED U.S. DOLLARS

Year	Clean Power Plan (CPP)	CPP Policy Extension	CPP Policy with New Nuclear	CPP Policy with Biomass CO2
2015	$0.07	-$0.66	-$0.20	-$0.25
2016	-$4.34	-$6.38	-$4.22	-$4.72
2017	-$4.04	-$7.67	-$3.92	-$4.98
2018	-$3.83	-$4.82	-$5.62	-$2.84
2019	-$2.97	-$4.53	-$1.77	-$0.14
2020	-$52.02	-$51.91	-$47.09	-$59.20
2021	-$80.23	-$69.47	-$73.27	-$90.13
2022	-$71.96	-$54.66	-$66.43	-$79.13
2023	-$64.01	-$45.35	-$63.32	-$72.33
2024	-$61.31	-$59.93	-$64.61	-$72.48
2025	-$44.78	-$44.52	-$43.53	-$53.31
2026	-$34.55	-$33.54	-$32.38	-$40.33
2027	-$26.19	-$23.46	-$24.82	-$32.85
2028	-$19.16	-$13.92	-$20.95	-$26.92
2029	-$19.52	-$13.09	-$18.82	-$26.73
2030	-$22.68	-$22.98	-$22.04	-$26.64
2031	-$22.84	-$33.11	-$22.81	-$27.79
2032	-$16.75	-$33.64	-$20.34	-$25.66
2033	-$14.67	-$38.00	-$16.97	-$22.20
2034	-$16.12	-$43.57	-$14.09	-$19.93
2035	-$13.74	-$43.96	-$12.62	-$18.92
2036	-$12.27	-$48.91	-$11.59	-$17.85
2037	-$7.89	-$54.97	-$6.75	-$13.00
2038	-$6.90	-$46.82	-$1.76	-$9.51
2039	-$7.28	-$44.79	-$1.95	-$8.06
2040	-$4.95	-$48.52	$1.17	-$10.37

Source: Author's calculations based on: U.S. Energy Information Administration, "Analysis of the Impacts of the Clean Power Plan," Table "Residential Sector Key Indicators and Consumption" and Table "Electricity Supply, Disposition, Prices, and Emissions," http://www.eia.gov/oiaf/aeo/tablebrowser/ (accessed June 22, 2015)."

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These increases result from the fact that the CPP will stifle the use of the least expensive forms of energy and force Americans toward using more expensive, less efficient alternatives. They indicate that the CPP would significantly impact household electricity prices across the residential sector, not just households that consume a significant amount of electricity. These higher electricity prices will have to be paid for with the already lost income described in the previous section.

Questionable Justification with Limited Environmental Benefit

There is no doubt that the regulations contained within the CPP will be burdensome to the American economy. The primary justification that the Obama Administration has used for instituting these regulations has been the social cost of carbon (SCC). As we have illustrated in our research at The Heritage Foundation, the models used to estimate the SCC are "flawed beyond use for policymaking," with extreme sensitivity to reasonable changes to assumptions.[7] Even if all carbon-dioxide emissions were brought to (literally) zero in the United States, global temperatures would change by less than 0.2 degrees Celsius. Completely eliminating all carbon-dioxide emissions in all industrialized countries across the globe would fail to reduce global temperatures by more than half of a degree Celsius.[8] With significant economic damage and limited benefit, there is no reason for policymakers to institute these types of regulations.

Conclusion

The Clean Power Plan institutes a series of burdensome regulations that provide little environmental benefits but significantly damage the American economy. Allowing free markets to determine prices and choices in the energy sector of the American economy, not the dictates of bureaucrats in Washington, will provide us with more affordable energy and a clean, healthy environment.[9]

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Kevin D. Dayaratna, Ph.D.

Kevin D. Dayaratna specializes in tax, energy and health policy issues as Senior Statistician and Research Programmer in The Heritage Foundation's Center for Data Analysis (CDA). An applied statistician, he has researched and published on the use of high-powered statistical models in public policy, medical outcomes, business, economics, and even professional sports.

Dayaratna, who joined CDA in September 2012, previously was a graduate fellow in Heritage's Center for Health Policy Studies. His fellowship paper, on comparing outcomes for Medicaid patients with those for the privately insured, was cited by the American Medical Association, the National Center for Policy Analysis, and the Galen Institute, among other groups.

Dayaratna is part of the CDA team that maintains scores of databases and statistical models to support policy research; provides confidential reviews of legislation for members of Congress and the White House; and supplies data and analysis for news organizations. Census Bureau, Internal Revenue Service, Social Security, Medicare and Department of Education are only a few of the agencies and programs included in the databases.

At CDA, Dayaratna instituted the Heritage Energy Model, derived from the Energy Information Administration's National Energy Modeling System, to quantify and help policymakers understand the long-term economic effects of energy policy proposals. In addition to energy modeling, Dayaratna also works on modeling and forecasting the effects of various tax policies.

Dayaratna grew up in Princeton Junction, N.J. He did his undergraduate work at the University of California, Berkeley, majoring in applied mathematics with a specialty in mathematical physics. He also holds two masters degrees from the University of Maryland, one in business and management and the other in mathematical statistics. In 2014, Dayaratna completed his Ph.D. in mathematical statistics from the University of Maryland with specialties in Bayesian modeling and statistical computing. His doctoral dissertation was titled "Contributions to Bayesian Statistical Modeling in Public Policy Research."

Dayaratna is also an adjunct faculty in the Mathematics department at The George Washington Univeristy.

Chairman BRIDENSTINE. I'd like to thank all the witnesses for their testimony. Members are reminded that Committee rules limit questioning to five minutes. The Chair recognizes himself for five minutes.

Dr. Gruenspecht, you talked about the retirement of coal-fired electric generation units. When you talk about the retirement, is that different than just shutting them down?

Dr. GRUENSPECHT. I think those are synonyms in this context.

Chairman BRIDENSTINE. So we could claim that this does shut down coal-fired power plants, which of course is happening in my State of Oklahoma.

Dr. GRUENSPECHT. Well, yes, and it's happening—I mean, again, we had some retirements of coal-fired power plants already——

Chairman BRIDENSTINE. Right.

Dr. GRUENSPECHT. —in part because of the mercury and air toxics standard, in part because, you know, simple aging in some cases and unwillingness to make the investments required to allow those plants to go forward, competing them against—economically against other technologies.

Chairman BRIDENSTINE. Got it. Your analysis found that under the base case scenario, 40 gigawatts of coal-fired electric generation capacity would retire mostly before 2017. Are the 40 gigawatts of retirements in the reference case a result of EPA regulations that are currently in the implementation stage, the 40 gigawatts, are they——

Dr. GRUENSPECHT. I think it's fair to say that the mercury and air toxic standards which, you know, would—the operators of these plants have to make decisions, do I want to invest in the technologies required by that standard, and they look forward and decide whether that's a worthwhile investment. In some cases, it is; in some cases, it's not. In the cases where it's not, they decide to close that plant.

Chairman BRIDENSTINE. So that is—so the answer would be yes, it is based on the current implementation of——

Dr. GRUENSPECHT. Well, and it also reflects the market situation, that natural gas prices have an effect on this as well. It's not the—EPA doesn't get natural gas prices.

Chairman BRIDENSTINE. How many additional gigawatts of retirements did EIA project as a result of the Clean Power Plan? How much additional on top of the 40 gigawatts?

Dr. GRUENSPECHT. Well, it varies across the different cases that we carried out but I think maybe 50 to 60 gigawatts additional.

Chairman BRIDENSTINE. So we're talking about 90 gigawatts being taken, basically being shut down, and based on the implementation of current regulation and then this new rule?

Dr. GRUENSPECHT. And the market.

Chairman BRIDENSTINE. Okay. When did your projections indicate that most of these additional retirements would occur as a result of the Clean Power Plan? When would they occur?

Dr. GRUENSPECHT. Well, the proposed Clean Power Plan rule takes effect in 2020, so most of these occur in that time frame.

Chairman BRIDENSTINE. EIA also analyzed the potential for the Clean Power Plan to affect the heat rate or efficiency of coal-fired power plants. Is that correct?

Dr. GRUENSPECHT. Yes.

Chairman BRIDENSTINE. And EIA's analysis found that under the Clean Power Plan, that coal-fired power plants would be able to improve heat rates by approximately 1.9 percent. Is that correct?

Dr. GRUENSPECHT. I think that's on average what they actually achieved so, again, there are technologies available to improve heat rates. They cost something. Those are considered in the context of other options to comply, and we did find that improvement in heat rates.

Chairman BRIDENSTINE. Are you aware that the EPA believes that coal-fired power plants can improve efficiency by as much as six percent?

Dr. GRUENSPECHT. Right. So we—you know, in our analysis, we did not try to reconstruct their building blocks. I mean, as far as we're concerned, we thought our assignment and I think proper assignment for EIA is to take the standards as given and so EPA had a methodology for coming up with the standards for each state that might have included that assumption, but at some point the states, as I understand it, take the standards as given and then there's a "how do we meet it." So we looked at the "how do we meet it." We didn't second-guess the building blocks.

Chairman BRIDENSTINE. So the six percent, you didn't assume—you're saying 1.9 percent is probably more accurate than the six percent that the EPA claims? My question is, if you could save six percent, why would they not already be doing it? Because they could actually be more efficient, right?

Dr. GRUENSPECHT. Well, that's the classic economist question of a $20 bill on the floor, why didn't somebody pick it up, it can't be on the floor. But no in our analysis, we get something between one and two percent, and some of that is just the change in the heat rate. Some of that has to do with actually investing in these technologies. I think about a third of the plants that remain invest in these technologies. Some of it just reflects the fact that some of the plants that retire or shut down, depending on your choice of words, you know, maybe the less efficient ones tend to be the ones that shut down. So there is some actual investment in heat rate improvement but some of it is just a changing mix.

Chairman BRIDENSTINE. Okay. I'm out of time. I thank you, and I'd like to recognize the Ranking Member, Ms. Bonamici, for five minutes.

Ms. BONAMICI. Thank you very much, Mr. Chairman, and thank you to all of our witnesses.

Dr. Tierney, I especially appreciate how you pointed out that the EIA analysis doesn't fully reflect innovation and disruptive technologies. I think back a couple years ago, Oregon had a feed—in tariff pilot program that sold out in 1five minutes, and there is so much potential out there with new innovations to reduce costs and make a big difference, so thank you for pointing that out.

I wanted to also focus on the fact that it's clear that the EIA analysis does not consider potential health or environmental benefits from reducing CO_2 emissions. Dr. Gruenspecht actually said that in his testimony. But beyond the economic costs associated with changing climate, there are very serious public health risks related to increases in global temperature—longer heatwaves, what

just happened in India—changes in water and air quality, foodborne and insect borne disease, in my state, the risks of fire. Climate change also has the potential to exacerbate existing health conditions such as asthma and adversely affect vulnerable populations like children and the elderly.

So this cost to public health is unavoidable if we do nothing to address the present threat of climate change, so can you please talk a little bit more about what is the effect of improving human health and lowering healthcare costs on the U.S. economy? How does that affect the economy? And might there be some other costs that are borne by the public if we do not implement the Clean Power Plan?

Dr. TIERNEY. Thank you very much for the question. Clearly, the kinds of health benefits that you just described, avoiding asthma, avoiding respiratory illnesses, especially in vulnerable populations like the poor is particularly important. That shows up in the economy in lower healthcare costs around the country. That has economic effects that are quite direct in consumers' pockets but also in local economies that don't have to have the burden of higher healthcare costs. Importantly, additionally, the fact that communities will not have to incur the burden of so many costs associated with addressing the impacts of a changing climate. You described drought, fire, extreme weather events. I didn't love the 112 inches in Boston of snow that we had. It had a cost on people's roofs that we avoid—that we can avoid by avoiding some of the effects of climate change.

Ms. BONAMICI. Thank you. And—thank you very much.

Dr. Gruenspecht and Dr. Tierney, Dr. Gruenspecht, you stated in your testimony that EIA's analysis does not consider the potential health or environmental benefits from reducing carbon pollution under the proposed rule. It's not a cost-benefit analysis. So can you confirm that that's correct?

Dr. GRUENSPECHT. Yes.

Ms. BONAMICI. So is it fair to say that the NEMS model that the EIA uses for its annual energy outlook and for its analysis of the Clean Power Plan is not a comprehensive model of the U.S. economy?

Dr. GRUENSPECHT. Well, there is a pretty comprehensive macro model in NEMS but it's an energy economy model and it definitely doesn't address benefits I think it is fair to say.

Ms. BONAMICI. Thank you.

And Dr. Tierney, if the EIA's analysis does not include the health benefits, how should we interpret the GDP impacts that are presented by the EIA report?

Dr. TIERNEY. I would caution anyone from taking those home to the bank. They are one side of the ledger, and there are a number of co-benefits that will occur to the economy that are not reflected in the EIA's results.

Ms. BONAMICI. And Dr. Tierney, you know, critics of this rule and many other EPA rules claim that the economy and the American consumers will suffer as a result of the agency's efforts to make our environment cleaner. Now, this is contradicted by the fact that the U.S. economy has tripled in size since the adoption of the Clean Air Act. One of the concerns often raised by opponents

is that the Clean Power Plan will cause electricity prices to increase dramatically, but you state in your testimony that the impacts on electricity rates will be modest in the near term and can be accompanied by long-term benefits in the form of electricity bills. Can you please describe how the likely impact that the proposed rule will have? How will it affect electricity rates and bills?

Dr. TIERNEY. Well, let me use an example to explain the kinds of impacts that we have actually observed in states that have adopted carbon control programs for the power sector. If you look at the states of the mid-Atlantic and northeast region, that for now six years have had a cap on the amount of emissions that come from power plants, if you look at where the money flows after power plant owners buy an emissions allowance and that money flows into the hands of state governments, those state governments then have turned those around and invested in energy efficiency programs, allowing customers to reduce their overall energy use and have lower customer bills over time.

We analyzed extremely carefully the flow of dollars around the economy in those ten states for the first three years of the program. We found there were $1.6 billion to the good for those economies. Consumers got lower customer bills in the form of $1.3 billion, reflecting those programs during the first few years.

Ms. BONAMICI. Terrific. Thank you very much. My time is expired.

Thank you, Mr. Chairman.

Chairman BRIDENSTINE. Thank you.

I'd like to recognize Chairman Weber from Texas, Boomer Sooner.

Mr. WEBER. Thank you to the gentleman from the north Texas suburb of Oklahoma.

Dr. Tierney, you said in your testimony that some of the analyses did not take—and it was an interesting term. You said disruptive innovations.

Dr. TIERNEY. Like hydraulic fracturing.

Mr. WEBER. That is in fact what you said, and that's where I'm going. Thank you for saying that. She's ahead of me, folks. That's fracking weird.

At any rate, was that fracking technology described as disrupting the environment by some when that happened, when it became prevalent?

Dr. TIERNEY. I'm sorry. I don't understand your question. I was talking about disruptive technologies from an economic point of view.

Mr. WEBER. A lot of people said that fracking was also bad for the environment. Would you—a lot of people said that it was bad for the environment and was going to affect the water supply and so on and so forth.

Dr. TIERNEY. There's a wide debate. Having been a member of the Secretary of Energy's Advisory Committee on shale gas issues, I know that there are a wide variety of indicators——

Mr. WEBER. I'm just——

Dr. TIERNEY. —of air pollution.

Mr. WEBER. I know, but you recognize that that discourse did take place?

Dr. TIERNEY. Of course.

Mr. WEBER. Absolutely. So it's interesting to me that you call innovations disruptive.

Dr. TIERNEY. All economists would call technologies that are game-changing——

Mr. WEBER. I got it.

Dr. TIERNEY. —disruptive technologies.

Mr. WEBER. I've got you, and I've got a specific question. I'm going to get there.

So the EIA study did not take into account disruptive innovations. Did it take into account the possibility of disruptive regulations?

Dr. TIERNEY. I don't understand the phrase, "disruptive regulations."

Mr. WEBER. You understand the phrase "disruptive innovations," though?

Dr. TIERNEY. Sure. They are game-changing technologies——

Mr. WEBER. Right.

Dr. TIERNEY. —that reduce the cost associated with some activity.

Mr. WEBER. So you might agree that there are also regulations that are game-changing as well?

Dr. TIERNEY. Yes, and in fact, that may occur but this is a relatively modest effect.

Mr. WEBER. Would you call those disruptive as well?

Dr. TIERNEY. I would not call it disruptive.

Mr. WEBER. You wouldn't? That's interesting bias, in my opinion. Let me move on.

Dr. Gruenspecht, the EIA analyzed the impact the Clean Power Plan would have on electricity prices across the country. Now, I'm from Texas. The gentleman from Oklahoma has already lauded that. What impact would the Clean Power Plan have on electricity prices in my home State of Texas under the EIA's analysis?

Dr. GRUENSPECHT. Well, our model is not a state-by-state model but Texas being a big place and having its own region in our model you could look at Texas. So in the base in 2020, the modeling results are 7.3 percent above baseline, in 2030, about .7 percent above baseline.

Mr. WEBER. It's going to cost our consumers money.

Dr. GRUENSPECHT. There are positive impacts in Texas, yes, positive price impacts.

Mr. WEBER. I got you. So Texas has been a great model for success. We've created more jobs in the last 10 or 12 years than all the other 49 lesser states, and so we don't necessarily want to impact that in a negative way. Let me move on.

The EPA's regulatory impact analysis claims that while the price of electricity will rise—you just said electricity costs for consumers will decrease due to lower demand because of "enhanced demand-side energy management," what I might call disruptive regulations. EPA backs up this statement by assuming states can meet a target of 1.5 percent annual improvement in energy efficiency, which would theoretically lead to a decline in demand for electricity over time. But the EIA's report projects a more modest role for demand-side energy efficiency with the increase in electricity prices from

the Clean Power Plan far outweighing, using the percentages you just gave for Texas, far outweighing any decrease in demand. Remember, a decrease of 1.5 percent but you just said seven percent higher prices. Given the analysis of your report, doesn't this directly contradict the EPA's claim that the prices will be higher but Americans' electricity bills will be lower?

Dr. GRUENSPECHT. I think on average, but again, you know, like they say in the television commercials, your results may differ than the average, but on average, we show higher electricity bills even—but not as much as the increase in electricity prices. Again, it kind of goes back to an earlier question. We tried to build in efficiency and have it compete with other options, and we found that we got a lot of renewable generation that was sort of a cheaper compliance approach than some of the investments in efficiency. There are disputes about the costs of efficiency——

Mr. WEBER. Okay. I'm running out of time. The answer is yes, it does dispute the prices.

Mr. Eule, would you agree with that?

Mr. EULE. Yes, I would. My analysis shows that people will be spending $140 billion more over the compliance period.

Mr. WEBER. Got you. And how about you, Dr. Dayaratna? You're agreeing with it too? Turn your mic on, please.

Dr. DAYARATNA. That the cost of electricity will rise, correct?

Mr. WEBER. Right.

Dr. DAYARATNA. Correct.

Mr. WEBER. And it disputes the EPA's findings that the price will go up but the demand for electricity will actually be lower.

Dr. DAYARATNA. I'm not familiar with what the EPA——

Mr. WEBER. I got you. Well, I'm out of time. Thank you for your input. I appreciate that.

Chairman BRIDENSTINE. The gentleman yields back.

The Ranking Member from Florida is recognized for five minutes.

Mr. GRAYSON. Thank you.

Dr. Tierney, earlier this week EPA released a report titled "Climate Change in the United States: Benefits of Global Action." The report describes some of the benefits that we'll see within the century if we take action to reduce emissions, for instance, approximately $3 billion in avoided damages from poor water quality, $11 billion in avoided damages in agriculture, and an estimated 12,000 fewer deaths from extreme temperatures in the 49 major U.S. cities.

Dr. Tierney, do you believe it's important to keep these long-term economic and public health costs of inaction in mind if we continue to promote policies that keep the United States at the forefront of addressing the global threat of climate change?

Dr. TIERNEY. Without a doubt, those are real costs that would be avoided if we are taking steps today to control emissions of greenhouse gases from the power sector.

Mr. GRAYSON. Dr. Gruenspecht, Mr. Eule's testimony states that EIA's analysis demonstrates that the economic costs exceed the climate benefits from this rule. Are you in a position to agree or disagree with that assessment?

Dr. GRUENSPECHT. Again, we only looked at the energy and economic side, not the benefits side, so our study doesn't really speak to that.

Mr. GRAYSON. So to be specific about this, did EIA calculate the economic benefits associated with the implementation of the Clean Power Plan?

Dr. GRUENSPECHT. The health benefits?

Mr. GRAYSON. No, the—well, let's start with the economic benefits and then discuss the health benefits.

Dr. GRUENSPECHT. So we looked at the energy system and the relationship of the energy system to the economy, and we did not look at the benefits in line with our—you know, which is our expertise and our mission.

Mr. GRAYSON. All right. So what kind of benefits other than health, which you mentioned, are not included in that analysis?

Dr. GRUENSPECHT. Again, there are no—there's no discussion of benefits in the analysis that we did.

Mr. GRAYSON. All right. So then you're left disagreeing with Mr. Eule's conclusion that somehow the EIA analysis demonstrates that the economic costs exceed the climate benefits because you didn't weigh one against the other?

Dr. GRUENSPECHT. Well, I think Mr. Eule should speak for himself but I think he did further work, you know, using a social cost of carbon or something. We didn't do any of that. So I'm not saying I agree or disagree. We just didn't address it.

Mr. GRAYSON. Mr. Eule, last month there was an independent peer-reviewed scientific paper published in a journal called Nature, Climate Change. The lead author was Charles Driscoll. Are you familiar with that?

Mr. EULE. No, I'm not.

Mr. GRAYSON. All right. Well, among other things, the research concluded that according to the article, the power sector policy that's been proposed with the great health benefits have the potential to prevent an expected 3,500—3,500 avoidable deaths in the United States each year and more than 1,000 heart attacks and hospitalizations each year from pollution-related illness. Did your analysis take any of that into effect?

Mr. EULE. Not having seen the study, no.

Mr. GRAYSON. Well, with regard to health consequences in general, did your analysis consider any of those?

Mr. EULE. My analysis concerned the climate benefits. EPA in its regulatory impact assessment does monetize co-benefits, and I anticipated a question like this and I have taken a look at the monetized co-benefits that EPA has calculated, and when you run the numbers, the costs still exceed the co-benefits.

Mr. GRAYSON. Well, we can only deal with what you actually report to us. Did your report include any analysis of the health benefits I just described, yes or no?

Mr. EULE. No. As I said——

Mr. GRAYSON. Okay. Then the answer is no. Thank you.

Dr. Dayaratna, what about you? Did your analysis consider any of the health benefits that come from controlling pollution including quite dramatically the 3,500 annual deaths that would be avoided in the United States from this pollution?

Dr. DAYARATNA. Well, like I mentioned, I've run the National Energy Modeling system myself over the past few years at The Heritage Foundation, and this analysis that I presented today was simply based on the EIA's report. I didn't rerun their simulations. But let me just say one thing.

Mr. GRAYSON. Well, how about answering the question?

Dr. DAYARATNA. Yeah, I will.

Mr. GRAYSON. Let's answer it now. I'm running out of time.

Dr. DAYARATNA. Okay.

Mr. GRAYSON. Go ahead, answer it.

Dr. DAYARATNA. Okay, I'll answer it.

Mr. GRAYSON. Yes or no?

Dr. DAYARATNA. Did I do it?

Mr. GRAYSON. Yes, did you do it? I asked you——

Dr. DAYARATNA. My analysis——

Mr. GRAYSON. —whether you did it.

Dr. DAYARATNA. My analysis was regarding just looking at what the EIA did in their report, the analysis of the report.

Mr. GRAYSON. Okay. So then your answer too seemingly very reluctantly is no, you did not consider any of the health consequences of pollution in the United States?

Dr. DAYARATNA. In this—in my analysis that I discussed today, no.

Mr. GRAYSON. Thank you. I'll yield back.

Chairman BRIDENSTINE. Mr. Hultgren from Illinois is recognized for five minutes.

Mr. HULTGREN. Thank you, Chairman. Thank you all for being here.

I do—I'm worried about the President's proposed new and existing source performance standards for a number of reasons, my chief concern being the arrogance of which preordained policy solution is shoved down the American people's throat after they flatly rejected it at the ballot box.

I came to Congress after this House rushed through a cap-and-trade bill, which was thankfully stopped in the Senate. I find it cynical for EPA to then try enacting a regulation that essentially mandates a technology which this Administration has undercut in CCS or requires the implementation of a state-based cap-and-trade system, which the Pope even disagrees with.

My constituents deserve their voice to be heard, and it's voter disenfranchisement to ignore them because they don't agree.

Dr. Gruenspecht, what impact do you find this rule to have on electricity costs above the baseline?

Dr. GRUENSPECHT. Again, over the 2020–2025 period, three to seven percent increase in electricity prices.

Mr. HULTGREN. So Dr. Gruenspecht and Mr. Eule and Dr. Dayaratna maybe as well, what populations and demographics are most affected by increased electricity rates? Dr. Gruenspecht?

Dr. DAYARATNA. Do you want me to go for it? All right. Okay.

Mr. HULTGREN. Go ahead.

Dr. DAYARATNA. Populations all across the board, demographics and populations all across the country, all across the board, especially those in low-income communities, those are particularly in-

cluded, and they will suffer the most, especially people on fixed income as I think Chairman Smith was alluding to earlier.

Mr. HULTGREN. Help me understand, and I'm sorry I missed Chairman's Smith questioning. My understanding is that low-income communities are going to be hit, some already spending more than ten percent of their income on energy certainly carry a higher burden for increased energy costs. Would you agree with that, and is that what your research has——

Dr. DAYARATNA. Absolutely, and in fact, what the analysis illustrates is that average income goes down and their electricity prices go up, so things become even more difficult for these people than just electricity prices going up.

Mr. HULTGREN. This is another thing that I find so ironic about this Administration and this regulation. If the EPA were a lender and their housing risk analysis disproportionately harmed low-income communities, populations of color and seniors on a fixed income, they'd be stuck in disparate impact litigation for so long that they'd probably choose to get out of that business, but I guess we can't even get the Justice Department to go after the most egregious cases involving this Administration.

Mr. Eule and also Dr. Dayaratna, what is the potential impact of the Clean Power Plan on grid reliability?

Mr. EULE. Well, I think any time you have about 30 percent of your baseload power sources coming off the grid at once, I think that poses a very significant challenge to reliability of the grid. This is something that NERC has agreed to, that FERC has agreed to. It's an issue that EPA really hasn't done enough on, and a number of states, 32 states, as a matter of fact, have pointed to reliability issues in their comments to EPA. So this is a concern that's all the way across the board, and unless we do something, we'll probably see more brownouts and blackouts, although EPA might call these unanticipated energy conservation events, but we all know that they will be blackouts. So I think that this is an issue that EPA needs to slow down on and take more time to consider.

Mr. HULTGREN. Dr. Dayaratna, do you have any thoughts on how the Clean Power Plan will impact grid reliability?

Dr. DAYARATNA. I actually have not looked at that question myself but I'm happy to look into it further.

Dr. TIERNEY. Mr. Hultgren, I have examined this very carefully, and the Federal Energy Regulatory Commission has written all five members, Republicans and Democrats, have written to the EPA saying that the tools we have in place today are adequate to handle the reliability issues. The grid operators who have analyzed the retirement scenarios indicate that those will take place over a period of time. It can be handled by the grid operators. That's true in the Midwest, that's true in your part of the country, that's true for both PJM and the Mid-Continent ISO. There is no historical basis——

Mr. HULTGREN. I've got last question——

Dr. TIERNEY. —for identifying the reliability issues.

Mr. HULTGREN. If I could reclaim my time, there's clearly a disagreement on that issue. Some are questioning the reliability there. I certainly am hearing concern from my constituents.

Mr. Eule, if I can wrap up my last 30 seconds, does the EPA rule recognize technology and its limitation in both the short and longer term?

Mr. EULE. I'm not sure. Could you repeat the question?

Mr. HULTGREN. Does the EPA rule recognize technology and its limitation in both the short and longer term?

Mr. EULE. I think the EPA makes assumptions about technologies and technology deployment that many states find unreasonable. That's something we found in our survey of the state comments to EPA. Many states have pointed out that the technology assumptions that EPA assumes just cannot be met.

Mr. HULTGREN. Thank you. My time is expired. I yield back. Thank you, Chairman.

Chairman BRIDENSTINE. Thank you.

I'd like to recognize the gentleman from Colorado, Mr. Perlmutter.

Mr. PERLMUTTER. Thanks, Mr. Chair, and thank you to the panel. Obviously this Committee, we agree on a lot of things, and then there are some places where we are in absolute disagreement, and this may be one of those areas, and I do want to thank my friend, Mr. Hultgren, for bringing up the Pope because the most recent encyclical says let's do everything we can to reduce pollution going into the atmosphere to avoid any further climate change. So I appreciate him bringing up the Pope.

I would like to address a couple things to you, Dr. Dayaratna, and so just I understand, I think I heard in your testimony you think that at its peak at some point, there would be potentially a loss of 200,000 jobs a year.

Dr. DAYARATNA. By 2023, a total of 200,000 lost jobs.

Mr. PERLMUTTER. A total by 2023?

Dr. DAYARATNA. Yes.

Mr. PERLMUTTER. So if I am not mistaken, and you're a mathematician, statistician, right?

Dr. DAYARATNA. Correct.

Mr. PERLMUTTER. Are you familiar with how many jobs we were losing at the end of the Bush Administration per month?

Dr. DAYARATNA. Um——

Mr. PERLMUTTER. About 800,000. I'll help you on that, okay? About 800,000 jobs a month in 2008 and 2009. So total is 200,000 jobs by 2023. Is that your testimony?

Dr. DAYARATNA. Yes, including probably some in your own district actually.

Mr. PERLMUTTER. Well, my guess is that there would be some, but on the other hand——

Dr. DAYARATNA. Including manufacturing jobs.

Mr. PERLMUTTER. On the other hand, we're gaining under the Obama Administration at least 200,000 jobs a month, not 200,000 jobs by 2023 are lost, 200,000 jobs a month, 13 million jobs since the Obama Administration took office.

Now, you had a very interesting statement right at the beginning, and I almost thought you were working for the Obama Administration because you said it with such authority: "For years it has been a primary goal of the Obama Administration to fundamentally expand regulations across the energy sector of the econ-

omy." Is that written down someplace where the Obama Administration has said they fundamentally want to expand regulations, or is that your opinion?

Dr. DAYARATNA. I haven't——

Mr. PERLMUTTER. Is that your opinion, sir?

Dr. DAYARATNA. It is my opinion. Throughout a variety of things that I've seen over the past few years, I have noticed that this seems to be the primary goal—one of the primary goals of this Administration.

Mr. PERLMUTTER. So it is your opinion? Yes or no?

Dr. DAYARATNA. I haven't seen it written down anywhere.

Mr. PERLMUTTER. Okay. Thank you.

So you, I understand, have taken a lot——

Dr. DAYARATNA. Let me just say this, though——

Mr. PERLMUTTER. No, it's my time.

Dr. DAYARATNA. All right. Go ahead.

Mr. PERLMUTTER. You'll get a chance to respond however you like later on.

Dr. DAYARATNA. Okay.

Mr. PERLMUTTER. So you took information from the Energy Information Agency to determine some of your statistics, correct?

Dr. DAYARATNA. Correct.

Mr. PERLMUTTER. Can I have the EIA's solar projections put up there, please? So did you in coming up with your analyses that there would be this job loss, did you take into consideration the growth factor of solar that the EIA has continually underestimated? Did you look at—are you familiar with this chart?

Dr. DAYARATNA. I am not familiar with that chart specifically but I am familiar with the fact that this—these jobs are net jobs overall. So saying that this plan is going to create jobs is essentially like saying minus five plus two is a positive number.

Mr. PERLMUTTER. Minus five plus two, so that would be minus three. Is that right?

Dr. DAYARATNA. Yes.

Mr. PERLMUTTER. I mean, I'm not a statistician but I'm just trying to do the math.

So—but you did not take that into consideration in doing——

Dr. DAYARATNA. Unless the model——

Mr. PERLMUTTER. —your analysis?

Dr. DAYARATNA. Unless the model did. I just used the EIA results from their annual—yeah.

Mr. PERLMUTTER. Can we put up the other one, the levelized costs of energy chart? So this is EIA information too comparing the costs of different kinds of energy technology, and first I'd like to ask, is The Heritage Foundation agnostic when it comes to what kind of energy this country has or is it coal-centric?

Dr. DAYARATNA. I—well, my testimony does not reflect the views of The Heritage Foundation so I'm not going to comment on anything in that regard.

Mr. PERLMUTTER. But when I look at your testimony, it starts off with "The Heritage Foundation." You do it on Heritage letterhead.

Dr. DAYARATNA. Well, if you actually look at the first paragraph, it specifically says that my views do not reflect the views of The Heritage Foundation.

Mr. PERLMUTTER. But you used their letterhead.

Dr. DAYARATNA. There is letterhead on my testimony, correct.

Mr. PERLMUTTER. All right. Well, in looking at the chart, levelized costs of energy, shows the most bang for the buck is energy efficiency. Would you agree with that? I mean, a BTU saved is a BTU earned, right in the middle, so the red sort of energy efficiency and renewable energy sources is blue, fossil fuels.

Dr. DAYARATNA. I'm not sure about the data that's used in this chart so I'm not sure I want to comment on it.

Mr. PERLMUTTER. All right. So you don't remember this chart or this data?

Dr. DAYARATNA. This chart and this data? Off the top of my head, no.

Mr. PERLMUTTER. Okay. Well, my time is expired. I have many other questions if we get to another round. I thank you, sir.

Chairman BRIDENSTINE. The gentleman from California, Mr. Knight, is recognized.

Mr. KNIGHT. Thank you, Mr. Chair.

It seems like a lot of folks have used their own states so I'm going to use mine in my testimony. Have we used California as kind of a model in any of this with the recent legislation that they've passed, the recent RPS standards, the AB–32 passage? Looking at what California has done when we had the five dirtiest cities in 2010, and now that we've passed all this legislation, we have the six dirtiest cities in 2015, can anyone comment on what has happened in California? Have we used this as a good model or is it something that we shouldn't use?

Dr. GRUENSPECHT. Well, we don't give policy advice of what you should do or shouldn't do, but we do incorporate the California programs into our energy outlook. That I will say.

Dr. TIERNEY. One aspect of the California program that is relevant here is that it uses a mass-based approach. It puts a cap on the amount of emissions. California's model is actually economywide. The Clean Power Plan would ask each state to adopt its own approach in the power sector. Many states are looking at joining together voluntarily to choose an approach that would do a multistate mass-based approach. The studies have indicated consistently that that type of approach is the most efficient way to deliver carbon reduction or air pollution benefits, and we've seen that in wide literature on this topic.

Mr. KNIGHT. And I won't speak countrywide, I'll just use California as an example of the things that have happened. Over the last five years, we have gone through AB–32 and RPS and we have tried to lower the standards. We have continually been the highest electric rates in this country, and we have risen by the highest percentage over the last five years in electric rates. Those are facts of legislation that has been passed in California. Those are facts of what has happened in California. Again, we've gone from the five dirtiest cities in this country to the six dirtiest cities in the country with very, very little impact by the legislation that we've passed.

But I guess my question would be more on some of the power that we address in these standards and what we're trying to do, and I'll just go straight down the line. Would we agree that nuclear power is a clean energy that we could use to lower the impacts of

carbon in the air and pollution in the air? And I'll start right with you, Dr. Gruenspecht.

Dr. GRUENSPECHT. Yes. It's just expensive to build new plants but definitely clean in terms of carbon.

Mr. EULE. Yes.

Dr. TIERNEY. Yes, and I hope that the EPA presents a rule that will allow us to retain safely operating existing nuclear reactors.

Dr. DAYARATNA. Correct.

Mr. KNIGHT. I knew that would be a quick answered question.

Again, I'll go back to what we have decided in California that that is not a clean energy and we are trying to get rid of those energy sources, so I'm glad that we would agree that that would be a very clean energy, that that would lower the carbon standards and our carbon footprint, and we could continue on with that.

And with that, I will yield back the balance of my time.

Chairman BRIDENSTINE. The gentleman yields back.

I recognize Mr. Veasey from Texas, Boomer Sooner.

Mr. VEASEY. They weren't saying that at the TCU game last year, that's for sure.

I did have a question that I wanted to ask about affordability. Dr. Tierney, you know, one of the things that I know that you're aware of is that critics of the proposed rule of the EPA claim that American consumers will have to pay more because of the changes. One of the specific concerns highlights that the Clean Power Plan will cause residential electricity prices to increase dramatically, and also it states that residents in certain areas of the country will see higher rates of increase, and one of those regions is in Texas that I represent, and residents in the district that I represent, I represent a very urban area in Dallas and Fort Worth, and it would be really tough for the constituents that I represent for them to see any increases in their utility bills. I'll be very frank with you on that. Which is why I was actually encouraged to see that you disagreed with the report's conclusion on this based on the analysis completed by EIA. Can you please describe in more detail the likely impact of the proposed rule and what it will have on electricity rates and bills?

Dr. TIERNEY. Sure, and I think there are two parts to your question that I'd like to address. One of them is, in a place like California and in other parts of the country where electricity rates may be higher than other parts of the country, the consumers' total bills, total electricity bills, in those parts of the country are lower than other parts because of energy efficiency. The amount of consumption that a poor person in a low-income housing building, they're going to end up paying less per month on total for electricity as a result of this fact that electricity rates may be slightly higher but you're going to spend much less on your total bill. So we've seen that. We've seen that around the country. We've seen that in California. The parts of the country that have invested the most in energy efficiency are places where there is a much bigger economic gain per dollar spent on energy by consumers and by the total economy. So this—the fact that people talk about rates just clouds the fact that in fact what customers do each month is write a check for their bill.

And the second part that I want to address is that those same consumers that are paying for electricity out of one pocket, in a situation where they're going to have lower healthcare costs and lower taxes as a result of their communities not having to address climate change impacts so much, they're going to be paying less out of that other pocket. So the customer or the person living in that community is going to be positively benefited by the kinds of things that are underway here.

Mr. VEASEY. Thank you very much. I'm glad that you talked about that. I think that's important, and I think that's left out of the discussion too often, and for people that do represent, you know, areas like I do, that's a huge concern when we have these particular debates.

Another issue that is very important to the state and the district that I represent is the impact that the rule will have on jobs. A recently released study found that the CPP would result in an increase of 263,000 civilian jobs by 2030, and I understand that you helped analyze the economic impact of a similar regional rule, the RGGI rule. Can you describe the economic impact that RGGI had in its region? And also, can you relate those results to the Clean Power Plan? And what I mean by that is, that you believe the effect on the economy would be similar?

Dr. TIERNEY. Let me address the report that I think you were referring to that has recently been published by the Economic Policy Institute, and there's another one recently published by Industrial Economics. Each of them uses a macroeconomic model, and what they do is look at what happens when consumers may end up spending less on electricity or they might spend a slightly higher amount for electricity but that local economy is hiring people to put lighting fixtures, insulation in homes, new windows, a variety of different things that are job-producing effects. Well, those folks who get those kinds of jobs are then spending their own dollars in the local economy associated with clean energy investments and those are producing jobs that offset some of the other things that may be associated with shutting down a power plant just like we all shut down our cars from time to time when we think that they're old and inefficient. We're seeing here the modernization that's going to lead to jobs in local economies.

Mr. VEASEY. Thank you very much. I appreciate that. My time has expired. Mr. Chairman, go Frogs.

Chairman BRIDENSTINE. The gentleman from California, Mr. Rohrabacher, is recognized for five minutes.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman.

And going over some of the things that have been said here I find quite disturbing, I—let me just note that the CO_2 impact on health has been—we continue hearing CO_2 is a pollutant, CO_2 is a pollutant, and that some people believe that a pollutant actually has to hurt human health in order to be a pollutant and there is great—well, there's not any controversy at all. CO_2 has no direct impact on human health.

I'd like to ask Dr. Tierney, you mentioned that asthma is created by CO_2. Could you give us any type of journal, medical backing for that?

Dr. TIERNEY. I didn't say that.

Mr. ROHRABACHER. Yes, you did.
Dr. TIERNEY. No, excuse me, I did not.
Mr. ROHRABACHER. All right. I'm taking back my time.
Dr. TIERNEY. I did not say that.
Mr. ROHRABACHER. I'm taking back my time. You just said you didn't say it.
Dr. TIERNEY. I didn't.
Mr. ROHRABACHER. The record will indicate whether or not you noted that asthma was a relationship from CO_2.
Dr. TIERNEY. Of the——
Mr. ROHRABACHER. You——
Dr. TIERNEY. —other emissions associated with fossil fuel combustion. I did not say they were from CO_2.
Mr. ROHRABACHER. Oh, well the record will——
Dr. TIERNEY. Excuse me.
Mr. ROHRABACHER. The record will—you used the word asthma and then you went to health impact. I don't know if you're trying to get your message through without being responsible for the message that's actually being delivered but——
Dr. TIERNEY. I will say it very clearly——
Mr. ROHRABACHER. Mr. Chairman, I think I just——
Dr. TIERNEY. —I did not say that CO_2——
Mr. ROHRABACHER. Mr. Chairman——
Dr. TIERNEY. —directly is a health problem.
Mr. ROHRABACHER. Madam, Madam, we have a certain length of time here. Your disregard for that is arrogant and disruptive. Let the members of this committee have their right to ask you questions without you utilizing our time so you won't have to answer more detailed questions. All right?

Let me note that the CO_2—from what I have heard today, the CO_2 health impact comes directly because of what it does to climate change. We've also heard from our opponents today that climate change caused by CO_2 causes droughts, causes floods, causes this rain to—causes more rain, causes less rain, causes things to be colder, causes things to be hotter, has more hurricanes, more rising ocean levels. Let me just note that every single malady that you can think of in the climate is caused by an increase in CO_2 according to what we have heard today from our colleagues on the other side of the aisle.

I, and I believe science, rejects that notion, that CO_2, plugged as—by the way, CO_2 does not itself have a health impact on human beings. We had other testimony here from other witnesses in the past, very—on the other side of this issue who also refused to say that CO_2 actually has a direct impact on people's health. So this idea that there's any savings whatsoever by these CO_2 standards, that that savings is based on the fact that there are health-related benefits by having lower levels of CO_2 is totally inaccurate.

Let me suggest that in terms of—you heard it from our colleagues on the other side of the aisle, that the pipeline—in the past we heard—when talking about exaggerated claims, we heard the pipeline in Alaska was going to eliminate the caribou. We heard that temperatures were going to increase dramatically unless we had something about CO_2 and reduce the CO_2 levels, that the tem-

peratures were going to climb. Well, the temperatures haven't climbed for 17 years.

We have basically heard that the polar bears would be extinct by now and they're not. We have heard that—again, we've heard about more droughts, and even—I—I'm not sure if this is your testimony; I'll go back and check—something about more hurricanes. We haven't had more hurricanes. There have been no more—and the climate is not more aggressive than it was in our time of growing up.

Now, all of these things that supposedly cost money could be put into an equation to show that increasing the electricity bills is actually going to have a positive impact. It's like saying if we break windows, you know, you break the windows of a house, that we're going to benefit by that because you're going to have to hire somebody to fix the window. Well, that makes no sense economically at all. It may seem like it does because there's now a job there, but if that job of fixing the window wasn't there because you didn't break the window, that money would be spent hiring somebody for a job that needed to be done that increased the level of wealth in our society.

I find—it's a good hearing today. Thank you very much. And let me just note we only have five minutes to ask questions, and when someone tries to filibuster that, they're taking away from the validity of the hearing and I resent that. I'm sorry if I lost my temper actually, but we have—we all have a right to—I'd give you an extra ten minutes if I could but I can't. I've got five minutes, so thank you very much.

Chairman BRIDENSTINE. I'd like to thank the gentleman from California.

I would remind all the folks on our panel—and I do—we're going to stick around for a second round at the request of Mr. Perlmutter. I'd remind everybody that our witnesses are here at our request, and as respectful as we can be even when we disagree, that's what we ought to do.

I'd like to recognize the gentleman from Texas, Mr. Babin, for five minutes.

Mr. BABIN. Thank you, Mr. Chairman. I appreciate that.

And I'll say it for you, Boomer Sooner.

Well, I live in Texas, District 36. We have more power plants, petrochemical facilities than any other district in the country. And 63 percent of our electricity is created in coal-fired plants, which is strange and it was a surprise to me when I found this out because the price of natural gas is cheap and very plentiful and being produced readily in my State.

But I had a group of utility folks come to see me last year and complained that if this Clean Power Plan is implemented, that they are coal-fired plants, 63 percent of our electricity is going to be endangered with the—whether you call it retirement or whether you call it just simply closing them on down.

This, according to some of the testimony I've heard today, would increase our utility bills by up to $70 a month and cost the average family of four $2,000 a year in the years to come because of the Clean Power Plan. The EIA analysis projected that coal production would decline under this plan. How much of a reduction in coal

production would occur according to your analysis, Dr. Gruenspecht?

Dr. GRUENSPECHT. Roughly 30 percent. Almost all the coal produced in this country is produced for electric power generation——

Mr. BABIN. Yeah.

Dr. GRUENSPECHT. —so 30 percent reduction generation, 30 percent reduction in coal production.

Mr. BABIN. Does EIA have any projections on the impact of the reduction in coal production—and you may have said this earlier and I just happened to miss it—with regard to employment in the future?

Dr. GRUENSPECHT. I don't think we addressed that in our report. It would depend on——

Mr. BABIN. Okay.

Dr. GRUENSPECHT. —productivity, trends in the industry. You know, coal employment has been falling for quite a while. But—and then rising very recently. But 30 percent, you might look at 30 percent of whatever the projected employment would be would be a good guess since it goes across all regions.

Mr. BABIN. Okay. Dr. Dayaratna, did you have a statistic on that?

Dr. DAYARATNA. Excuse me, on what?

Mr. BABIN. In regards to employment, the impact of rising coal—reduction in coal production with regards to employment.

Dr. DAYARATNA. I—based on the analysis of the Clean Power Plan, I suggested in my written testimony there's some overall impact on employment. Beyond that, I have not conducted any further analysis.

Mr. BABIN. Okay. What would be the impact of the United States, American GDP with regard to coal production reductions? Can anyone answer that one?

Dr. GRUENSPECHT. Well, I think that's included in our basic framework of the .17 to .25, you know, reduction in cumulative GDP over the 2015 to 2040 period. So again, there are losses in coal, there are gains in other things.

Mr. BABIN. Okay. Well, let's switch over real quick and talk about natural gas because this is a big part of our economy, and especially in my district. The EIA analyzed the impact of the Clean Power Plan on natural gas prices, and found that natural gas prices would not rise significantly as a result of the rule. Does this lack of price increase depend on the availability of domestic natural gas?

Dr. GRUENSPECHT. It does take account of that but it also reflects the extensive use of renewables for compliance. There is a pop in gas prices right around 2020, but over time, renewables become more important to compliance and natural gas sort of—we view as returning to our baseline view. But the view of natural gas is a very important part of this thing.

Mr. BABIN. Right. Yeah, Mr. Eule.

Mr. EULE. Just to make one comment about natural gas, EPA's plan really doesn't take into account the infrastructure that would be needed to deliver the gas for its building block two, which would increase dispatch from natural gas plants to the electricity grid. This is a very, very big concern. Siting and permitting is very, very

slow in this country and if we're going to expect to use more natural gas to meet EPA's goals, then we need the infrastructure to deliver that gas to where it's needed. And right now, that's a very time-consuming process.

Mr. BABIN. Absolutely.

Thank you, Mr. Chairman. I yield back.

Chairman BRIDENSTINE. The gentleman yields back.

I'd like to recognize for five minutes Mr. Westerman from Arkansas.

Mr. WESTERMAN. Thank you, Mr. Chairman. And I will add a woo pig sooie to that.

I'd like to thank the panel for coming today.

I've got kind of an interesting background as it relates to this topic. Before I was in Congress, I'm an engineer and I designed industrial manufacturing facilities, including renewable energy facilities. Even the renewable energy facilities had to go by the EPA guidelines for permitting. And another interesting thing, even renewable energy facilities take into account their pro forma analysis of electrical cost and whether to build the facility or move somewhere else where electrical costs are lower.

Also, I did graduate work at the Yale School of Forestry and Environmental Studies, which is a leading institution in environmental responsibility, so I've got a pretty good grasp and understanding of that as well.

In my State of Arkansas we have a wide variety of energy sources. We have coal, natural gas, hydro, nuclear, and we've got a variety of renewables there. We're a relatively small State. We've only got about 16,000 megawatts of total electrical generating capacity and we do export electricity out of Arkansas.

About 40 percent of our power comes from coal. We happen to have the most efficient, low-emission coal plant that can be built. It's the Turk Plant. And thanks to research and technology and better materials, we're able to use ultra-supercritical process. It allows higher temperatures and pressures and makes that facility about 40 percent system-efficient versus 30 percent for a traditional coal-fired facility.

Now, when we look at renewables in my State, we are blessed with an abundance of biomass. That's our largest source of renewable energy there. Our state forestry economists said that we've got right now in excess of 18 million tons per year of growth in our state. That's timber and biomass growth that's not being utilized right now. If every bit of that could be harvested and put into a renewable energy facility making electricity, it would make less than 1/10 of the 16,000 megawatts that are produced that we have in generating capacity right now. We're talking about cutting millions and millions of acres of timber and putting it all in a power plant to make 1/10 of our needs currently.

These regulations create a Catch-22 for a coal-fired plant in my State. They say you have to have an efficiency rate of X, you've got to have an emission rate of Y. When you put the control technology and to get the efficiency rate or to get the emission rate, you lower the efficiency rate, so you've put this coal-fired plant in a position where it can't succeed. If it closes down in the real world it'll make

electrical rates for consumers drop to—or rise to 20 to 40 percent more than they currently are.

So, Dr. Dayaratna, I've got a question for you. In your testimony you indicated that you've used the same economic model as EIA to calculate impacts of the Clean Power Plan. Your analysis has determined that households will see a loss of $2,000 of income as a result of this rule, so what are some of the real-world impacts of a loss of $2,000 of income as a result of the Clean Power Plan?

And also, are the impacts of the plan even greater for families that are on fixed incomes because I've got a lot of families on fixed incomes in my district.

Dr. DAYARATNA. Yeah, thank you for your question, Congressman.

The—I just want to correct something. This is based on the—I didn't rerun the dissimulation myself. This is based on their results that are online. But I have used the National Energy Modeling System myself many times before. So, yes. I suggested in my testimony that during the course of the next decade, as a result of the impacts on GDP, this would cost—the Clean Power Plan will cost a family of four nearly $2,000. And that is roughly the cost of like a full semester's worth of tuition at a local junior college, which is—which isn't trivial at all.

And furthermore, unemployment will increase, jobs will be killed, and this will significantly harm people. It'll make it difficult to move up the ladder in this country. And it will harm people on fixed income.

Mr. WESTERMAN. All right. And moving along, Dr. Gruenspecht and Mr. Eule, can you give us just a brief overview of the cost of electricity produced from different fuels? Like what is the lowest-cost electricity and what is the highest cost if you look at nuclear, Hydro, coal, natural gas?

Dr. GRUENSPECHT. Well, this is a good question and you have to be really careful about this. And it came up in an earlier question by one of your colleagues. You have to distinguish between the cost going forward, so like a coal plant, very expensive to build, you probably wouldn't build it today given natural gas prices, but the cost of running that coal plant is very cheap, you know, relatively cheap, on average across the country, the fuel cost would be $24 a megawatt hour, 2.46——

Mr. WESTERMAN. Let me just move on because I'm almost out of time.

Dr. GRUENSPECHT. Yes.

Mr. WESTERMAN. Is it—have we fully developed renewable technologies or—to make them cost-competitive with traditional fuel sources?

Dr. GRUENSPECHT. I think they're very competitive if you need new fuel capacity. But the issue here is replacing existing generation from existing capacity with new generation from new capacity, and that's the issue. It's not the comparison of the levelized cost that was shown earlier. It's the operating cost of what you have now versus what you will bring in to replace it, which will have to cover not only its operating costs but it's capital costs of building it.

Mr. EULE. May I add onto that? Renewables are also intermittent so they need backup. Oftentimes, when you build renewables, you have to build the transmission lines because where the renewable power is generated isn't where the people live so you have to—the expense of building additional transmission lines. There are a lot of costs involved in—of very rapid build-out of renewable energy that have to be considered.

Mr. WESTERMAN. Where I was leading with that was would it be better to invest more in research to make renewables fit into their place better and utilize the low-cost traditional fuels that we have in place today?

Mr. EULE. And I think the better approach, instead of making cheap energy expensive, it's probably better if we try to make expensive energy cheap.

Mr. WESTERMAN. Thank you, Mr. Chairman.

Chairman BRIDENSTINE. The gentleman yields back.

The gentleman from Louisiana, Mr. Abraham, is recognized for five minutes.

Mr. ABRAHAM. Thank you, Mr. Chairman, and thank the witnesses for being here.

Mr. Eule, I'll start with you and then I'll follow up with Dr. Dayaratna.

This Administration, Obama Administration, has been increasingly relying on the social cost of carbon in order to justify all these regulations that they're throwing out there. Can you please explain the social cost of carbon and some of the controversy surrounding the analysis to measure the supposed benefit of this Clean Power Plan?

Mr. EULE. Sure. I mean the social cost of carbon is a tool that folks use to measure the alleged benefits of producing CO_2 emission. This could be benefits as far as agriculture go, there are some health benefits involved, some benefits to forestry, a whole host of things that go into the social cost of carbon.

It's very controversial. The models that they use, if they're tweaked a certain way, can actually come up with a negative social cost of carbon. So no one quite knows what the level is but that hasn't stopped the Administration from certainly making an attempt to come up with a number. And they have. And when you employ that number and use it compared to the GDP losses that EIA identifies in its model, you wind up still with a negative net—a net cost in GDP to the country.

Mr. ABRAHAM. Okay. Dr. Dayaratna, let me refer to you on this. Would you explain how the models used to calculate the costs are flawed?

Dr. DAYARATNA. Excuse me. You're asking me to—can you repeat the question?

Mr. ABRAHAM. Well——

Dr. DAYARATNA. Yeah.

Mr. ABRAHAM. —Mr. Eule just said that, you know, there's some controversy——

Dr. DAYARATNA. Yes.

Mr. ABRAHAM. —and I guess my question would you please explain how the model is used that he was referencing used to calculate the social cost of carbon are actually flawed? What——

Dr. DAYARATNA. How are they flawed? That's the question.

Mr. ABRAHAM. How—exactly.

Dr. DAYARATNA. All right. Okay. Well, the issue is, firstly, and a variety of issues that I've looked at these in my own research, that there are three integrated assessment models that the EPA has used to compute the social cost of carbon, the DC. model, the FUND model, and the PAGE model. We looked at two of these three models in my research, and the larger issue is that there are extremely sensitive to choices and assumptions.

And when you tweak the assumptions slightly ranging from the discount rate to the ECS distribution to the end year, these models end up trying to make projections 300 years into the future, which is just completely ridiculous. And if you even tweak that to make it say an unrealistic end year, say 150 years into the future, you get vastly different estimates of the social cost of carbon. And in some cases, as Mr. Eule suggested, you can even get negative estimates of the social cost of carbon, suggesting that there are even benefits to carbon dioxide emissions primarily due to like issues like fertilization. So with the results all across the map, their—the tool is just completely unreliable for these purposes.

Mr. ABRAHAM. Okay. Thank you very much.

And I'm going to follow up with you again, Dr. Dayaratna.

Dr. DAYARATNA. Sure.

Mr. ABRAHAM. Your testimony indicated that even if all the carbon emissions were brought to zero in the United States, the global temperature would decrease by 2/10 Celsius. Does that mean, then, that the Clean Power Plan represents only tremendous costs without measurable benefits?

Dr. DAYARATNA. Exactly, yes. The Clean Power Plan will—it's just—it's an extremely expensive way to approach an issue that will provide, you know, negligible impact and it will just kill jobs and stifle the American economy for years to come.

Mr. ABRAHAM. Thank you. Mr. Chairman, I yield back.

Chairman BRIDENSTINE. The gentleman yields back.

I'd like to recognize the gentleman from Alabama, Mr. Palmer, for five minutes.

Mr. PALMER. To continue the theme, "roll tide," and I guess "war eagle" since my kids went to Auburn. But anyway, I want to get into these questions real quick.

You know, there is a lot of talk about how the Clean Power Plan is going to impact the economy and impact job growth. And, Dr. Tierney, you talked about how it's going to lower heating costs, and I think you said something about—that heating costs have gone down in Boston. I think the fact of the matter is is that it's gone up 37 percent and last year was particularly tough on families of the Northeast.

Dr. TIERNEY. You don't have to tell me that.

Mr. PALMER. Okay.

Dr. TIERNEY. I don't know that.

Mr. PALMER. Here's something I want to point out. Now, this is the interesting thing about this is you talk about how this green technology is going to lower energy costs and everything. In December 2005 when the State of Maryland began implementing their plan for going over to renewables, the cost of natural gas was

$13.05 per million BTUs. Do you know what it was in December 2014?

Dr. TIERNEY. It was probably 1/3 of that because of disruptive technologies of hydraulic fracturing and directional drilling that combined were applied—

Mr. PALMER. Well, you're close. You're close. It was $3.48. Now, the interesting thing is is that over that same period of time, household energy costs went up 61 percent. Now, when you start talking about disruptive technology, that's pretty disruptive.

And I also want to point out, you know, Mr. Rohrabacher got a little emotional there and I think he got off topic, but he was talking about asthma rates. And you also made this point that our GDP has tripled since the passage of the Clean Air Act. Since 1980 it's grown 460 something percent. At the same time, vehicle miles driven have gone up 90 something percent, energy output has gone up 32 percent, the population has gone up 38 percent, yet emissions have gone down 50 percent.

Now, the interesting thing about that is is that we've had an explosion of asthma cases. That doesn't quite compute from a health benefit perspective when the air is demonstrably cleaner today than it has been in the last 50 or 60 years, yet asthma rates have gone up. And the other interesting thing about it is is that it's related to income, the problem with asthma. There's a study out of UCLA that indicates that the preponderance of asthma cases in California are among the low-income households.

Now, I want to get into how this new Clean Power Plan is going to impact that. You talked about that one of my distinguished colleagues mentioned that employment has gone up. Well, actually it hasn't. And there's a new report—an article by the CEO of Gallup talking about the big lie, you know, we're reporting that our unemployment rate is below six percent when in fact it's—I've got the numbers here—it's over—thank you. Ignore the buzzer.

The unemployment rate in reality is about 15.8 percent. And the way this was calculated is the reported unemployed U.S. workers is 9 million, involuntary part-time workers is 6.8 million, the marginally attached to the labor force work is 2.1 million, and then the additional unemployed workers with 65 civilian labor force participation rate is 7.—almost 8 million. That's 26 million people who are either unemployed or underemployed or just quit looking.

So I want to point out that when you take into account what's going on with these renewables and the regulatory environment that's been created and the impact on the economy, it's devastating and it's going to have a very negative impact on people's health.

Mr. Eule, I think you wanted to say something.

Mr. EULE. Yeah, the employment numbers you pointed to, very interesting. If you take a look at the employment numbers since the end of 2007 for the rest of the economy other than the oil and gas industry, employment has been essentially flat. In other words, it's about returned to the place where it was at the end of 2007. Employment in the oil and gas sector, because of the disruptive technologies, fracking has gone up about 40 percent. So the energy revolution that's underway now in the United States has really been a driver of employment.

Mr. PALMER. That's the only thing that's really saved us and kept us to this point. Also——

Dr. TIERNEY. But, you know, renewables are cheaper in some parts of the country than a fossil fuel technology. Recently in Minnesota, for example, there was a request to have offers from different suppliers. Natural gas-fired power plants did not beat the price of a renewable project.

Mr. PALMER. If I may reclaim my time, Mr. Chairman, I just would like to point out, though, that there's an offset here and the offset is far more negative than the positive.

So I yield the balance of my time. Thank you.

Chairman BRIDENSTINE. The gentleman yields back. I think we—is there anybody that hasn't been heard? I think we've been through the list on both sides so we're going to go into a second round of questions.

Was that a call for the votes, by the way, that—Okay. Okay.

So we're going to go into a second round of questions as we have time here.

I've been—I obviously—you guys have heard me say Boomer Sooner to my Texas friends on the panel on both sides of the aisle. In full disclosure, I actually went to Rice University in Houston, Texas, which is in Texas, and my constituents are aware of that so I'm going to be okay there.

But one of my good friends Chuck McConnell is the Executive Director of a department at Rice University called Energy and the Environment. He was in the Obama Administration from 2011 to 2013. He was the Assistant Secretary of Energy at the Department of Energy from 2011 to 2013. He wrote an op-ed that was in The Hill recently. He says this: He says "I just spent a day in Washington last month testifying before the House Science, Space, and Technology Committee on the Environmental Protection Agency's recently released Clean Power Plan, specifically the EPA's 111(d) rule. I was honored to be asked to testify and came away simply amazed at the misdirected political rhetoric around climate change that dominated the hearing. I was often offered an insightful and—I was often offered as insightful and concerned inputs about jobs and our environment, was completely disconnected from what this proposed policy would achieve and absent any connection to fact.

This clean carbon plan does not"—and then he says "let me repeat, the plan does not impact CO_2 levels or climate change at any relevant or impactful way." This is a former, you know, Administration official. "Discussion about implementation and policy and economic impact abounds, but the fundamental truth is that this rulemaking does not reduce CO_2 or greenhouse gas to affect the climate. So how disingenuous is it to talk about climate change, jobs, our future, implementation, et cetera? We're acting as if meaningful discussion for our citizens—we're acting as if it is meaningful discussion for our citizens and it masks the facts.

These are the facts for EPA 111(d) if fully implemented." He says this: "Number 1: a .18 percent reduction in global CO_2 output," .18 percent reduction of—he says "The resulting .01 degrees Celsius impact to global temperature," .01 degrees Celsius impact. And if I remember from his testimony, I think these facts were from EPA's own models but I'd have to go back and check that. "A re-

sulting impact of the lessening of global sea rise by an amount equal to 1/3 the thickness of a dime," 1/3 the thickness of a dime, and again, I think that's from the EPA's own models.

"Can we be serious that this is meaningful, relevant, and impactful? EPA Administrator Gina McCarthy"—this is from Chuck McConnell—"EPA Administrator Gina McCarthy has already answered that question in testimony to the House of Representatives in 2013. That answer was and is today "no." McCarthy admitted this fact but added that the United States needed to take this action to gain "political leverage" in the world and show "climate change leadership." This is from one of the Obama Administration's own officials who is now at my alma mater Rice University.

Mr. Eule, you prepared testimony. You referenced the EIA's projection of cumulative reduction of CO_2 emissions by 6.2 gigatons in 2030. How does this reduction compare to global carbon emissions, 6.2 gigatons compared to global carbon emissions?

Mr. EULE. That is 6.2 gigatons saved over 11 years, so it's a very, very small amount. And you get an idea of how small. In 2030 Chinese emissions will offset that 6.2 gigaton reduction in a little over 7 months.

Chairman BRIDENSTINE. So it's—your quote was very, very small.

Mr. EULE. Very, very small.

Chairman BRIDENSTINE. What about emissions from China specifically? Do you have information on that?

Mr. EULE. Information—emissions from China, depending on which model you use, emissions from China, carbon dioxide emissions, not talking about total greenhouse gas emissions, carbon dioxide emissions in 2030 could be anywhere from nine to ten billion-gigatons so——

Chairman BRIDENSTINE. Got it. The EIA describes the impact from the Clean Power Plan on GDP as "equivalent to changes of a few tenths of one percent from the baseline given the magnitude of GDP and disposable income accumulated over the 2015 to 2040 period." Can you elaborate on this generalization, Mr. Eule?

Mr. EULE. It's a significant amount of money, and the way that I calculate it, it's a cost of about $1.2 trillion over 11 years. Even in Washington, that should be considered real money.

Chairman BRIDENSTINE. Dr. Dayaratna, what is the value to a family of four of that GDP impact?

Dr. DAYARATNA. So as I——

Chairman BRIDENSTINE. Will you turn on your microphone?

Dr. DAYARATNA. As I said in my—I was alluding to in my testimony, by the middle of the next decade it would cost a family of four nearly $2,000.

Chairman BRIDENSTINE. Okay. That's good information. Now that I have made the blood boil of my good friend from Colorado, Mr. Perlmutter, I would like to recognize him for—now that my time is expired, I'd like to recognize him for five minutes.

Mr. PERLMUTTER. Thanks, Mr. Chair.

And, Dr. Dayaratna, I want to apologize. I got a little aggressive with you and I'll tone it down. I do want to start with a question for you going back to—you know, for me I'm agnostic as to the energy source or energy efficiency, that we just continued—you know,

the title to our committee is Science, Space, and Technology, technology being the key here as to disruptive technologies that continue to provide more energy at less cost with innovation and invention, okay?

So would you be opposed—there's a company in Boulder, Colorado, called Zolo Technologies. And what they've done is they've taken the ability—these guys are rocket scientists actually from the Jet Propulsion Laboratory, and they're improving the burners of coal-fired power plants to get more power per ton from coal. Would you have any opposition to that in——

Dr. DAYARATNA. In terms of letting innovators do what they want to do in terms of the free market, no.

Mr. PERLMUTTER. So I mean that kind of efficiency is something you would embrace? You know, you're saying if there's a regulation that forces that, you won't embrace it, but just on its own, you would embrace it?

Dr. DAYARATNA. I mean I would have to see the details of that. I mean I came here to discuss the impacts of the Clean Power Plant itself.

Mr. PERLMUTTER. Right. So—but you wouldn't object to more efficient power production, would you, just as a general proposition?

Dr. DAYARATNA. I mean, again, so I would have to see the general details of what you're describing.

Mr. PERLMUTTER. You're going to get me more aggressive here as we go through. You would have to see it. I agree. Okay.

Dr. DAYARATNA. So——

Mr. PERLMUTTER. So, I mean, yeah. I do want to——

Dr. DAYARATNA. The devil is in the details.

Mr. PERLMUTTER. —you to know you have a friend up here who said you're a good guy and for me not to be so harsh on you. So I will not be harsh and I will turn to Dr. Tierney and I won't be harsh on her. I'm going to try to be not a trial lawyer cross examining you all.

Dr. Tierney, I had a slide up there—if we could put the one up on the solar projections—that shows how the EIA has projected solar usage over the last few years, and based on this chart, they've underestimated the construction and the building of new solar generation. Can you comment on that, please?

Dr. TIERNEY. Yes. In fact, if you were to take those annual energy outlooks for many years before 2010, which you're showing on this chart, and look over the past decade, each of the outlooks that EIA has used looking forward to the amount of installed renewables—I'll put it solar, wind, other renewable technologies all combined, they have undershot what has actually happened in the real world in part because the cost reductions of these technologies is moving forward at such a clip that they are coming in at lower cost on an installed basis.

Mr. PERLMUTTER. So based on the cost piece solar is coming in, you know, less per kilowatt hour, wind is coming in less per kilowatt hour, natural gas coming in because of changes through fracking and innovation in the oil and gas industry, less per kilowatt hour, right?

Dr. TIERNEY. Yes. I mean what we saw for natural gas was over a period from mid-2007 to 2012 we saw dramatic increases in elec-

tricity generation. Those have kind of flattened off in some sense because we have not continued to see the declines that we saw over the last year when technology was first being introduced.

Mr. PERLMUTTER. Okay. Dr. Gruenspecht, you wanted to comment?

Dr. GRUENSPECHT. Well, thank you so much for recognizing me.

Mr. PERLMUTTER. You're——

Dr. GRUENSPECHT. Since we seem to direct questions about EIA to everybody but EIA, I think it might be useful——

Mr. PERLMUTTER. You want me to cross examine you?

Dr. GRUENSPECHT. No. I welcome it actually. It'd be very interesting.

Mr. PERLMUTTER. Okay.

Dr. GRUENSPECHT. But I do want to point out, you know, we do pay careful attention to renewables in our projections. I've been reading a lot of press articles. You know, actually there's a publication called Politico that ran something this morning, an appropriately named publication. It should not be called Analytico for sure. The top of this things says in 2009 the federal government's EIA made a forecast for the next two decades wind power would reach 44 gigawatts in 2030 and then just six years later U.S. wind capacity is already up to 66 gigawatts and kind of basically this guy has these interesting tweets and he says we're idiots pretty much. He didn't use that word.

But I would say this, our projections are appropriately developed based on current laws and regulations given EIA's role. You are the policymakers. You and the people at the other end of Pennsylvania Avenue are the policymakers. We don't guess what you're going to do.

I would say that in 2009 this body met and passed something called ARRA, the American Recovery and Reinvestment Act, a very important piece of legislation. We came out in April of 2009 with an update to our reference case of our Annual Energy Outlook, and in that reference case we had a projection for wind energy for 2014. It was, guess what, 65 gigawatts. These projections are not always going to be right, but it is exactly what the capacity at the end of 2014 was.

So, you know, we can play these games and put up charts like this and pretend it's all about technology progress, and there are surprises and there are disruptions, but a lot of what goes on here——

Mr. PERLMUTTER. I'm going to reclaim my time because I wasn't——

Dr. GRUENSPECHT. It doesn't——

Mr. PERLMUTTER. I was not putting this up there as a cheap shot.

Dr. GRUENSPECHT. Okay.

Mr. PERLMUTTER. I was putting this up there to show that there have been improvements. I don't mind that you're conservative in your estimations and your predictions.

Dr. GRUENSPECHT. Thank you.

Mr. PERLMUTTER. You know, the future is always kind of a fuzzy thing for most people.

Dr. GRUENSPECHT. Right. That's not what I said.

Mr. PERLMUTTER. So I was not taking a cheap shot by putting that up there.

Dr. GRUENSPECHT. I say you're not. I'm saying the policy matters so that, yes, there are improvements in technology, yes, there are improvements, but things like a 30 percent tax credit, things like a production tax credit, those are the things that have driven this thing, because in April of 2009, after taking account of the ARRA, we projected the wind capacity at 65 gigawatts, which is exactly what it is in 2014.

You read the article in Politico, which I know you didn't write so you don't have to take credit for it, but——

Mr. PERLMUTTER. I don't read Politico.

Dr. GRUENSPECHT. You shouldn't. It's a waste of time. But I—you know, but basically I say——

Mr. PERLMUTTER. I take it back. I do read Politico from time to time.

Dr. GRUENSPECHT. Well, you——

Mr. PERLMUTTER. I don't want to—yeah.

Dr. GRUENSPECHT. You had extra time then.

Mr. PERLMUTTER. All right.

Dr. GRUENSPECHT. But all I want to say is this——

Mr. PERLMUTTER. Let's——

Dr. GRUENSPECHT. —it's policy as well as—you know, we tell the story and it's legitimate about, you know, unanticipated advances, this and that, but a lot of what happens is driven by policy, and to talk about how off EIA projections are that don't take account of policies, when we take account of the policies like our update after you passed the ARRA, the projections are actually—turn out to be quite good.

Mr. PERLMUTTER. Okay.

Dr. GRUENSPECHT. So again——

Mr. PERLMUTTER. Thank you very much.

Dr. GRUENSPECHT. You're very welcome.

Mr. PERLMUTTER. And I yield back my time——

Chairman BRIDENSTINE. Thank you.

Mr. PERLMUTTER. —and whatever may exist of it.

Chairman BRIDENSTINE. I appreciate Mr. Perlmutter from Colorado——

Dr. GRUENSPECHT. And I appreciate him.

Chairman BRIDENSTINE. I'm glad I'm on the side of the table and not on that side of the table.

I would say, Dr. Dayaratna, you mentioned earlier that the Obama Administration has fundamentally expanded regulations across the energy sector, and I know Mr. Perlmutter got on your case about that. I would just say this: When the President was asked in 2008 as he was campaigning—they asked him at the San Francisco Chronicle, they said are you going to shut down coal? And he said, no, I'm not going to shut down coal; I'm just going to make it so expensive that they won't be able to operate.

Dr. DAYARATNA. Yes.

Chairman BRIDENSTINE. So I would say that your testimony is accurate.

I'd like to recognize the gentleman from Texas, Mr. Weber, for five minutes.

Mr. WEBER. I want to note that the preceding editorial comments about Politico were not necessarily reflecting the views of the management or any other living Member for that matter.

And the President did say, by the way, while he was running to the Chairman over here to my right that under his energy plan electricity prices would of necessity skyrocket, his words, not mine. Find the YouTube. So you're absolutely on track with that.

Dr. Gruenspecht, in your bio here that was along with our notebook, it's written that you were the Economic Advisor to the Chairman of the U.S. International Trade Commission 1988 to 1990.

Dr. GRUENSPECHT. I think that's accurate.

Mr. WEBER. You think that's accurate? Well, I'm glad that at least some of the information we have is accurate. So you kept up with international trade obviously. So following this energy debate, once we shut down coal prices or, as the President said in San Francisco, make it too expensive for them to operate, do you think, based on your experience with the U.S. International Trade Commission, that other countries are going to follow suit or is this going to put us at a—the United States had a comparative disadvantage?

Dr. GRUENSPECHT. I can't speculate on that. I have no—

Mr. WEBER. Fair enough. You don't want to say, that's fine. You have to have an—I would think you'd have an opinion.

Furthermore, in your testimony you basically say on page three of it that "there is considerable uncertainty and many challenges" or—and I'm reading from your testimony—"many challenges are involved in projecting the impacts of the proposed Clean Power Plan."

Dr. GRUENSPECHT. Yes.

Mr. WEBER. You did make that comment? So in your estimation, your opinion, is it worth that kind of uncertainty, all of the downturn in the economy that we've talked about with the minimal uptick on good stuff? Do you know what I'm saying? Do you think it's worth that risk?

Dr. GRUENSPECHT. Well, again, I'm—I mean we did our best job on this thing. We take our role pretty seriously—

Mr. WEBER. Yeah. Okay. How about you, Mr. Eule? You think—with the considerable uncertainty, you think it's worth that risk?

Mr. EULE. The numbers don't indicate that it is.

Mr. WEBER. They don't. Let me just follow with what Dr. Babin said earlier about the coal industry. I looked it up on Google real quick and there was 174,000 jobs in the coal industry, so I think the figure thrown out there was 30 percent reduction. So, you know, do the math. That was 174,000 direct jobs. So—and then there was a lot of indirect jobs that—a lot of jobs that were supported indirectly by the coal industry. It's not worth that risk.

Let me move on here. You also said in your testimony, Dr. Gruenspecht, since you wanted to be cross examined——

Dr. GRUENSPECHT. I was getting a little bored.

Mr. WEBER. You were getting a little bored? You looked a little sleepy there for a minute. You said that the construction of new generation to comply with the Clean Power Plan may necessitate upgrades and expansion of electric power transmission systems. We would call that infrastructure. Okay.

Dr. GRUENSPECHT. That's right.

Mr. WEBER. Additional costs. So you're actually—there's another factor in here that we don't know what that would require that's going to be the additional cost, which would further increase the price of electricity possibly. Now, on page five of your testimony—I'm sorry, on page three of your testimony, again you said in the last paragraph "NIMS does not consider how deliverability of natural gas to power plants using that fuel might be impacted." And there at the very bottom you said because of the shift away from coal toward "intermittent" renewables, is intermittent another word for unreliable?

Dr. GRUENSPECHT. Intermittent is a—means that you can't dispatch them. You can't just order them to turn on when you want them.

Mr. WEBER. So when you want them and they're not there, would you say that—would you admit that that's unreliable?

Dr. GRUENSPECHT. Well, it's not available. You have to do something else.

Mr. WEBER. Okay. Well, to me when energy is not available when you want it, that seems pretty unreliable, not that I'm putting words in your mouth. Okay.

Dr. GRUENSPECHT. You'd have a hard time doing that.

Mr. WEBER. You know, I can believe that.

Now, let me just tell you, you also said earlier that we were the—just in your recent exchange with the cross examiner over here to my right——

Dr. GRUENSPECHT. My friend.

Mr. WEBER. Your newfound friend, your BFF, that we are policymakers along with the gentlemen at the other end of Pennsylvania Avenue or something like that.

Dr. GRUENSPECHT. That's right. We're located right in the middle.

Mr. WEBER. In theory, that's supposed to be true but the truth of the matter is when the EPA unilaterally under the President's direction decides to implement these kinds of policies, that actually takes Congress out of the policy decision-making chair. So I just want to opine on that.

Finally, I own an air-conditioning company, 34 years. I can tell you about power. I can tell you about SEERs, seasonal energy efficiency ratings.

Dr. GRUENSPECHT. Yeah.

Mr. WEBER. I can tell you about the number of amps compressors draw on. I can tell you about the number—the houses and the cooling bills and what they use in Texas in the way of energy. And I will just tell you that when you take a family on a low income and they need a new air-conditioning system and the standard efficiency is going to cost them 4, 5, 6, $7,000 to put that new system in their house but a high-efficiency—let's say $5,000—but a high-efficiency system is going to cost $8,000, trust me, based on 34 years' worth of experience in the Gulf Coast of Texas, they're going to opt for the lower efficiency equipment. So when you drive energy prices up, they're not only not going to be able to take advantage of them, they're going to have less money in their pockets even to

buy high-efficiency equipment. And so I take this very seriously when we start increasing their price.

Mr. Chairman, I'm going to yield back.

Chairman BRIDENSTINE. The gentleman yields back.

I do need a new air-conditioning unit in my home so I'll probably be giving you a call.

Mr. WEBER. 281–4859.

Chairman BRIDENSTINE. I'd like to recognize the gentleman from California, Mr. Rohrabacher, for five minutes so long as he commits to not yell at the witnesses.

Mr. ROHRABACHER. All right. Well, I think if my colleague from Colorado can be so gracious as to apologize for being too combative, I, too, can be that gracious and apologize for being too combative with Dr. Tierney.

And as I said, I would give you the time if I had it and I do have the time, so I'm going to yield one minute and a half to Dr. Tierney, who has got lots of comments and hasn't been able to make them because we've had witnesses on the side, whatever you'd like to put into the record now about what you gleaned from this hearing.

Dr. TIERNEY. Congressman, that was so generous.

Mr. ROHRABACHER. All right.

Dr. TIERNEY. And I apologize in turn for stepping on your own words, so thank you very much.

Mr. ROHRABACHER. All right.

Dr. TIERNEY. I appreciate that.

I think the one thing that I want to say is with regard to this question of whether or not acting through the Clean Power Plan will make a difference in the emissions that contribute to climate change, in the world, 1 out of every 15 tons of omissions anywhere in the entire globe comes from the United States' power generation sector. Reducing ten percent, reducing 20 percent, reducing 30 percent of that would—is equivalent to the tons of emissions that are produced by scores of countries around the world. This will make a difference and it will be affordable by the United States.

It does—global warming is causing tremendous impacts around globe. I'm not a Catholic person—I mean I'm not a Catholic. That sounds crazy what I said. I am not a member of the Catholic Church. I am so impressed that we have a global leader who has written and is cyclical who has talked about the impacts of a warming globe on the poorest of the poor around the world.

We can make a difference here. It is worth doing. We are not going to kill jobs. The economy will come out in a robust fashion. We are Americans and we can do this. Thank you very much.

Mr. ROHRABACHER. All right. Well, thank you. And let me——

Chairman BRIDENSTINE. Try not to yell.

Mr. ROHRABACHER. Let me just note that we—there are fundamental differences in the analysis of what the science says. And as I say, when I have heard over the—my lifetime, I remember when Jacques Cousteau when I was a young reporter told me that the oceans would be black goo within ten years. And I'm a surfer and I can tell you that oceans are not black goo. I was just out on a surfboard last weekend. I actually had a word that we had 66 peo-

ple on one surfboard in Huntington Beach and I'm very proud of that.

Dr. TIERNEY. So I used to do body surfing at the Wedge growing up as a girl, so I know this well. I was raised in Redlands, California. I'm going out with you.

Mr. ROHRABACHER. You know what, we probably were body surfing at the Wedge together. It was my favorite spot when I was younger.

Dr. TIERNEY. Me, too. It was awesome.

Mr. ROHRABACHER. Okay. There you go.

Now—but with that said, people who are benevolent people can disagree and disagree aggressively. I certainly disagree with the idea that CO_2 is causing any change in the climate, especially manmade CO_2, which is only ten percent of the CO_2 that's in the air. And all of the CO_2 that we're talking about, the minimal amount that this draconian regulation is going to have on our society, even that tiny bit is just what mankind or what Americans of mankind are contributing. We're talking about a microscopic impact if there is any impact on CO_2 at all on our climate.

But the cost, and then again here we go into the cost that we're being said is a—compensates for this is going to be that our health benefits are going to be better or because people—if indeed the climate is better, fewer people will get sick, there'll be less people dying in India because of the heat waves or Boston because of the snow in the winter time. It just doesn't pencil out. And when it doesn't pencil out, it means there's less wealth in the society.

Efficiency through better technology does mean there's more wealth in society. But efficiency that's generated by regulation, as we have heard here, is most often accompanied by mandatory controls and/or, I might add, tax supplements which cost the federal government revenue that could go into education and other type of programs for today.

So when you're consuming wealth in order to promote technology that would not otherwise be implemented, that wealth is not available for the other things government has to do. And if we take it out of somebody's pocket, personal pocket, then they don't have the money to pay for their kids' junior college education. So there's really a cost that we may disagree on that and I don't believe that the health benefits that will derive from changing the climate—and of course we don't believe the climate will change on this—but those health benefits in some way are going to offset the cost of what we're—of what's being imposed by these regulations.

And thank you very much for understanding.

Chairman BRIDENSTINE. The gentleman yields back. That was actually quite nice. And I think I might like the other Dana Rohrabacher better.

The gentleman from Louisiana, Mr. Abraham, is recognized for five minutes.

Mr. ABRAHAM. Thank you, Mr. Chairman. It won't take that long.

Just one quick question to follow up on—Dr. Gruenspecht, I'll direct it to you. What's the total estimated loss to the GDP in dollars, not—we've been talking about tenths of percent and that type of—

on the Clean Power Plan, but the estimated cost in dollars year-to-year is analyzed by the EIA.

Dr. GRUENSPECHT. It's cumulative over 2015 to 2040——

Chairman BRIDENSTINE. Will the gentleman turn on his microphone?

Dr. GRUENSPECHT. Excuse me, sir. Cumulative over 2015 through 2040, it's 1 to 1–1/2 trillion—3—depending on how you——

Mr. ABRAHAM. Three with a T?

Dr. GRUENSPECHT. Trillion with a T.

Mr. ABRAHAM. Okay.

Dr. GRUENSPECHT. So again, there are two figures, figures 38 and 39 that show the same information. You know, it's all a question of framing. Different people want to frame this in different ways. We try to frame it pretty neutrally.

Mr. ABRAHAM. Okay. That's all I had, Mr. Chairman. Thank you. I yield back.

Chairman BRIDENSTINE. The gentleman yields back. This is the end of our hearing. I thank the witnesses for their valuable testimony and the Members for their questions. The record will remain open for two weeks for additional comments and written questions from the Members.

The hearing is adjourned. Thank you.

[Whereupon, at 12:30 p.m., the Subcommittees were adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Howard Gruenspecht

QUESTIONS FROM REPRESENTATIVE JOHNSON

Q1. Every year EIA publishes an *Annual Energy Outlook Retrospective Review* comparing its Reference case projections against realized outcomes. The most recent version, published in March 2015, provides projections and comparisons for gross domestic product, petroleum, natural gas, coal, electricity, total energy, total carbon emissions, and energy intensity. It does not cover renewable sources (utility-scale or distributed generation- scale), nuclear energy, pumped storage/other, conventional hydroelectric power, biomass, fuel cells, or distributed generation natural gas, though these are recognized categories of generation in the Reference Case tables.

a) Please explain the rationale that determines what categories are included in the *Retrospective Review* and why the other categories listed above are not included for comparisons.

b) For each of the following categories, please explain whether EIA has access to the data needed to provide *Retrospective Review* comparisons for price, capacity, and generation.

1. Conventional hydropower
2. Geothermal
3. Biogenic municipal waste
4. Wood and other biomass
5. Solar thermal
6. Solar photovoltaic- utility-scale
7. Solar photovoltaic - distributed generation-scale
8. Wind- on-shore
9. Wind- off-shore
10. Energy efficiency- residential, industrial, and commercial

c) If EIA has sufficient data to provide *Retrospective Review* comparisons for some or all of the categories listed above, please describe which categories EIA plans to include in future *Retrospective Review*.

d) If EIA has sufficient data but has no plans to expand the categories currently analyzed in the *Retrospective Review*, please explain why additional categories will not be considered.

e) If EIA does not have sufficient data to provide *Retrospective Review* comparisons for the categories listed in (b) above, please describe:

1. what data EIA would need for each category listed in (b) that would enable a *Retrospective Review* comparison,
2. what, if any, additional legislative authority would be needed to collect this data, and
3. any other limits that prevent EIA from collecting this data.

A1a. The *Retrospective Review* was first published in 1996 as the *Annual Energy Outlook Forecast Evaluation*, (see Issues in Midterm Analysis and Forecasting 1996, DOE/EIA-0607(96), August, 1996). The express purpose of the first review was to compare "projections for major energy variables from the reference case" from each of the *AEOs* published beginning with *AEO82* with actual historical data. Focusing on major variables provides a cogent analysis of overall results. The *Retrospective Review* was designed to be inclusive of the entire U.S. energy system, commensurate with the coverage of the *AEO* itself. Thus the need to evaluate a limited set of indicators for any one portion of the energy system, such as the electric power sector, also follows from the need for consistency while maintaining a manageable final publication. Including ten additional electric power indicators would provide inconsistent coverage in the *Retrospective Review* unless several dozen detailed indicators within other sectors were also included. The limited availability of more detailed concepts from earlier *AEOs* is another reason for this emphasis. NEMS is continuously evolving in detail and sophistication as computing resources become more powerful, as energy markets evolve, and as more complete or more granular data become available. The more recent *AEOs* have more detail than earlier editions but the purpose of the *Retrospective Review*, to compare projections for major energy variables, has not changed.

More detail perhaps as background: In that original AEO Forecast Evaluation publication, 16 major forecast concepts were evaluated. By category there were 5 energy consumption and sales concepts, 3 production concepts, 3 import and export concepts, and 5 price concepts and income concepts. Over the years, the evaluation categories have changed slightly and expanded some to now include 21 concepts (including 4 nominal price comparisons). Considerations for modifying or adding a concept include changes in the availability of historical data (e.g., EIA no longer reports historical wellhead natural gas prices due to data quality concerns) and having forecast results for a candidate concept over a series of AEOs (the NEMS has expanded its analytical detail over the years and older AEOs may not have had explicit projections for some concepts). Some examples of changes in concepts reported in the Retrospective Review are: disposable personal income was replaced by real GDP, natural gas wellhead prices were replaced by natural gas prices to the electric power sector, nominal

price concepts were added to complement the real dollar price concepts, energy consumption by major end user category was added, and carbon dioxide emissions and energy intensity were both added.

A1b. In many cases a full set of results for older *AEOs* cannot be constructed because either the *AEO* did not project a concept or because actual data for a concept is not available. There is no price data for any of items listed in (b) above in either historical data or model projections. With respect to data on capacity and generation of renewables, the *Monthly Energy Review* (or at the time of many *AEOs*, its predecessor publication, the *Annual Energy Review* or *AER*) has evolved in its data reporting as new sources appear and become relevant. As an example, the *AER2001* included expanded renewable energy data for the end use sectors and for the first time explicitly included MSW in the commercial sector and PV in the residential and commercial sectors. The attached schedules from the Monthly Energy Review provide detail by fuel/technology for wholesale and retail production and consumption.

A1c. EIA has no plans to expand the *Retrospective Review* at this time.

A1d. EIA has no plans to expand because the purpose of the *Retrospective Review* has always been to focus on a limited set of energy variables across the entire U.S. energy system, and expanding to consistently include more indicators in the full range of NEMS/AEO coverage would result in a much more labor-intensive product that could be of limited further use to the public.

A1e. Any missing historical data cannot be easily reconstructed or may be impossible to reconstruct with sufficient quality. The importance of timely and well-scoped energy survey data in the first instance cannot be overstated.

Q2. EIA collects and reports on price data for petroleum, natural gas, and coal in the *Annual Energy Outlook* Reference Case, but does not provide price data for renewable energy sources. During the hearing, there were concerns expressed about how EIA calculates costs and prices of renewable sources.

a) For each of the following categories, please explain whether EIA collects price data for:
    1. Conventional hydropower
    2. Geothermal
    3. Biogenic municipal waste
    4. Wood and other biomass
    5. Solar thermal
    6. Solar photovoltaic- utility-scale
    7. Solar photovoltaic- distributed generation-scale
    8. Wind- on-shore
    9. Wind- off-shore

b) If EIA does collect price data, please list:
    1. the sources of the price data for each of the categories listed in (a) above,
    2. the frequency of data collection for each of the categories listed in (a) above,
    3. whether the data collected is sufficient for EIA to provide price summaries in the Reference Case tables, and
    4. whether EIA has any plans to begin providing price summaries for renewable energy in its Reference Case tables.

c) If EIA has sufficient data to provide price summaries for some or all of the categories listed in (a) above, please list the categories that will have price summaries provided in future Reference Case tables.

d) If EIA has sufficient data but has no plans to provide price summaries for renewable resources in future Reference Case tables, please explain why price summaries will not be provided for each category.

e) If EIA does not collect price data, please describe for each category in (a) above:
    1. what data EIA would need for each category to calculate or estimate price summaries
    2. what, if any, additional legislative authority would be needed to collect this data, and
    3. any other limits that prevent EIA from collecting this data.

A2. In its Annual Energy Outlook (AEO), EIA reports the price of fuels used to produce electricity, including petroleum, coal, and natural gas (the price of a gallon of fuel oil, ton of coal, or cubic foot of natural gas). The renewable resources listed in the question are not typically marketed as fuels, and therefore have no price to report or project. EIA does not

report or project the price of electricity generated from petroleum, coal, natural gas, or any of the listed renewable resources. Instead, EIA reports and projects the wholesale and retail price of electricity. EIA also estimates the cost of generating power from different resources, but as discussed below, cost does not always reflect price.

The price-setting mechanism for electricity varies across the U.S., but in most cases, it is not possible to accurately determine the "price" of electricity generated from a particular fuel or resource. In states with cost-of-service regulation, electricity prices are typically set based on the overall cost of meeting electricity demand, including the cost of building and operating a portfolio of plants, and resource-specific component prices neither known nor calculable. Other states or regions use market exchanges to buy and sell electricity; prices in these exchanges are typically set by the highest bidder, and all resources below that bid receive the same price, regardless of the resource used to produce the electricity.

In both types of markets (cost-of-service and power exchange), some power may be bought and sold using private, bilateral contracts (known as power purchase agreements or PPAs). While the Federal Energy Regulatory Commission (FERC) collects data on the terms of PPAs, the data collection design does not support reporting by resource type, and would require substantial EIA resources and/or modification of the data collection effort by FERC to develop reportable statistics from that data. Furthermore, more than 60% of U.S. electricity is generated by utility-owned plants, and would not typically be covered by a PPA. Any estimated price for the electricity produced would not necessarily be representative of average prices, especially for electricity generated from hydroelectric or coal plants since 75% to 90% of the electricity generated by those facilities are owned by utilities operating under cost-of-service regulation.

In the supporting documentation to the Annual Energy Outlook (AEO), EIA reports its assumptions for the capital cost of various conventional and renewable electric generating technologies, including those listed in the question. EIA also reports the levelized cost of electricity for these technologies in an annual supplement to the AEO. While the capital costs reported for electric generation technologies reflect EIA's estimate of the price paid for a

given power plant, it does not include fuel or operating costs, and does not necessarily bear much relationship to the price paid for the electricity generated from each plant. The levelized cost of electricity does account for fuel and other operating costs, but is not necessarily useful as an estimate of price, since pricing mechanisms consider many other factors (as indicated above).

Q3. EIA's projections for energy efficiency under the CPP Base Policy case, and under the two CPP energy efficiency (EE) sensitivity cases (CPPEENO and CPPEEHI) suggest that consumer electricity bills will be highest under the policy with high energy efficiency. This seems counterintuitive, as energy efficiency is often cited as a major tool in reducing the costs of implementing the Clean Power Plan. In a September 2013 Issue Brief on energy efficiency, written by the Edison Foundation whose electric utility members represent about 70 percent of the electric power industry, the authors conclude "the value of EE goes far beyond the avoidance of building generation. Demand-side resources- both efficiency and demand response- are an increasingly important asset to the modern grid."

Please provide a list and description of the cost categories that were included in estimating the costs of demand-side energy efficiency in EIA's Analysis of the Impacts of the Clean Power Plan.

A3. Energy efficiency plays an important yet limited role in EIA's Analysis of the Impacts of the Clean Power Plan because competing compliance options are available within a narrow range of incremental cost. Across the CPP EE side cases, renewable capacity and generation provide the trade-off for EE expenditures and demand reductions. Because of the fairly uniform cost and performance characteristics of renewable power capacity, additional capacity builds tend to remain at roughly the same incremental cost when more or less is added to the power system. But energy efficiency costs increase as more is added to the system, effectively appearing as a more typical upward-sloping cost function as opposed to the renewable capacity which exhibits a 'step' function with fairly flat segments separated by discontinuous jumps or steps. Natural gas combined cycle plants, the other main competing compliance option, also exhibit this incremental cost step function (which is common in capital-intensive industries like electric utilities and airlines, if analyzed in sufficient detail). This creates the seemingly counterintuitive effect in the analysis: for any given level of emission rate control, and given all the other factors in the model (fuel prices, transmission constraints, etc.), there is a modeled level of EE in the system compliance mix. This level is largely determined not by the bill impact of the EE spending (which is on net positive because

the least expensive EE was already picked up in the no-policy baselines), but by the reduced system cost of avoiding more renewable capacity and generation to meet the emissions rate standard. In other words, at the modeled EE level all of the available emission reduction options have the same incremental system cost. Any further EE spending after this point comes at higher cost because the EE continues to increase in incremental cost while the competing compliance option (renewables or gas) does not due to the 'flatness' of the incremental cost function. Differences in utility fuel costs also play a part in affecting electricity prices and in turn, electricity bills. Both EE sensitivity cases result in less pressure on natural gas-fired generation, mitigating the price rise for natural gas. In the CPPEENO case, increased renewable generation reduces the pressure on natural gas while in the CPPEEHI case, lower electricity sales are responsible. It is also the case that if the renewables and natural gas were assumed to be more expensive, more EE would be included in the compliance mix.

Two cost categories were included in estimating the costs of incremental demand-side EE spending in EIA's Analysis of the Impacts of the Clean Power Plan.

1. **Subsidies** to encourage consumer adoption were included in the form of direct rebates that decrease the installed capital cost of energy-efficient equipment. Subsidized end uses include space heating, space cooling, water heating, ventilation, lighting, refrigeration, and residential building envelopes. In the analysis, rebate portfolios were assumed to vary by region in terms of the implementation, timing, and level of end-use subsidies. Portfolios were assumed to be fully deployed by 2025 in all regions with rebate levels reaching 15% of the installed capital cost of efficient equipment. This category is comparable to the "Incentives" category of annual costs included in the energy efficiency program information collected from electric power industry entities on Form EIA-861.

2. **Additional efficiency program costs** were assumed to add 50% to the total cost of equipment rebates. This category is comparable to the "Direct Costs" category of annual costs included in the energy efficiency program information collected on Form

EIA-861. Based on the EIA-861 efficiency program data, total Direct Costs added 79% to the total cost of Incentives in 2012. We assume some economies are achieved in expanding existing efficiency programs leading to the assumption of 50% for additional program costs.

Responses by Dr. Susan Tierney

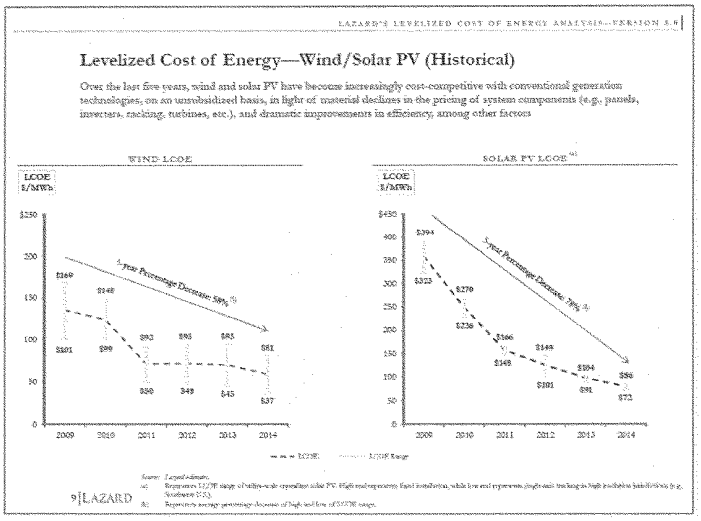
Tierney Responses to Questions from the June 24th, 2015 Hearing on the Impacts of the Clean Power Plan
House Committee on Science, Space and Technology, Subcommittee on Environment and Subcommittee on Energy

Renewable Deployment Projections

Dr. Tierney, during the June 24th hearing, various members asked questions about the outlook for renewable energy and its role in the Energy Information Administration's 2015 analysis of the Clean Power Plan. Is there anything you'd like to add, including with respect to the following questions?

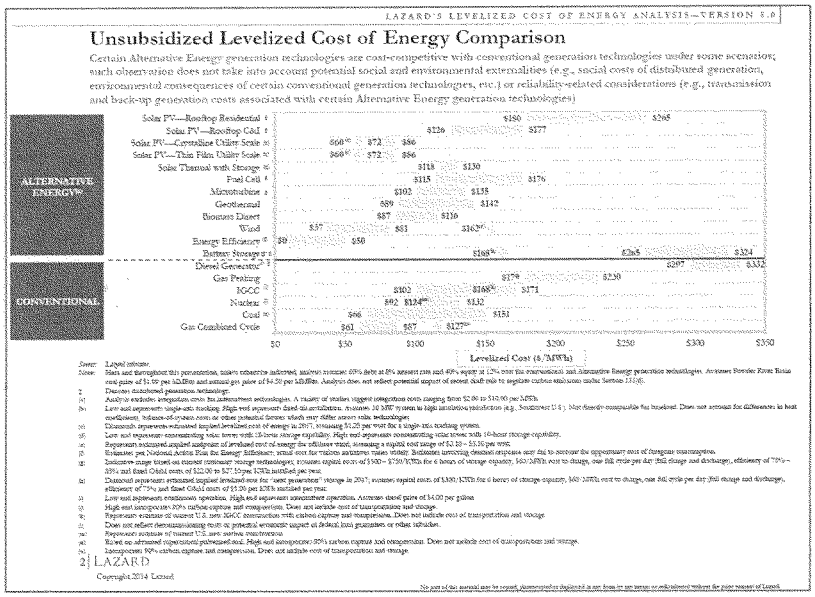
- ***What can you provide us about trends in the costs of various renewable energy technologies (like wind and solar) over the past decade (or more)?***

Many organizations track the trends in costs of renewable energy technologies. For example, Lazard (the financial advisory, asset management and investment banking firm) publishes annual reports on the cost characteristics of energy technologies. Lazard's most recent report on levelized costs of energy technologies (Version 8.0, September 2014) presents information showing the declining costs of wind and solar photovoltaic ("PV") over the past half decade, and states that "Over the last five years, wind and solar PV have become increasingly cost-competitive with conventional generation technologies, on an unsubsidized basis, in light of material declines in the pricing of system components (e.g., panel, inverters, racking, turbines, etc.), and dramatic improvements in efficiency, among other factors." For wind, the 5-year decline in costs was 58 percent; for solar PV, it was 78 percent, as shown in the figure below.



- ***In light of such trends, how important are renewable energy technologies in helping the U.S. meet both its climate and our energy-security goals over the next decades?***

The improving, relative cost competitiveness of renewable technologies will make them increasingly attractive in U.S. electric systems. The same Lazard September 2014 Lazard report anticipates continued decline in costs of wind and solar technologies in the next few years even in the absence of federal tax subsidies. As shown in the Lazard chart below, the costs of wind solar PV (e.g., utility scale) are cost-competitive with natural gas combined cycle technologies on an unsubsidized levelized cost basis, and have lower costs than new coal, nuclear, or natural-gas peaking facilities.



- ***What relevant information can be found in recent reports of other pre-eminent groups (e.g., the International Energy Agency; the National Academy of Sciences; the National Renewable Energy Laboratory)?***

Several of the U.S. Department of Energy's national laboratories also track costs of renewable technologies relative to other energy technologies. For example, the National Renewable Energy Lab's "Open EI" (Open Energy Information) website tracks and updates energy cost estimates in the literature. See http://en.openei.org/apps/TCDB/.

Bloomberg New Energy Finance ("BNEF"), which publishes data on clean-energy investment and comparative costs of different energy technologies both in the U.S. and abroad, indicates the substantial growth in investment: "The US clean energy sector has seen $35-65bn of investment each year since 2007 and has totalled $386bn over that period. These annual investment tallies are much higher than the levels a decade ago ($10.3bn in 2004), indicating that the industry has greatly matured. Investment in 2014 was $51.8bn, a 7% increase from 2013 levels." BNEF, Sustainable Energy in America Factbook, 2015: http://www.bcse.org/wp-content/uploads/BCSE-2015-Sustainable-Energy-in-America-Factbook-Executive-Summary.pdf.

The International Energy Agency ("IEA") estimates that in light of rapid cost reductions and public policies addressing clean technology, approximately two-thirds of the new annual power-plant investment in the U.S. between 2014 through 2020 will be for renewable energy, This new annual investment outlook is double the annual rate during the 2000-2013 period, indicating the improved competitiveness and attractiveness of wind, solar and other renewables. IEA, Special Report: World Energy Investment Outlook, 2014, page 165. http://www.worldenergyoutlook.org/investment/

- ***EIA's analysis indicates that expanding the use of renewable resources will actually reduce the number of existing coal-fired plants at risk of retirement. Can you explain how this could be the case, since it seems a bit counterintuitive?***

I agree that this is counterintuitive. The reason for this result, though, is relatively straightforward: for a given amount of carbon emissions that may be emitted from a power system, if there are more zero-carbon renewable resources providing electricity to a system, its lack of carbon emissions will allow for more "room" for carbon emissions from a carbon-intensive generating resource like a coal-fired power plant. By contrast, if natural-gas-fired generation is the predominate alternative generating resource to displace output at coal plants, then there will be less room for coal (which is roughly twice as carbon-intensive on a CO_2/MWh basis, than natural gas, when than the latter is consumed at combined-cycle power plants).

- ***Is there anything you would like to add about the prospects for storage technologies to support the adoption of renewable energy?***

Storage technology at commercially competitive prices and at scale would be a game-changer to support integration of intermittent resources like wind and solar. Storage – whether in pumped-storage systems, or battery technologies, or flywheels, or thermal storage (e.g., ice-storage systems), or compressed-air-energy storage systems, or other storage technologies – allows for the ability of an electrical system to absorb and store excess output from wind or solar resources when it is producing power (i.e., when it is very windy or very sunny) and then to re-inject the stored power supply into the system when the wind or solar resources are not producing power. Different types of storage technologies allow

for different functionalities, from ones that allow for extremely versatile and controllable two-way energy storage and release, to ones that allow for storage across seasons or hours of the day. Grid operators would be able to dispatch such stored energy to balance the system and essentially turn a non-controllable resource (i.e., wind or sunshine) into a dispatchable resource. Considerable work is underway by researchers and private companies to demonstrate the technical and commercial viability of a wide variety of technologies with differentiate functional capabilities for electric systems.

Energy Efficiency Projections

In you testimony, you note that "EIA's assumptions about energy efficiency may understate its value in mitigating cost impacts of the Clean Power Plan." Specifically, you point out that EIA's analysis, which estimates that more aggressive energy efficiency programs will lead to higher costs for consumers, runs counter to the actual experience of states that have adopted aggressive energy efficiency programs. You also note that EIA's conclusions in this area are "inconsistent with recent analyses conducted by the grid operator in the PJM region and by other independent studies which conclude that energy efficiency lowers overall compliance costs associated with CO_2-emission reductions from the power sector."

- ***Please discuss these differences and why you believe that the EIA analysis understates the net benefits of energy efficiency investments.***

A variety of modeling studies conducted by grid operators have identified that deeper reliance on energy efficiency will lower the cost of power production and compliance with the Clean Power Plan, compared to scenarios with less reliance on energy efficiency. See, for example:

> PJM Interconnection, "Economic Analysis of the EPA Clean Power Plan Proposal," March 2015. http://www.pjm.com/~/media/4CDA71CBEC864593BC11E7F81241E019.ashx;
>
> Center for Climate and Energy Solutions (C2ES), "Modeling EPA's Clean Power Plan: Insights for Cost Effective Implementation," May 2015. http://www.c2es.org/docUploads/modelingepascleanpowerplaninsightscosteffectiveimplementation.pdf
>
> Franz Litz and Jennifer Macedonia, "Policy Pathways for States under the Clean Power Plan," Bipartisan Policy Center, 2015. http://bipartisanpolicy.org/wp-content/uploads/2015/05/Policy-Pathways-Paper.pdf

The basic reason for this relatively consistent result (about the value of energy efficiency) is that lowering the demand for electricity in most hours of the day (e.g., through energy efficiency investments that reduce some consumers' demand) means that the utility or grid operator does not need to bring on line and dispatch power plants that have

relatively high operating costs. In periods of peak demand (e.g., during each day's peak or each week's peaking periods or each season's peak), the system operator need to operate relatively inefficient power plants to meet consumers' requirements; in those hours in particular, reducing demand for power through energy efficiency can lower the entire cost of the power system, providing benefits to all consumers (whether they installed energy efficiency measures themselves, or not).

- ***Do you have any updated information from your own analysis that is relevant to the role of energy efficiency in reducing the impacts of compliance costs for actual CO2-emission reduction programs?***

Yes. My colleagues and I have recently published an analysis of the Regional Greenhouse Gas Initiative's ("RGGI") latest three full years of implementation (during 2012-2014), and in our report, we noted the value of energy efficiency in mitigating consumers' costs of compliance with carbon-controls in the power sector. Specifically, we noted that the states' decision to sell CO2 allowances to power generators and then to use the proceeds of the CO2 auctions for public benefit led to RGGI having lowered consumers' energy bills relative to what they would have been in the absence of the RGGI program:

> **Local reinvestment of RGGI dollars in energy efficiency and renewable energy programs is offsetting the impact of increased electricity prices resulting from the cost of RGGI allowances.** RGGI has also led to changes in consumers' overall expenditures on electricity: On the one hand, the inclusion of the cost of CO_2 allowances in wholesale prices increased retail electricity prices in the RGGI region throughout 2012-2014. But the near-term price impacts are more than offset during these years and beyond, because these states invested a substantial amount of the RGGI auction proceeds in energy-efficiency programs that reduce overall electricity consumption, and in renewable energy programs that displace higher-priced electricity generation resources. In the end, consumers gain because their overall electricity bills go down as a result of state RGGI allowance revenue investments, primarily in energy efficiency but also renewable energy-focused programs.
>
> **Energy consumers overall – households, businesses, government users, and others – have enjoyed a net gain of $460 million, as their overall energy bills drop over time.** The net positive benefits to consumers are spread across residential consumers and commercial and industrial customers. Consumers of electricity save $341 million, and natural gas and heating oil save $118 million.
>
> (Citation: Paul J. Hibbard, Andrea M. Okie, Susan F. Tierney, and Pavel G. Darling, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States: Review of RGGI's Second Three-Year Compliance Period (2012-2014)," July 14, 2015, page 7 of the Executive Summary. http://www.analysisgroup.com/news-and-events/news/energy-report--states-that-limit-carbon-emissions-through-markets-see-economic-benefits/)

Clean Power Plan's Impact on Electricity Prices and Jobs

You have co-authored several studies examining the economic impacts of the Regional Greenhouse Gas Initiative (RGGI).

- ***Please summarize the results of those studies with regard to the impacts on electricity bills in states that have participated in the RGGI program.***
- ***Additionally, what have your studies indicated with respect to the impact of the RGGI program on jobs in the participating states?***

In our July 2015 report on RGGI, we focused on the economic impacts to the consumers and economies of the 9 states that participated in the RGGI program during the 2012-2014 period. (See: Paul J. Hibbard, Andrea M. Okie, Susan F. Tierney, and Pavel G. Darling, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States: Review of RGGI's Second Three-Year Compliance Period (2012-2014)," July 14, 2015, page 7 of the Executive Summary. http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_july_2015.pdf) (Hereafter called the "2015 Analysis Group RGGI Report".) This was our second report reviewing the economic impacts of RGGI; the first report focused on the first three years of program implementation (2009-2011): Paul J. Hibbard, Susan F. Tierney, Andrea M. Okie, and Pavel G. Darling, "The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States: Review of RGGI's First Three-Year Compliance Period (2009-2011)," http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/economic_impact_rggi_report.pdf

In each report, we tracked "the path of RGGI-related dollars as they leave the pockets of competitive-power generators who buy CO2 allowances to demonstrate compliance, show up in electricity prices and customer bills, make their way into state accounts, and then roll out into the economy through various pathways. Our analysis is unique in this way – it focuses on the actual observable flow of payments and economic activity: known CO2 allowance prices; observable CO2 auction results; dollars distributed from the auction to the RGGI states; actual state-government decisions about how to spend the allowance proceeds; measurable reductions in energy use from energy efficiency programs funded by RGGI dollars; traceable impacts of such expenditures on prices within the power sector; and concrete value added to the economy." (2015 Analysis Group RGGI Report, pages 1-2.)

Our recent analysis found the following positive benefits of the RGGI program to the states' economies and consumers' energy bills (with the quoted text below coming from the 2015 Analysis Group RGGI Report's Executive Summary, pages 5-11).

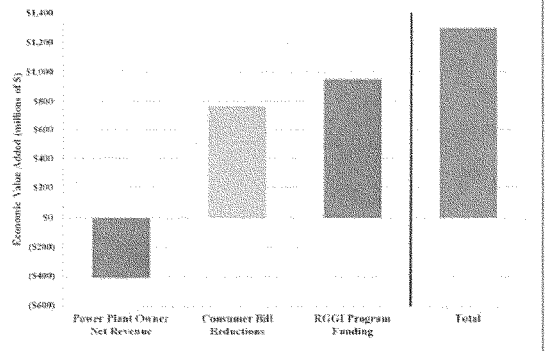
> **Over the last three years (2012-2014), the RGGI program led to $1.3 billion (net present value) of economic value to the nine-state region.** Similar to our

findings with respect to the first three years of the RGGI program, its implementation in the second three-year period generates $1.3 billion in net economic benefits across the region.5 The region's economy – and each state's as well – benefits from the expenditures of RGGI auction proceeds on various programs, with benefits flowing to consumers and the broader economy. When spread across the region's population, these economic impacts amount to over $31 in value added per capita in the region, on average. Figure ES-4 shows the net economic value broken out by the macroeconomic effects of RGGI on consumers and power plant owners, as well as effects that flow from direct spending of RGGI auction revenues.

This recent positive economic outcome from the RGGI program results in large part from the states' decision to sell CO2 allowances via a centralized auction and then use the proceeds from the auction in various ways that address state policy objectives, primarily by returning funds to electric ratepayers and funding local investment in energy efficiency ("EE") and renewable energy ("RE") resources.

During the 2012-2014 period, the states received, programmed, and disbursed virtually all the $1.0 billion in allowance proceeds back into the economy (shown in Figure ES-3). The money has been spent on energy efficiency measures, community-based renewable power projects, assistance to low-income customers to help pay their electricity bills, greenhouse gas reduction measures, and education and job training programs. The local investment keeps more of the RGGI states' energy dollars inside their region, reducing the amounts that leave the region to pay for fossil fuel production outside the RGGI states.

Figure ES-4
Net Economic Impact to States in the RGGI Region (2015$)



These economic benefits reflect the complex ways that RGGI dollars interact with local economies. The states' use of RGGI auction proceeds on energy-efficiency programs, for example, leads to more purchases of goods and services in the economy (e.g., engineering services for energy audits, more sales of energy efficiency equipment, labor for installing solar panels, dollars spent to train those installers and educators, and so forth). Together, these dollar flows have direct and indirect multiplier effects locally and regionally.

The size of RGGI's positive economic benefits varies by state and region, in large part because the RGGI states spent their RGGI auction proceeds differently.6 Different expenditures have different direct and indirect effects in their economies and different impacts on their electric systems. For example, a state's use of RGGI dollars to pay for energy efficiency programs that reduce energy consumption in the electric sector, and to invest in renewable projects that have low operating cost, both served to lower electricity prices in wholesale power markets (compared to a 'no-RGGI' scenario). This mitigated the early-years' cost impact for electricity consumers by turning the RGGI program into a down payment on lower overall bills for electricity in the longer-term.

Implementation of RGGI during the past three years continues to generate substantial economic benefits for the RGGI states while continuing to reduce emissions of CO2.

Economic value added

Our analysis of RGGI impacts over the past three years took into consideration the program's effects on power system dispatch, costs to consumers, revenues to electric generators, and overall state economic performance. We found lower costs to electric consumers throughout the region, decreases in revenues to the owners of certain power plants, and positive economic impacts across all states, totaling approximately $1.3 billion in economic value added (in 2015 dollars) as a result of RGGI's second three years (2012-2014). This is on top of what we found for the first three years (2009-2011) of the program: $1.6 billion of economic value added (in 2011 dollars). Thus, considering results found in both our studies, the first six years of RGGI program implementation has continuously generated significant economic value for the RGGI states, while achieving the region's collective objectives in terms of reducing emissions of CO2.

Jobs

Taking into account consumer gains, lower producer revenues, and net positive macroeconomic impacts, RGGI led to overall job increases amounting to thousands of new jobs over time. RGGI job impacts may in some cases be permanent; others may be part-time or temporary. But according to our analysis, the net effect is that the second three years of RGGI leads to nearly 14,200 new job years, with each of the nine states showing net job additions. This is on top of what we found for the first three years (2009-2011) of the program: 16,000 job-years. Jobs related to RGGI activities are located around the economy, with examples including engineers who perform efficiency audits; workers who install energy efficiency measures in commercial buildings; or staff performing teacher training on energy issues.

Flexibility of Clean Power Plan

Several organizations have provided extensive information about the options available to states as they consider the design of their State Plans to comply with EPA's Clean Power Plan. For example, last month the National Association of Clean Air Agencies released a report entitled, Implementing EPA's Clean Power Plan: A Menu of Options. The report covers a broad range of technologies and policies that go well beyond the four building blocks EPA used as the "best system of emission reduction" for establishing each state's carbon target.

- ***Please comment on the flexibility the Clean Power Plan provides to states and the benefits of this approach.***
- ***Please summarize the analyses that indicate the value of various approaches that will help states minimize the costs of compliance.***

One of the hallmarks of the EPA's Clean Power Plan is the fact that it provides states with the option to develop their plans in various ways. EPA has provided extensive information about the kinds of flexible approaches and options that states may consider in preparing their plans: http://www2.epa.gov/cleanpowerplantoolbox. This flexibility will allow states to design plans that suit their particular set of power plants, their preference for market-based versus non-market –based compliance approaches, their desires to work with other states, and so forth.

Many other organizations have also described the rich variety of options that will be available to the states. For example, see:

World Resources Institute (WRI), "Power Sector Opportunities for Reducing Carbon Dioxide Emissions," state specific fact sheet series.
http://www.wri.org/powersectoropportunitiesreducingcarbondioxideemissions

Paul Hibbard, Andrea Okie, Susan Tierney, "EPA's Clean Power Plan: States' Tools for Reducing Costs and Increasing Benefits to Consumers," July 2014.
http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_epa_clean_power_plan_report.pdf

Resources for the Future (RFF), "A Primer on Comprehensive Policy Options for States to Comply with the Clean Power Plan," April 2015.
http://www.rff.org/Publications/Pages/PublicationDetails.aspx?PublicationID=22548

Regulatory Assistance Project, "It's Not a SIP: Opportunities and Implications for State 111(d) Compliance Planning," February 2015.
http://www.raponline.org/document/download/id/7491

Cost of Inaction on Climate Change / Health Benefits

The EPA has recently released a report titled, "Climate Change in the United States: Benefits of Global Action." The report describes just some of the benefits that we will see within this century if we take action to reduce GHG emissions. For example, approximately $3 billion in avoided damages from poor water quality, $11 billion in avoided damages to agriculture, and an estimated 12 thousand fewer deaths from extreme temperatures in 49 major U.S. cities.

- ***Do you believe it is important to keep these long-term economic and public health costs of inaction in mind as we continue to promote policies that keep the United States at the forefront of addressing the global threat of climate change?***
- ***Based on your experience as one of the co-authors of the National Climate Assessment, are there other points you'd like to add about the costs associated with inaction on carbon-reduction policies?***

It is certainly and critically important to consider the long-term economic and public health costs of a changing climate and inaction in addressing them. As the National Climate Assessment has reported in significant detail in its 2014 report (prepared by a team of more than 300 experts guided by a 60-member Federal Advisory Commission and extensively reviewed by the public and experts, including federal agencies and a panel of the National Academy of Sciences), the global climate is already changing and is impacting economic activities around the nation. http://nca2014.globalchange.gov/ . I have excerpted several findings from the report below:

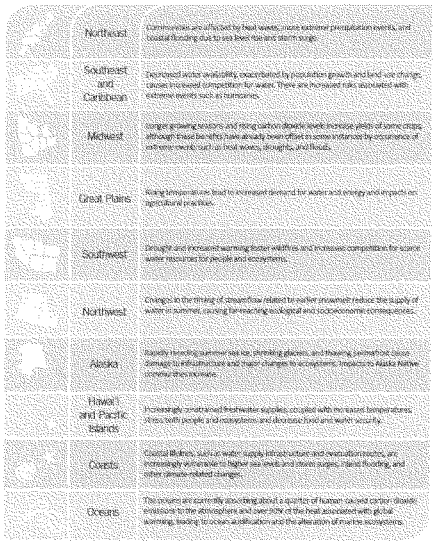
> Global climate is changing and this is apparent across the United States in a wide range of observations. The global warming of the past 50 years is primarily due to human activities, predominantly the burning of fossil fuels.
>
> Some extreme weather and climate events have increased in recent decades, and new and stronger evidence confirms that some of these increases are related to human activities. [These impacts include: heat waves; drought; heavy downpours; floods; hurricanes; and change in other storms such as heavy snowfalls.]
>
> Human-induced climate change is projected to continue, and it will accelerate significantly if global emissions of heat-trapping gases continue to increase.
>
> Impacts related to climate change are already evident in many regions and sectors and are expected to become increasingly disruptive across the nation throughout this century and beyond. Climate changes interact with other environmental and societal factors in ways that can either moderate or intensify these impacts.

Sectors affected by climate changes include agriculture, water, human health, energy, transportation, forests, and ecosystems. Climate change poses a major challenge to U.S. agriculture because of the critical dependence of agricultural systems on climate. Climate change has the potential to both positively and negatively affect the location, timing, and productivity of crop, livestock, and fishery systems at local, national, and global scales. The United States produces nearly $330 billion per year in agricultural commodities. This productivity is vulnerable to direct impacts on crops and livestock from changing climate conditions and extreme weather events and indirect impacts through increasing pressures from pests and pathogens. Climate change will also alter the stability of food supplies and create new food security challenges for the United States as the world seeks to feed nine billion people by 2050. While the agriculture sector has proven to be adaptable to a range of stresses, as evidenced by continued growth in production and efficiency across the United States, climate change poses a new set of challenges.8

Water quality and quantity are being affected by climate change. Changes in precipitation and runoff, combined with changes in consumption and withdrawal, have reduced surface and groundwater supplies in many areas. These trends are expected to continue, increasing the likelihood of water shortages for many uses. Water quality is also diminishing in many areas, particularly due to sediment and contaminant concentrations after heavy downpours. Sea level rise, storms and storm surges, and changes in surface and groundwater use patterns are expected to compromise the sustainability of coastal freshwater aquifers and wetlands. In most U.S. regions, water resources managers and planners will encounter new risks, vulnerabilities, and opportunities that may not be properly managed with existing practices.9

Climate change affects human health in many ways. For example, increasingly frequent and intense heat events lead to more heat-related illnesses and deaths and, over time, worsen drought and wildfire risks, and intensify air pollution. Increasingly frequent extreme precipitation and associated flooding can lead to injuries and increases in waterborne disease. Rising sea surface temperatures have been linked with increasing levels and ranges of diseases. Rising sea levels intensify coastal flooding and storm surge, and thus exacerbate threats to public safety during storms. Certain groups of people are more vulnerable to the range of climate change related health impacts, including the elderly, children, the poor, and the sick. Others are vulnerable because of where they live, including those in floodplains, coastal zones, and some urban areas. Improving and properly supporting the public health infrastructure will be critical to managing the potential health impacts of climate change.10

Observed and projected climate change impacts vary across the regions of the United States, as summarized by the chart below for selected impacts (which are described in more detail in the regional chapters of the National Climate Assessment).



http://s3.amazonaws.com/nca2014/high/NCA3_Full_Report_01_Overview_Report_Findings_HighRes.pdf?download=1

Finally, the main conclusion from a report by the White House Council of Economic Advisors titled The Cost of Delaying Action to Stem Climate Change is that any short-term gains from delayed climate policies are outweighed by increased long-term costs associated with such a delay. The report also highlights recent research which shows that even if international efforts are delayed, unilateral or fragmented action reduces the overall costs of delay.

- ***Please comment on the conclusions of this report that delaying action increase costs to the United States.***

The recent report by the Council of Economic Advisors ("CEA") translates the types of trends observed in the National Climate Assessment into monetary and other economic impacts on the nation. Because – to date – few carbon emissions from fossil energy production and use are controlled, these emissions are "negative externalities," in the words of the CEA, and cause costs to show up in various ways in the economy.

> The emission of greenhouse gases such as carbon dioxide (CO2) harms others in a way that is not reflected in the price of carbon-based energy, that is, CO2 emissions create a negative externality. Because the price of carbon-based energy does not reflect the full costs, or economic damages, of CO2 emissions, market forces result in a level of CO2 emissions that is too high. Because of this market failure, public policies are needed to reduce CO2 emissions and thereby to limit the damage to economies and the natural world from further climate change. (CEA report, page 1.)

I agree with the two main conclusions of the report, "both of which point to the benefits of implementing mitigation policies now and to the net costs of delaying taking such actions." These conclusions (on pages 1-2 of the CEA report) are:

> First, although delaying action can reduce costs in the short run, on net, delaying action to limit the effects of climate change is costly. Because CO2 accumulates in the atmosphere, delaying action increases CO2 concentrations. Thus, if a policy delay leads to higher ultimate CO2 concentrations, that delay produces persistent economic damages that arise from higher temperatures and higher CO2 concentrations. Alternatively, if a delayed policy still aims to hit a given climate target, such as limiting CO2 concentration to given level, then that delay means that the policy, when implemented, must be more stringent and thus more costly in subsequent years. In either case, delay is costly.
>
> These costs will take the form of either greater damages from climate change or higher costs associated with implementing more rapid reductions in greenhouse gas emissions. In practice, delay could result in both types of costs. These costs can be large:
>
> - Based on a leading aggregate damage estimate in the climate economics literature, a delay that results in warming of 3° Celsius above preindustrial levels, instead of 2°, could increase economic damages by approximately 0.9 percent of global output. To put this percentage in perspective, 0.9 percent of estimated 2014 U.S. Gross Domestic Product (GDP) is approximately $150 billion. The incremental cost of an additional degree of warming beyond 3° Celsius would be even greater. Moreover, these costs are not one-time, but are rather incurred year after year because of the permanent damage caused by increased climate change resulting from the delay.
>
> - An analysis of research on the cost of delay for hitting a specified climate target (typically, a given concentration of greenhouse gases) suggests that net mitigation costs increase, on average, by approximately 40 percent for each decade of delay. These costs are higher for more aggressive climate goals: each year of delay means more CO2 emissions, so it becomes increasingly difficult, or even infeasible, to hit a climate target that is likely to yield only moderate temperature increases.
>
> Second, climate policy can be thought of as "climate insurance" taken out against the most severe and irreversible potential consequences of climate change. Events such as the rapid melting of ice sheets and the consequent increase of global sea levels, or temperature increases on the

higher end of the range of scientific uncertainty, could pose such severe economic consequences as reasonably to be thought of as climate catastrophes. Confronting the possibility of climate catastrophes means taking prudent steps now to reduce the future chances of the most severe consequences of climate change. The longer that action is postponed, the greater will be the concentration of CO2 in the atmosphere and the greater is the risk. Just as businesses and individuals guard against severe financial risks by purchasing various forms of insurance, policymakers can take actions now that reduce the chances of triggering the most severe climate events. And, unlike conventional insurance policies, climate policy that serves as climate insurance is an investment that also leads to cleaner air, energy security, and benefits that are difficult to monetize like biological diversity.

Ensuring Reliability

In your testimony, you note that standard practices used by the industry and regulators for decades to maintain the reliability of the electric grid will be sufficient to ensure reliability during implementation of the Clean Power Plan.

- ***Please provide a few examples of the practices and tools currently used to ensure reliability.***
- ***Do you think requests for delays in implementation of the Clean Power Plan or for a 'reliability safety valve' are needed?***
- ***Are there any significant differences between how electricity operators will maintain reliability while implementing the Clean Power Plan compared to the methods they are using to maintain reliability while implementing the Mercury and Air Toxics Standard regulations?***
- ***Based on your studies of the PJM and MISO reliability regions, are there reasons to be concerned that the industry will not address any reliability issues that might arise as a result of compliance with the Clean Power Plan?***
- ***Do you have any comments on the written interchange between EPA's Acting Assistant Administrator Janet McCabe and the five Commissioners of the Federal Energy Regulatory Commission with regard to the role of FERC under the Clean Power Plan?***

I have recently co-authored and authored several reports that describe the extensive, robust and well-proven reliability practices used in the electric industry to assure that changes in the electric industry (such as new environmental regulations) do not jeopardize electric system reliability. These reports are listed at the end of this response, after a summary of the findings from our primer on electric system reliability and the Clean Power Plan, published in February 2015.

Executive Summary

Since the U.S. Environmental Protection Agency (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. There are, however, many reasons why carbon pollution at existing power plants can be controlled without adversely affecting electric system reliability.

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.

In the past several years, dramatic increases in domestic energy production (stemming from the shale gas revolution), shifts in fossil fuel prices, retirements of aged infrastructure, implementation of numerous pollution-control measures, and strong growth in energy efficiency and distributed energy resources, have driven important changes in the power sector. 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.

The electric industry's many players are keenly organized and strongly oriented toward safe and reliable operations. There are well-established procedures, regulations and enforceable standards in place to ensure reliable operations of the system, day in and day out.

Among other things, these "business-as-usual" procedures include:

- Assigning specific roles and responsibilities to different organizations, including regional reliability organizations, grid operators, power plant and transmission owners, regulators, and many others;
- Planning processes to look ahead at what actions and assets are needed to make sure that the overall system has the capabilities to run smoothly;
- Maintaining secure communication systems, operating protocols, and real-time monitoring processes to alert participants to any problems as they arise, and initiating corrective actions when needed; and
- Relying upon systems of reserves, asset redundancies, back-up action plans, and mutual assistance plans that kick in automatically when some part of the system has a problem.

As proposed by EPA, the Clean Power Plan provides states and power plant owners a wide range of compliance options and operational discretion (including various market-based approaches, other means to allow emissions trading among power plants, and flexibility on deadlines to meet interim targets) that can prevent reliability issues while also reducing carbon pollution and cost.

EPA's June 2014 proposal made it clear that the agency will entertain market-based approaches and other means to allow emissions trading within and across state lines. Examples include emissions trading among plants (e.g., within a utility's fleet inside or across state lines), or within a Regional Transmission Organization (RTO) market. In this respect, the Clean Power Plan is fundamentally different from the Mercury and Air Toxics Standard (MATS) and is well-suited to utilize such flexible and market-based approaches. Experience has shown that such approaches allow for seamless, reliable implementation of emissions-reduction targets. In its final rule, EPA should clarify acceptable or standard market-based mechanisms that could be used to accomplish both cost and reliability goals.

Moreover, EPA has stated repeatedly that it will write a final rule that reflects the importance of a reliable grid and provides the appropriate flexibility.[footnote in original] We support such adjustments in EPA's final rule as needed to ensure both emissions reductions and electricity reliability.

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. Reliability 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*.

Some of the cautionary comments are just that: calls for timely action. Many market participants have offered remedies (including readiness to bring new power plant projects, gas infrastructure, demand-side measures, and other solutions into the electric system where needed). [footnote in original] 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.[footnote in original]

We note many concerns about electric system reliability can be resolved by the addition of new load-following resources, like peaking power plants and demand-side measures, which have relatively short lead times.[footnote in original] Other concerns are already being addressed by ongoing work to improve market rules, and by infrastructure planning and investment. A recent Department of Energy (DOE) report found that while a low-carbon electric system may significantly increase natural gas demand from the power sector, the projected incremental

increase in natural gas pipeline capacity additions is modest (lower than historic pipeline expansion rates), and that the increasingly diverse sources of natural gas supply reduces the need for new pipeline infrastructure. [footnote in original]

Some other comments raise the reliability card as part of what is – in effect – an attempt to delay or ultimately defeat implementation of the Clean Power Plan. We encourage parties to distinguish between those who identify issues and offer solutions, and those who (incorrectly) suggest that reducing carbon pollution through the Clean Power Plan is inconsistent with electric system reliability.

In the end, because there are such fundamental shifts already underway in the electric industry, inaction is the real threat to good reliability planning. Again, there are continuously evolving ways to address electric reliability that build off of strong standard operating procedures in the industry.

There are many capable entities focused on ensuring electric system reliability, and many things that states and others can do to maintain a reliable electric grid.

First and foremost, states can lean on the comprehensive planning and operational procedures that the industry has for decades successfully relied on to maintain reliability, even in the face of sudden changes in industry structure, markets and policy.

Second, states should take advantage of the vast array of tools available to them and the flexibility afforded by the Clean Power Plan to ensure compliance is obtained in the most reliable and efficient manner possible. Given the interstate nature of the electric system, we encourage states to rely upon mechanisms that facilitate emission trading between affected power plants in different states. Doing so will increase flexibility of the system, mitigate many electric system reliability concerns, and lower the overall cost of compliance for all. [footnote in original]

In this report we identify a number of actions that the Federal Energy Regulatory Commission (FERC), grid operators, states, and others should take to support electric system reliability as the electric industry transitions to a lower-carbon future. We summarize our recommendations for these various parties in tables at the end of our report.

In the end, the industry, its regulators and the States are responsible for ensuring electric system reliability while reducing carbon emissions 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.

We observe that, too often, commenters make assertions about reliability challenges that really end up being about cost impacts. Although costs matter in this context, we think it is important to separate reliability considerations from cost issues in order to avoid distracting attention from the actions necessary (and feasible) to keep the lights on. There may

> be "lower cost" options that reduce emissions some part of the way toward the target reductions, but that fail to meet acceptable reliability standards. We do not view such 'solutions' as the lowest cost solution precisely because they fail to account for the cost of unacceptable system outages to electricity consumers.
> Any plan that starts with consumer costs and works backward to reliability and then to emission reduction is one that fails to consider the wide availability of current tools that have served grid operators for more than a decade to meet reliability needs. There is no reason to think that cost and reliability objectives cannot be harmonized within a plan to reduce carbon pollution.

The reliability reports that I have recently authored or co-authored are as follows:

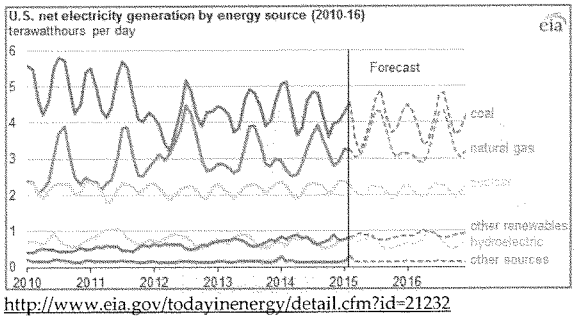
> Susan Tierney, Paul Hibbard, and Craig Aubuchon, "Electric System Reliability and EPA's Clean Power Plan: Tools and Practice," February 2015. http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/electric_system_reliability_and_epas_clean_power_plan_tools_and_practices.pdf
>
> Susan 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
>
> Susan Tierney, Paul Hibbard, and Craig Aubuchon, "Electric System Reliability and EPA's Clean Power Plan: The Case of MISO," June 8, 2015. http://www.eenews.net/assets/2015/06/10/document_daily_01.pdf
>
> Susan Tierney, Eric Svenson, and Brian Parsons, "Ensuring Electric Grid Reliability Under the Clean Power Plan: Addressing Key Themes from the FERC Technical Conferences," April 2015. http://blogs.edf.org/climate411/files/2015/04/Ensuring-Electric-Grid-Reliability-Under-the-Clean-Power-Plan.pdf
>
> Susan Tierney, "Greenhouse Gas Emission Reductions From Existing Power Plants: Options to Ensure Electric System Reliability," May 2014. http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/tierney_report_electric_reliability_and_ghg_emissions.pdf

Impact on Coal Plants and the "War on Coal"

One of the main concerns over the Clean Power Plan is that it will adversely impact coal plants, with many observers raising concerns that the proposed rules is the sole reason coal plants will retire. What is your view about the factors contributing to changes in the output from coal-fired power plants over time?

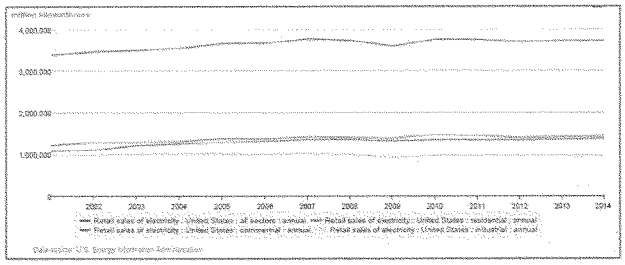
There are several fundamental economic drivers that are affecting the viability of many coal-fired power plants going forward. I have previously written about these factors in a report entitled, "Why Coal Plants Retire: Power Market Fundamentals as of 2012," http://www.analysisgroup.com/uploadedfiles/content/news_and_events/news/2012_tierney_whycoalplantsretire.pdf, and note that the fundamental drivers have not changed significantly since 2012.

1. Natural Gas: First, the relatively low cost of another large domestic energy resource – natural gas – is causing strong price competition for the less-efficient coal plants in the U.S. Natural gas began to erode the market share of coal as a low-cost fuel for power generating starting in the past decade, and is expected to continue to compete strongly (on price) with coal. A recent chart published by the EIA illustrates this point.



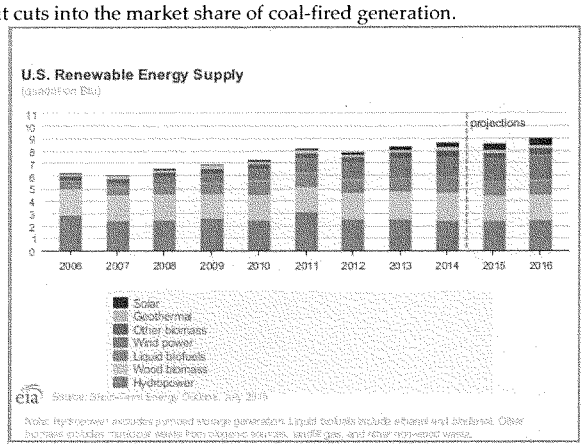
http://www.eia.gov/todayinenergy/detail.cfm?id=21232

2. Flat demand for electricity. For the past decade, electricity demand has been almost flat, in part because the economy is using less electricity to produce goods and services, in part as a result of adoption of energy efficiency measures, and in part because of the economic slowdown starting in late 2008. The chart below shows this trend, which is expected to continue even as the economy has picked up strength.



EIA, electricity data browser, U.S. Retail Sales of Electricity, 2000-2014.
http://www.eia.gov/electricity/data/browser /

3. Renewable energy competition. Growing market share from wind and solar energy, in part driven by: many states' preferences for renewable resources for fuel diversity, for development of their indigenous renewable resources, for clean energy, and for mitigating price volatility in fossil fuel markets; consumers' appetite for rooftop solar; federal tax policy; and the declining costs of wind and solar technologies. As new renewable generation has increased in recent years (and is expected to increase further in the years ahead, as indicated in the chart below from EIA showing actual output since 2006 and expected output in the next two years), this output cuts into the market share of coal-fired generation.



http://www.eia.gov/forecasts/steo/report/renew_co2.cfm

4. Environmental regulations: Finally, the implementation of the Mercury and Air Toxics Rule, designed to limit unhealthy air emissions from existing power plants, went into effect in April 2015. Some of the least-efficient, oldest and smallest of the nation's coal-fired power plants retired in anticipation of this rule, rather than make the upgrades that would be necessary to keep the plants in operations.

Appendix II

Additional Material for the Record

EIA REPORT SUBMITTED BY REPRESENTATIVE JIM BRIDENSTINE

Independent Statistics & Analysis
U.S. Energy Information Administration

Analysis of the Impacts of the Clean Power Plan

May 2015

Independent Statistics & Analysis
www.eia.gov

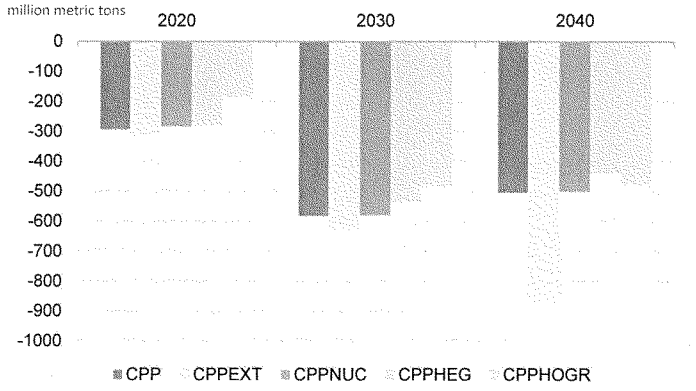
U.S. Department of Energy
Washington, DC 20585

Summary of Results

Power sector CO_2 emissions declined by 363 million metric tons between 2005 and 2013, due to a decline in coal's generation share and growing use of natural gas and renewables, but the CO_2 emissions are projected to change only modestly from 2013 through 2040 in the 3 baseline cases used in this report. Relative to the AEO2015 Reference case, the projected emissions trajectory is somewhat lower in the High Oil and Gas Resource case baseline, which has cheaper natural gas, and somewhat higher in the High Economic Growth case, which has higher electricity use.

The proposed Clean Power Plan would reduce projected power sector CO_2 emissions (Figure 3, Table 3 and Table 4). Reductions in projected emissions in 2030 relative to baseline projections for that year range from 484 to 625 million metric tons. The projected power sector emissions level in 2030 ranges from 1,553 to 1,727 million metric tons across the cases, reflecting a reduction of between 29% and 36% relative to the 2005 emissions level of 2,416 million metric tons.

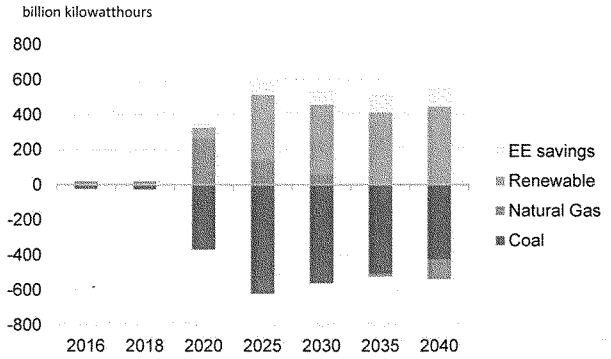
Figure 3. Change in electric power sector CO_2 emissions in Clean Power Plan (CPP) cases relative to baseline, selected years



Source: U.S. Energy Information Administration.

Switching from coal-fired generation to natural gas-fired generation is the predominant compliance strategy as implementation begins, with renewables playing a growing role in the mid-2020s and beyond (Figures 4 and 5; Tables 3 and 4). Demand-side energy efficiency plays a moderate role in compliance, relative to the early role of natural gas and the eventual role of renewables. The economics of increased natural gas generation and expanded renewable electricity capacity vary regionally, the key determinants being: 1) the natural gas supply and combined cycle utilization rates by region; and 2) the potential for penetration of renewable generation in regions including states that have no (or low) renewable portfolio standards.

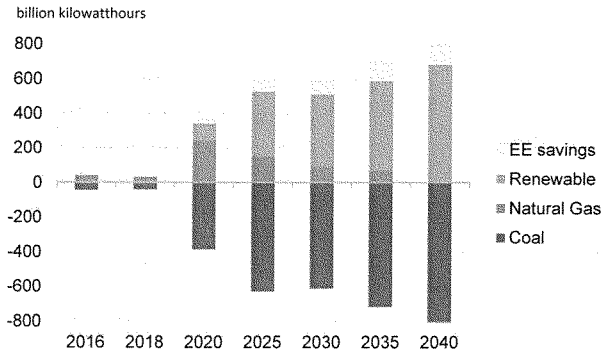
Figure 4. Change in generation and energy efficiency savings under the Clean Power Plan Base Policy case relative to AEO2015 Reference case



Source: U.S. Energy Information Administration.

With continued Clean Power Plan emissions reduction requirements through 2040 under the Policy Extension Case (CPPEXT), the shift to higher natural gas-fired generation is maintained through 2030-35 (Figure 5 and Table 3).

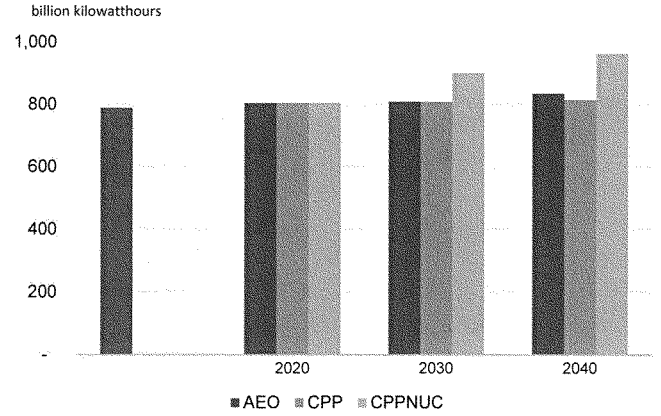
Figure 5. Change in generation and energy efficiency savings under the Clean Power Plan Policy Extension case relative to AEO2015 Reference case



Source: U.S. Energy Information Administration.

If new nuclear power generation were to be treated in the same manner as new renewable generation in compliance calculations, the Clean Power Plan would also result in increased nuclear generation (Figure 6 and Table 3).

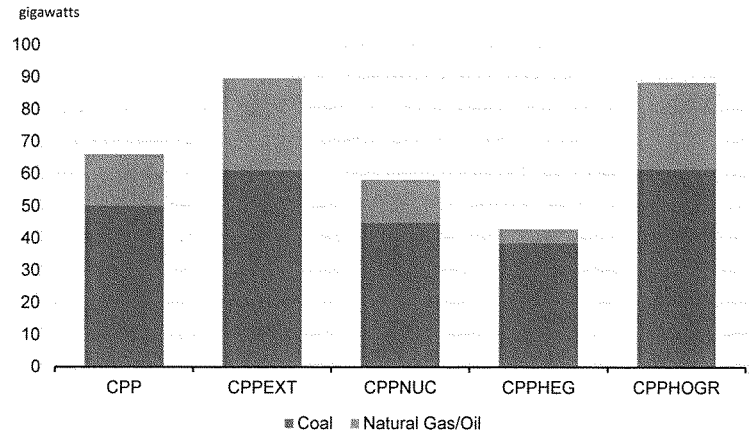
Figure 6. Nuclear generation in AEO2015 Reference and Clean Power Plan cases, selected years



Source: U.S. Energy Information Administration.

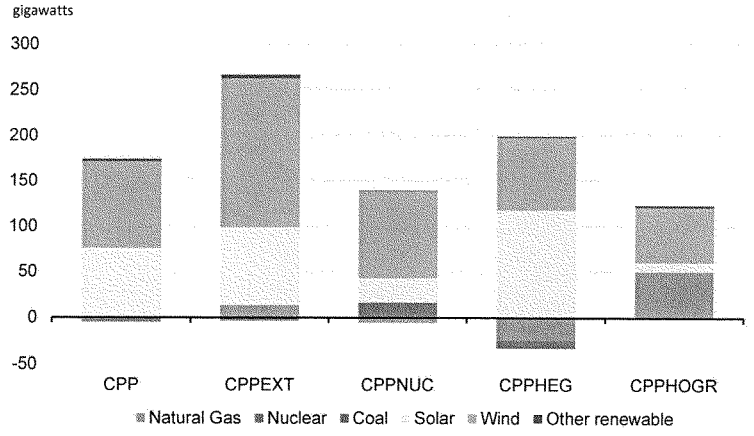
The Clean Power Plan has a significant effect on projected retirements and additions of electric generation capacity (Figures 7 and 8; Tables 3 and 4). Projected coal plant retirements over the 2014-40 period, which are 40 GW in the AEO2015 Reference case (most before 2017), increase to 90 GW (nearly all by 2020) in the Base Policy case (CPP). Retirements of inefficient units fueled by natural gas or oil, generally involving primary steam cycles, are also projected to rise. Turning to additions, which are dominated by natural gas and renewables over the 2014-40 period in the AEO2015 Reference case, the Clean Power Plan significantly increases projected renewable capacity additions in all cases. Under favorable natural gas supply conditions, the Clean Power Plan also increases additions of generation capacity fueled by natural gas (CPPHOGR). Nuclear capacity is also added in a sensitivity case in which new nuclear generation receives the same treatment as new renewable generation in compliance calculations (CPPNUC).

Figure 7. Change in generating capacity retirements by fuel type in Clean Power Plan cases relative to baseline (cumulative, 2014-40)



Source: U.S. Energy Information Administration.

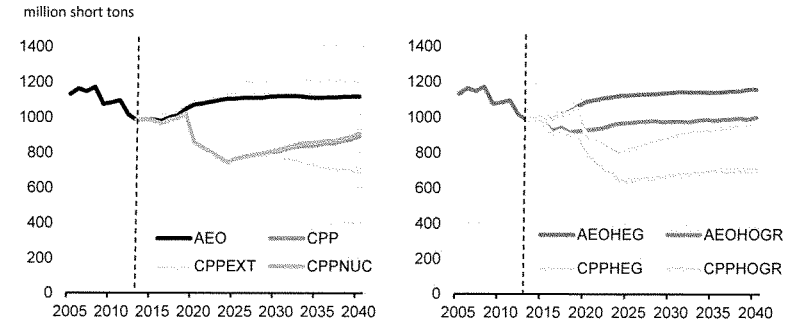
Figure 8. Change in generating capacity additions by fuel type in Clean Power Plan cases relative to baseline (cumulative, 2014-40)



Source: U.S. Energy Information Administration.

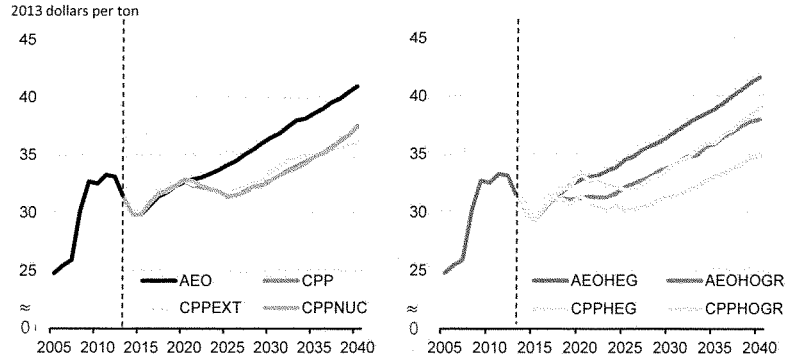
Coal production and minemouth steam coal prices are lower compared with the AEO2015 Reference case in the early years following Clean Power Plan implementation (Figures 9 and 10, and Tables 3 and 4). In the Base Policy case (CPP) projected U.S. coal production in 2020 and 2025 is 20% and 32% lower relative to the AEO2015 baseline level in those years, respectively. All major coal-producing regions (West, Interior, and Appalachia) experience negative production impacts in 2020. Expanded generation from renewables, rising natural gas prices, and static CPP targets in the post-2030 period in the CPP case allow existing coal-fired plants to operate at a higher utilization rate which rises from a low of 60% in 2024 to 71% in 2040. As a result, coal production edges higher but still remains 20% below the AEO2015 Reference case level in 2040. The Interior coal-producing region, which primarily includes the Illinois and Gulf-lignite Basins, and the West coal-producing region, which primarily includes the Powder River, Rocky Mountain, Arizona/New Mexico and Dakota-lignite Basins, account for most of the increase in production levels in the CPP case towards the end of the projection period. Average minemouth steam coal prices also decline after 2020 and are 8% and 10% lower in 2025 and 2030, respectively in the Base Policy Case compared with the AEO2015 Reference case and then remain at least 8% lower than the Reference case through 2040.

Figure 9. Total U.S. coal production in baseline and Clean Power Plan cases, 2005-40



Source: U.S. Energy Information Administration.

Figure 10. Minemouth steam coal prices in baseline and Clean Power Plan cases, 2005-40

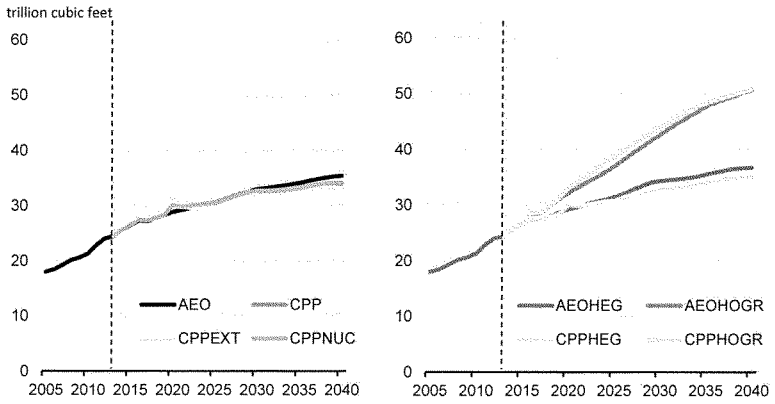


Note: Minemouth steam coal prices include coal delivered to all users of steam coal (buildings, industrial, and electricity sectors as well as steam exports).

Source: U.S. Energy Information Administration.

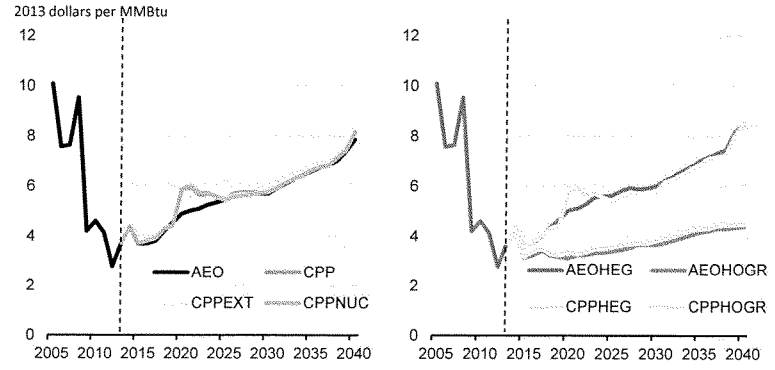
The Clean Power Plan's effect on natural gas production and prices is very sensitive to baseline supply conditions (Figure 11 and Figure 12; Tables 3 and 4). The Clean Power Plan increases natural gas use significantly relative to baseline at the start of Clean Power Plan implementation, but this effect fades over time as renewables and efficiency programs increasingly become the dominant compliance strategies. While there are significant differences in projected natural gas prices across baselines, with persistently lower prices in the High Oil and Gas Resource case, the Clean Power plan itself does not significantly move natural gas prices with the exception of an initial impact expected during the first 2-3 years after the start of implementation.

Figure 11. Natural gas production in baseline and Clean Power Plan cases, 2005-40



Source: U.S. Energy Information Administration.

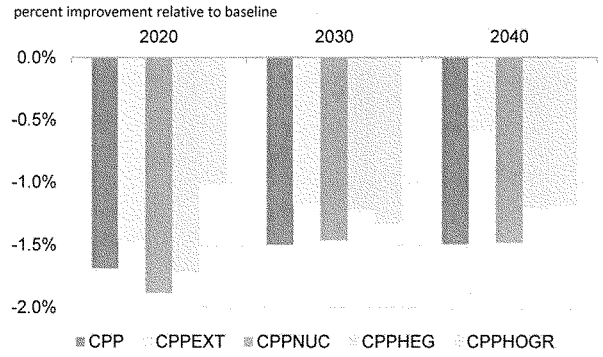
Figure 12. Henry Hub spot price for natural gas in baseline and Clean Power Plan cases, 2005-40



Source: U.S. Energy Information Administration.

Heat rates for coal-fired generators that remain in use, defined as the energy content of coal consumed (in Btu) per kWh of net electricity generated, improve modestly under the Clean Power Plan (Figure 13). In all cases, the average heat rate improvement across the fleet of coal-fired generators is less than 2%. The projected level of heat rate improvement is sensitive to assumptions about natural gas supply that influence natural gas prices, reflecting competition between available compliance options.

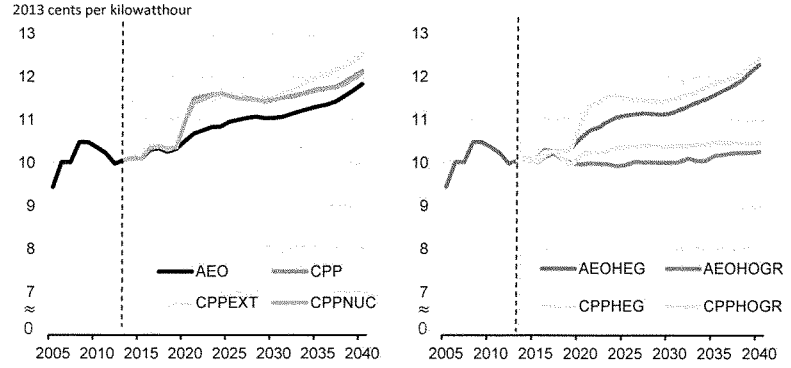
Figure 13. Average percentage change in heat rate of coal-fired generators in Clean Power Plan cases, relative to baseline cases



Source: U.S. Energy Information Administration.

Retail electricity prices and expenditures rise under the Clean Power Plan. Retail electricity prices increase most in the early 2020s, in response to initial compliance measures. Increased investment in new generating capacity as well as increased use of natural gas for generation lead to electricity prices that are 3% to 7% higher on average from 2020-25 in the Clean Power Plan cases, versus the respective baseline cases (Figure 14). While prices return to near-baseline levels by 2030 in many regions, prices remain at elevated levels in some parts of the country. In Florida and the Southeast, the Southern Plains, and the Southwest regions the projected electricity prices in 2030 are roughly 10% above baseline in the Base Policy case (CPP). Electricity expenditures also generally rise with Clean Power Plan implementation, but expenditure changes are smaller in percentage terms than price changes as the combination of energy-efficiency programs pursued for compliance purposes and higher electricity prices tends to reduce electricity consumption relative to baseline. By 2040, total electricity expenditures in the CPP case are slightly below those in the AEO2015 Reference case, as decreases in demand more than offset the price increases.

Figure 14. All sectors average retail electricity price in baseline and Clean Power Plan cases, 2005-40



Source: U.S. Energy Information Administration.

Biomass generation accounts for only a small share of total generation with or without the Clean Power Plan. Implementation of the Clean Power Plan can either increase or decrease projected biomass generation depending on the emission rate applied to biomass generation in the compliance calculation. Using the 195 pounds/MMBtu emissions rate for biomass assumed in EPA's Regulatory Impact Analysis, as in the CPPBIO195 case, EIA projects that biomass generation in 2020 and 2030 would be 33% and 71% below the respective AEO2015 baseline levels of 24 billion kWh (BkWh) and 41 BkWh for those years. In the Base Policy case (CPP), which uses the standard EIA treatment of biomass generation as a net zero emissions generation source, EIA projects that biomass generation in 2020 and 2030 would be 46% above and 5% below the respective AEO2015 baseline levels for those years.

Economic activity indicators, including real gross domestic product (GDP), industrial shipments, and consumption, are reduced relative to baseline under the Clean Power Plan. Across cases that start from the AEO2015 Reference case, the reduction in cumulative GDP over 2015-40 ranges from 0.17%-0.25%, with the high end reflecting a tighter policy beyond 2030. Implementing the Clean Power Plan under baselines that assume high economic growth or high oil and gas resources ameliorate both GDP and disposable income impacts relative to outcomes using the AEO2015 Reference case baseline.

Table 3. Summary results for AEO2015 Reference case and Clean Power Plan cases, selected years

	2005	2013	2020				2030				2040			
			AEO	CPP	CPPEXT	CPPNUC	AEO	CPP	CPPEXT	CPPNUC	AEO	CPP	CPPEXT	CPPNUC
ELECTRIC GENERATION (billion kWh)														
Coal	2,013	1,586	1,709	1,340	1,324	1,357	1,713	1,153	1,101	1,165	1,702	1,278	904	1,306
Natural Gas	761	1,118	1,117	1,382	1,359	1,371	1,371	1,429	1,464	1,401	1,569	1,456	1,560	1,400
Nuclear	782	789	804	804	804	804	808	808	808	900	833	813	811	962
Hydro	270	267	292	295	296	295	295	299	298	298	297	300	301	299
Wind	18	168	232	272	313	269	245	562	575	548	319	602	812	604
Solar	1	19	51	60	60	60	71	148	151	96	110	275	292	171
Other renewables	69	76	104	114	112	114	146	146	148	138	183	178	184	166
Oil/other	142	47	43	41	41	41	43	40	40	40	43	41	39	41
Total	4,055	4,070	4,351	4,308	4,308	4,311	4,691	4,584	4,586	4,586	5,056	4,942	4,903	4,948
ELECTRIC GENERATION CAPACITY (GW)														
Coal	313	304	263	217	210	222	260	209	200	214	260	209	197	214
Natural gas / Oil	442	470	482	490	491	490	519	518	528	521	595	579	582	578
Nuclear	100	99	101	101	101	101	102	101	101	113	105	102	102	121
Hydro	78	79	80	80	80	80	80	81	81	81	80	81	81	81
Wind	9	61	83	100	114	99	87	192	198	188	110	205	273	206
Solar	0	13	28	32	32	32	39	76	77	51	61	136	146	87
Other renewables	12	15	17	18	18	18	20	23	23	22	24	26	28	25
Other	24	25	26	26	26	26	26	26	26	26	26	26	26	26
Total	978	1,065	1,079	1,065	1,074	1,068	1,133	1,226	1,235	1,215	1,261	1,365	1,435	1,337
ELECTRICITY-RELATED CARBON DIOXIDE EMISSIONS (million metric tons)														
Power sector	2,416	2,053	2,107	1,814	1,794	1,825	2,177	1,596	1,553	1,598	2,195	1,691	1,329	1,696
ELECTRICITY PRICES (2013 cents per kWh)														
Residential	11.0	12.2	12.9	13.5	13.5	13.4	13.6	14.2	14.2	14.2	14.5	14.9	15.3	14.8
Commercial	10.1	10.1	10.6	11.1	11.1	11.1	11.1	11.5	11.5	11.5	11.8	12.1	12.5	12.1
Industrial	6.6	6.9	7.3	7.7	7.7	7.7	7.7	8.0	8.1	8.0	8.4	8.6	9.0	8.5
All Sectors[1]	9.4	10.1	10.5	11.0	11.0	11.0	11.1	11.5	11.5	11.5	11.8	12.1	12.5	12.1
ELECTRICITY EXPENDITURES (billion 2013 dollars)														
Residential	149.0	169.2	183.6	189.8	189.8	189.2	202.9	205.8	205.9	205.7	229.9	230.6	235.0	229.7
Commercial	128.3	135.7	150.1	155.9	156.1	155.4	169.2	170.9	170.8	170.7	195.4	192.8	196.7	192.1
Industrial	67.8	65.8	79.6	83.3	83.1	82.8	91.2	92.7	92.9	92.6	101.5	101.7	105.3	101.3
Total[2]	345.1	370.7	413.3	429.1	429.0	427.4	463.3	469.4	469.5	469.0	526.7	525.1	537.0	523.1
ENERGY PRODUCTION (quadrillion Btu)														
Natural Gas	18.6	25.1	29.6	30.9	30.7	30.8	33.9	33.6	33.5	33.5	36.4	35.0	35.2	34.8
Coal	23.2	20.0	21.7	17.6	17.4	17.7	22.5	16.6	16.1	16.7	22.6	18.3	14.6	18.6
Oil	13.3	19.2	27.7	27.7	27.7	27.7	26.8	26.8	26.8	26.7	25.4	25.4	25.5	25.4
Nuclear	8.2	8.3	8.4	8.4	8.4	8.4	8.5	8.5	8.5	9.4	8.7	8.5	8.5	10.1
Renewable	6.2	9.0	10.4	11.0	11.4	11.0	11.0	14.8	15.0	14.1	12.5	16.7	18.9	15.5
Other	0.0	1.3	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9
Total	69.4	82.7	98.7	96.5	96.5	96.5	103.7	101.2	100.7	101.4	106.6	104.9	103.6	105.4

Table 3. Summary results for AEO2015 Reference case and Clean Power Plan cases, selected years (cont.)

	2005	2013	2020				2030				2040			
			AEO	CPP	CPPEXT	CPPNUC	AEO	CPP	CPPEXT	CPPNUC	AEO	CPP	CPPEXT	CPPNUC
OTHER PRICES (2013 $/MMBtu, unless otherwise noted)														
Natural Gas (Henry Hub)	10.08	3.73	4.88	5.83	5.78	5.80	5.69	5.86	5.90	5.82	7.85	8.15	8.12	8.11
Average Delivered Natural Gas Price to Electric Power Sector	9.55	4.40	5.39	6.47	6.36	6.41	6.22	6.38	6.41	6.29	8.28	8.32	8.33	8.13
Steam Coal Minemouth Price (2013$/short-ton)	24.79	31.31	32.64	32.75	32.80	32.82	36.49	32.78	33.65	32.77	40.94	37.48	36.06	37.51
Steam Coal Price Delivered to Electric Power Sector	1.79	2.34	2.38	2.29	2.29	2.30	2.67	2.33	2.32	2.32	2.92	2.61	2.41	2.63
Brent Spot Price (2013 dollars per barrel)	63.32	108.64	79.13	79.09	79.10	79.09	105.64	105.64	105.64	105.64	141.28	141.31	141.47	141.46
ECONOMIC INDICATORS (billion 2009 chain-weighted dollars, unless otherwise noted)														
Gross domestic product	14,234	15,710	18,801	18,739	18,732	18,744	23,894	23,866	23,855	23,862	29,898	29,886	29,831	29,899
Total industrial shipments	7,464	7,004	8,467	8,423	8,417	8,426	9,870	9,810	9,801	9,810	11,463	11,418	11,374	11,423
Non-farm employment (millions)	134	136	149	149	149	149	159	159	159	159	169	169	169	169
Average Annual Change in CPI from 2013 (%)	-	0.00%	1.75%	1.82%	1.83%	1.81%	1.85%	1.88%	1.88%	1.88%	1.98%	1.99%	2.00%	1.99%
END-USE ENERGY CONSUMPTION (quadrillion Btu)														
Liquids	39.1	35.6	36.9	36.7	36.7	36.7	36.3	36.0	36.0	36.1	36.0	35.9	35.8	35.9
Natural Gas	16.6	18.5	19.0	18.9	18.9	18.9	19.8	19.7	19.6	19.7	20.9	20.7	20.7	20.8
Electricity	12.5	12.6	13.4	13.3	13.3	13.3	14.3	14.0	14.0	14.0	15.3	14.8	14.7	14.8
Coal	2.1	1.5	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
PRIMARY ENERGY (quadrillion Btu)														
Consumption	100.2	97.1	100.8	99.0	99.0	99.0	102.9	100.4	100.2	100.6	105.7	104.0	102.7	104.4
Imports	34.7	24.5	20.2	20.2	20.1	20.2	21.7	21.3	21.3	21.3	24.1	23.7	23.5	23.7
Exports	4.5	11.7	18.1	17.7	17.7	17.8	22.4	21.9	21.7	21.9	24.6	24.3	24.1	24.4
Production	69.4	82.7	98.7	96.5	96.5	96.5	103.7	101.2	100.7	101.4	106.6	104.9	103.6	105.4

[1]All sector average price includes transportation sector.

[2]Total expenditures exclude transportation sector.

Source: U.S. Energy Information Administration.

Table 4. Summary results for AEO2015 High Oil and Gas Resource, High Economic Growth and CPP cases, selected years

	2005	2013	2020				2030				2040			
			AEO HOGR	CPP HOGR	AEO HEG	CPP HEG	AEO HOGR	CPP HOGR	AEO HEG	CPP HEG	AEO HOGR	CPP HOGR	AEO HEG	CPP HEG
ELECTRIC GENERATION (billion kWh)														
Coal	2,013	1,586	1,443	1,212	1,733	1,415	1,441	898	1,733	1,293	1,440	910	1,744	1,421
Natural Gas	761	1,118	1,450	1,610	1,204	1,377	1,832	2,092	1,573	1,422	2,200	2,439	1,705	1,475
Nuclear	782	789	804	804	804	804	808	808	818	808	808	808	911	863
Hydro	270	267	289	294	294	305	290	295	297	305	290	295	298	308
Wind	18	168	229	263	243	315	232	407	301	634	234	412	489	725
Solar	1	19	51	59	52	70	65	85	80	247	85	106	160	420
Other renewables	69	76	107	110	106	117	146	128	158	161	175	145	222	207
Oil/other	142	47	44	41	43	42	42	39	43	41	42	40	43	42
Total	4,055	4,070	4,417	4,392	4,480	4,445	4,854	4,753	5,003	4,912	5,274	5,154	5,574	5,461
ELECTRIC GENERATION CAPACITY (GW)														
Coal	313	304	245	201	265	230	242	173	263	223	242	173	264	223
Natural gas / Oil	442	470	497	516	490	497	573	607	564	540	674	704	657	629
Nuclear	100	99	101	101	101	101	101	101	103	102	101	101	115	109
Hydro	78	79	79	80	80	82	79	80	80	82	79	80	81	83
Wind	9	61	82	97	87	115	83	142	105	216	84	144	165	245
Solar	0	13	27	32	28	38	36	45	44	121	48	58	82	200
Other renewables	12	15	17	18	18	19	20	21	23	26	22	23	32	31
Other	24	25	26	26	26	26	26	26	26	26	26	26	26	26
Total	978	1,065	1,075	1,070	1,094	1,108	1,159	1,196	1,207	1,335	1,275	1,309	1,422	1,546
ELECTRICITY-RELATED CARBON DIOXIDE EMISSIONS (million metric tons)														
Power sector	2,416	2,053	1,973	1,789	2,165	1,886	2,089	1,605	2,262	1,727	2,179	1,701	2,266	1,827
ELECTRICITY PRICES (2013 cents per kWh)														
Residential	11.0	12.2	12.3	12.6	12.9	13.4	12.6	13.1	13.7	14.1	12.8	13.1	14.9	15.1
Commercial	10.1	10.1	10.1	10.3	10.8	11.1	10.0	10.4	11.3	11.6	10.2	10.4	12.4	12.6
Industrial	6.6	6.9	6.8	7.0	7.4	7.7	6.8	7.1	7.9	8.1	7.1	7.2	8.9	8.9
All Sectors[1]	9.4	10.1	10.0	10.2	10.6	10.9	10.0	10.4	11.1	11.5	10.3	10.5	12.3	12.4
ELECTRICITY EXPENDITURES (billion 2013 dollars)														
Residential	149	169	177	179	190	194	192	194	220	222	211	211	265	264
Commercial	128	136	144	146	153	156	156	158	174	175	174	172	209	205
Industrial	68	66	76	78	86	89	86	88	104	105	90	91	127	126
Total[2]	345	371	397	403	428	439	434	440	498	502	475	473	602	594
ENERGY PRODUCTION (quadrillion Btu)														
Natural Gas	18.6	25.1	33.1	34.0	30.0	30.8	43.8	45.0	35.3	33.9	52.0	52.2	37.7	36.0
Coal	23.2	20.0	18.8	16.3	22.0	18.4	19.8	14.0	23.0	18.3	20.3	14.7	23.5	20.0
Oil	13.3	19.2	32.6	32.6	27.7	27.7	40.5	40.5	27.1	27.0	43.6	43.3	26.0	25.8
Nuclear	8.2	8.3	8.4	8.4	8.4	8.4	8.5	8.5	8.6	8.5	8.5	8.5	9.5	9.0
Renewable	6.2	9.0	10.4	10.9	10.7	11.8	10.9	12.6	12.0	16.9	11.4	13.0	15.5	20.1
Other	0.0	1.3	0.9	0.9	0.9	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
Total	69.4	82.7	104.3	103.1	99.7	98.1	124.4	121.6	107.0	105.6	136.8	132.7	113.3	111.9

Table 4. Summary results for AEO2015 High Oil and Gas Resource, High Economic Growth and CPP cases, selected years (cont.)

	2005	2013	2020				2030				2040			
			AEO HOGR	CPP HOGR	AEO HEG	CPP HEG	AEO HOGR	CPP HOGR	AEO HEG	CPP HEG	AEO HOGR	CPP HOGR	AEO HEG	CPP HEG
OTHER PRICES (2013 $/MMBtu, unless otherwise noted)														
Natural Gas (Henry Hub)	10.08	3.73	3.12	3.38	5.03	5.75	3.67	3.81	6.02	5.81	4.38	4.47	8.45	8.49
Average Delivered Natural Gas Price to Electric Power Sector	9.55	4.40	3.68	4.07	5.65	6.34	4.15	4.27	6.61	6.31	4.67	4.86	8.71	8.57
Steam Coal Minemouth Price (2013$/short-ton)	24.79	31.31	31.18	31.37	32.74	33.37	33.82	31.32	36.61	33.83	37.96	34.78	41.60	38.92
Steam Coal Price Delivered to Electric Power Sector	1.79	2.34	2.24	2.18	2.39	2.33	2.44	2.12	2.68	2.41	2.67	2.30	2.96	2.73
Brent Spot Price (2013 dollars per barrel)	63.32	108.64	75.72	75.40	79.67	79.62	98.15	97.99	107.51	107.24	129.38	129.52	145.17	144.91
ECONOMIC INDICATORS (billion 2009 chain-weighted dollars, unless otherwise noted)														
Gross domestic product	14,234	15,710	18,841	18,796	19,590	19,526	24,222	24,192	26,146	26,126	30,236	30,186	34,146	34,107
Total industrial shipments	7,464	7,004	8,566	8,536	8,967	8,924	10,349	10,314	11,081	11,022	11,989	11,969	13,786	13,656
Non-farm employment (millions)	134	136	149	149	152	152	160	160	166	166	170	170	176	176
Average Annual Change in CPI from 2013 (%)	-	0.00%	1.56%	1.60%	1.67%	1.74%	1.63%	1.63%	1.62%	1.65%	1.85%	1.84%	1.80%	1.82%
END-USE ENERGY CONSUMPTION (quadrillion Btu)														
Liquids	39.1	35.6	37.4	37.3	37.8	37.6	37.7	37.4	38.3	38.2	37.4	37.3	39.7	39.4
Natural Gas	16.6	18.5	19.8	19.7	19.2	19.1	21.9	21.9	20.6	20.6	24.1	24.0	22.5	22.4
Electricity	12.5	12.6	13.6	13.6	13.8	13.7	14.8	14.5	15.3	15.0	15.9	15.5	16.8	16.4
Coal	2.1	1.5	1.6	1.6	1.7	1.7	1.6	1.5	1.8	1.8	1.5	1.5	1.9	1.9
PRIMARY ENERGY (quadrillion Btu)														
Consumption	100.2	97.1	101.8	100.6	103.1	101.6	106.8	103.7	108.5	107.2	110.8	107.7	116.2	114.9
Imports	34.7	24.5	19.9	20.4	21.0	20.9	18.2	18.0	23.5	23.2	18.3	18.4	27.3	26.9
Exports	4.5	11.7	22.5	23.0	17.7	17.4	35.7	35.8	21.7	21.4	44.0	43.2	23.9	23.5
Production	69.4	82.7	104.3	103.1	99.7	98.1	124.4	121.6	107.0	105.6	136.8	132.7	113.3	111.9

[1]All sector average price includes transportation sector.
[2]Total expenditures exclude transportation sector.

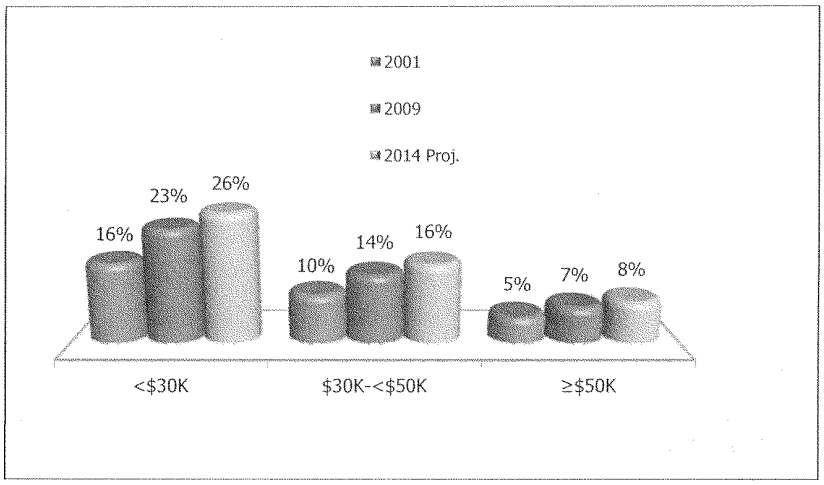
Source: U.S. Energy Information Administration.

The entire report can be found here:
https://www.eia.gov/analysis/requests/powerplants/cleanplan/pdf/powerplant.pdf

DOCUMENTS SUBMITTED BY REPRESENTATIVE GARY PALMER

ACCCE
AMERICAN COALITION FOR CLEAN COAL ELECTRICITY

Energy Cost Impacts on American Families, 2001-2014



Energy Costs as Percentage of Nominal After-Tax Household Income

February 2014

www.americaspower.org

Executive Summary

This report analyzes consumer energy cost increases and the reduction of real household incomes since 2001 for all U.S. households. It projects household energy expenditures for 2014 among four income levels and for senior and minority families. It relies on historical energy consumption survey data and current energy price forecasts from the U.S. Department of Energy's Energy Information Administration (EIA).[1] Energy costs are summarized in nominal (then-current) and constant 2001 dollars by household income category for U.S. households in 2001, 2005, 2009, and 2014, using data from EIA, U.S. DOT, and the U.S. Bureau of the Census.[2] Energy price projections for 2014 are based on the DOE/EIA Short-Term Energy Outlook released in January 2014.

Key findings of this report are:

- Declining real household incomes, coupled with increased energy prices, are burdening family budgets for millions of low- and middle-income Americans. Real household incomes have declined across all five income quintiles measured by the Bureau of Labor Statistics since 2001. The largest percentage losses of real average household incomes have occurred in the first and second income quintiles, among households least able to afford higher energy costs for heating, cooling and other necessities. Average real household incomes in these lower-income household groups decreased by 13% and 10%, respectively, from 2001 to 2012.

- For households with gross annual incomes below $50,000 – representing one-half or more of U.S. households since 2001 – total energy costs will increase by 27% in constant dollars between 2001 and 2014, while estimated average real after-tax household incomes will decline by 22%. Average U.S. household energy costs for residential utilities and gasoline will increase by 33% in real terms. Average real after-tax household income is projected to decline by 10% from 2001 to 2014. The percentage of after-tax income spent on energy is not affected by the adjustment of survey-based income and expenditures from then-current to constant 2001 dollars.

- For low- and middle-income families, energy costs are consuming a portion of after-tax household income comparable to that traditionally spent on major categories such as housing, food, and health care. The average American family's energy expenditures will increase by 33% in real terms since 2001, while average real pre-tax income will decline by 6%.

- Higher gasoline prices account for most of the increased cost of energy for consumers since 2001. Average U.S. household expenditures for gasoline will grow by 55% measured in 2001 constant dollars from 2001 to 2014, based on EIA gasoline price projections for 2014 and changes in household gasoline consumption. In comparison, residential energy costs for heating, cooling, and other household energy services will increase on average by 10% in constant 2001 dollars over this period.

- Residential electricity has maintained relatively stable average annual price increases at a national level, with steeper increases in many eastern states. National residential electricity prices have increased by 7% in constant dollars since 2001, while the price of gasoline has increased by 72% in real terms. The price of residential natural gas has declined in real terms by 10% since 2001, reflecting the expansion of gas supplies due to new drilling technologies.

- Additional upward pressures on electricity prices can be expected due to additional capital, operating and maintenance costs associated with meeting new clean air and other environmental standards, as well as higher natural gas prices.

- Lower-income families are more vulnerable to energy costs than higher-income families because energy represents a larger portion of their household budgets, reducing the amount of income that can be spent on food, housing, health care, and other necessities. Some 30% of U.S. households had gross annual incomes less than $30,000 in 2012. Energy costs in 2014 are projected to account for an average of 26% of their family budgets, before taking into account any energy assistance programs.

- The Census Bureau finds that real median household incomes for both white and minority households have not returned to their pre-2001 recession peaks. Household income in 2012 was 6.3 percent lower for non-Hispanic Whites (from $60,849 in 1999), 15.8 percent lower for Blacks (from $39,556 in 2000), 7.7 percent lower for Asians (from $74,343 in 2000), and 11.8 percent lower for Hispanics (from $44,224 in 2000).

- The average incomes of Hispanic and Black households were 25% and 33% lower, respectively, than the average income of U.S. households in 2012. These income inequality data indicate that disproportionate numbers of Black and Hispanic families are vulnerable to energy price increases.

- Fixed-income seniors are a growing proportion of the U.S. population, and are among the most vulnerable to energy cost increases due to their relatively low average incomes. In 2012, the median gross income of 27.9 million households with a principal householder aged 65 or older was $33,848, one-third below the national median household income.

Energy Cost Impacts on American Families, 2001–2014

Energy costs for residential utilities and gasoline continue to strain low- and middle-income family budgets. As Table 1 illustrates, the average American family with an after-tax income of $54,286 will spend an estimated $5,752 on energy in 2014, or 11% of the family budget. The 60 million households earning less than $50,000, representing 49% of U.S. households, will devote an estimated 20% of their after-tax incomes to energy, compared with an average of 8% for households with annual incomes above $50,000. For the 37 million lower-income families with pre-tax incomes less than $30,000, energy costs in 2014 will represent 26% of average after-tax incomes, compared with 16% in 2001. These energy expense estimates for lower-income households do not take into account any energy assistance programs that may be available.

The summary income and energy expenditure data in Table 1 are based on U.S. Bureau of the Census pre-tax household income data for 2012 (the most recent available, with households as of March 2013) and energy prices for 2014 projected by U.S. DOE/EIA. The Congressional Budget Office has calculated effective total federal tax rates, including individual income taxes and payments for Social Security and other social welfare programs.[3] Federal tax rates for 2014 are based on CBO's estimates for 2009 adjusted for payroll and other tax increases in the American Taxpayer Relief Act of 2012.[4] State income taxes are estimated from current state income tax rates

Table 1. Projected Household Energy Expenditures as a Percentage of Income, 2014

Pre-tax income	<$30K	$30K<$50K	<$50K	≥$50K	Average
Est. average after-tax income	$15,120	$33,469	$22,624	$85,827	$54,286
Percentage of households	30%	19%	49%	51%	100%
Residential energy	$1,715	$1,985	$1,832	$2,642	$2,246
Transportation fuel	$2,171	$3,260	$2,606	$4,369	$3,506
Total energy	$3,886	$5,245	$4,438	$7,011	$5,752
Energy pct. of after-tax income	26%	16%	20%	8%	11%

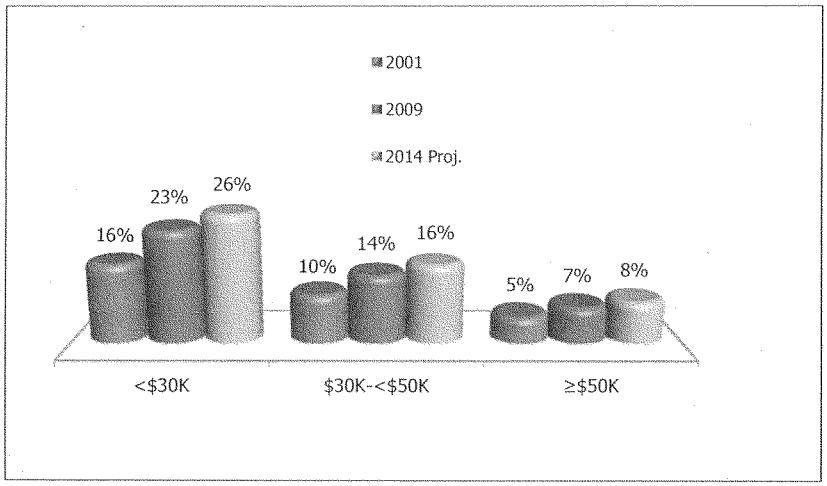
Source: Appendix Table 1.

The Bureau of Labor Statistics reports that 21% of total pre-tax household income is concentrated among the top-4% of households, those earning $200,000 or more. The 49% of U.S. households earning less than $50,000 in 2012 received 17% of total household income. The 30% of households earning less than $30,000 received 7% of total household income.[5]

Many lower-income families qualify for federal or state energy assistance. However, these programs are unable to keep up with household energy costs. In FY2011, federal funding for the Low Income Home Energy Assistance Program (LIHEAP) was cut from $5.1 billion to $4.7 billion.[6] In FY2012, Congress again reduced annual funding for LIHEAP to $3.5 billion.[7] LIHEAP funding for FY2014 is $2.9 billion under the Continuing Resolution.[8] Based on DOE/EIA's 2009 Residential Energy Consumption Survey (2012), a $2.9 billion funding level for LIHEAP would offset less than 4% of projected 2014 residential energy bills for lower-income households with incomes below $30,000.

The portion of household incomes devoted to energy has increased substantially since 2001 (see Chart 1). In 2001, 62 million families with nominal gross annual incomes less than $50,000 spent an average of 12% of their after-tax income on residential and transportation energy. In 2014, energy will account for an average of 20% of the after-tax income of the 60 million American families in this income category. Energy cost burdens are greatest on low-income families, those earning less than $30,000. Their average energy bills will increase from 16% of estimated after-tax income in 2001 to 26% in 2014. Because these estimates do not account for any energy assistance that these families may receive, they may not reflect actual personal energy consumption expenditures.

Chart 1
Energy costs as percentage of nominal after-tax household income,
2001, 2009, and projected 2014



Source: Appendix Table 1.

Adjustment to Constant Dollars

The quadrennial government energy expenditure survey data used in this report are updated for current population and energy prices. The DOE/EIA residential energy survey results are expressed in current dollars, and the percentage of income allocated to energy does not change when income and expenditure data are converted to constant 2001 dollars (see Appendix Tables 1 and 2). These calculations use as-reported income categories (e.g., <$30,000) in current dollars to preserve the integrity of the survey findings.

The impacts of higher energy prices on lower-income families are compounded by the sluggish growth of household incomes since 2001 expressed in then-current dollars, and by the reduction of real incomes in constant 2001 dollars. For the 36 to 38 million low-income households with pre-tax incomes below $30,000 represented in the DOE/EIA residential energy surveys since 2001, and the 58 to 62 million households with gross incomes below $50,000, average pre-tax incomes have declined substantially in real terms:

Table 2
Household incomes for low- and middle-income households in current and constant dollars, 2001, 2005, 2009 and projected 2014

Income/pop.	2001	2005	2009	2014 (Proj.)
<$30K	<$30K	<$30K	<$30K	<$30K
H/holds (mil.)	38.7	37.5	35.5	36.9
Avg. pre-tax income (current $)	$16,168	$16,112	$16,217	$16,096
Avg. pre-tax income (2001$)	$16,168	$14,647	$13,402	$11,284
<$50K	<$50K	<$50K	<$50K	<$50K
H/holds (mil.)	62.3	60.9	58.2	59.9
Avg. pre-tax income (current $)	$24,893	$25,055	$25,143	$24,953
Avg. pre-tax income (2001$)	$24,893	$22,778	$20,779	$18,622

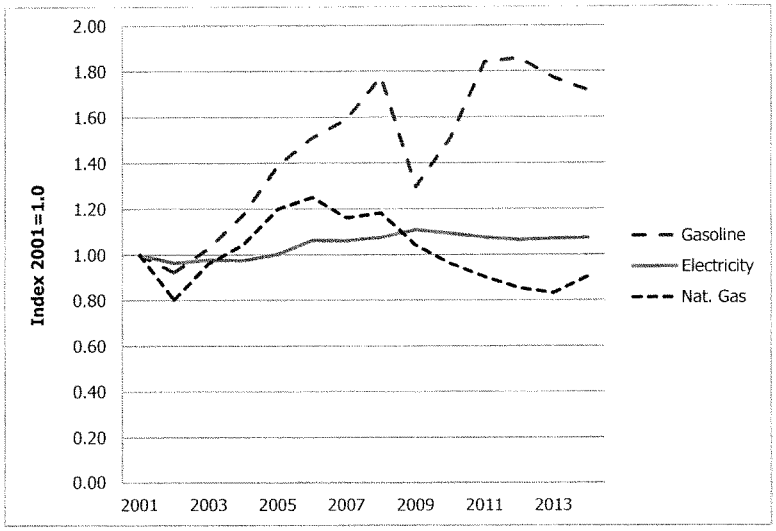
Source: Appendix tables 1 and 2.

Relative energy price increases

Chart 2 (below) presents an index of price trends for the three principal consumer energy commodities - gasoline, residential electricity and natural gas - in constant 2001 prices from 2001 to 2014. Price projections for 2014 are based on current EIA projections.

The price of gasoline will increase by 72% in real terms over this period, while residential electricity is projected to increase by 7%. Residential natural gas prices will decline by 10% following a period of sharp price volatility and the development of additional gas reserves. Average U.S. household expenditures for gasoline will grow by 55% measured in 2001 constant dollars from 2001 to 2014, based on EIA gasoline price projections for 2014 and changes in household gasoline consumption. In comparison, residential energy costs for heating, cooling, and other household energy services will increase on average by 10% in constant 2001 dollars over this period.

Chart 2
Index of real prices of gasoline, residential electricity, and residential natural gas, 2001-2014 (2001=1.0)
(Gasoline in $/gal., electricity in cents/kWh and natural gas in $/tcf)

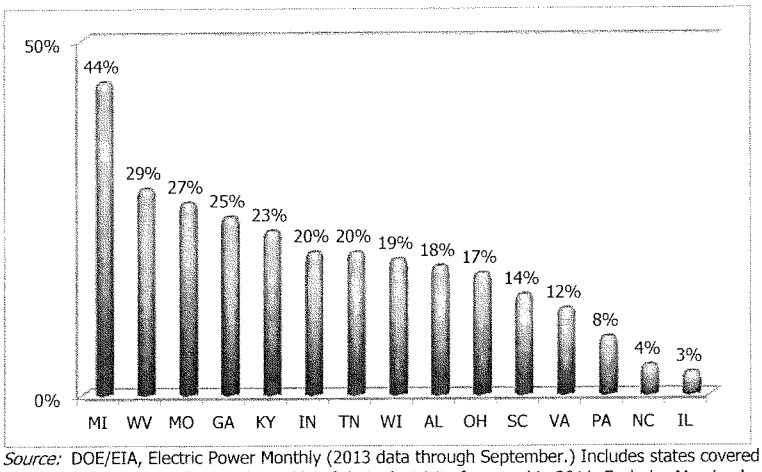


Source: U.S. DOE/EIA, Annual Energy Review (2012) and Short-Term Energy Outlook (January 2014)
Prices are adjusted from current dollars to constant 2001 dollars using the CPI and indexed to 2001.

These national energy price trends mask larger consumer electric price increases in eastern coal-dependent states subject to major U.S. EPA rules for reducing sulfur dioxide and nitrogen oxides, including the 1998 Ozone Transport Rule and the 2005 Clean Air Interstate Rule.[9] The chart below summarizes real residential electric price increases from 2005 to 2013 in 15 eastern states subject to both of these rules. The total estimated capital

investment for pollution control retrofits in this group of states for compliance with federal and state air quality regulations is $71 billion (nominal $) through the year 2012.[10]

Chart 3
Residential real electric price increases in coal-dependent states covered by U.S. EPA's Ozone Transport Rule and Clean Air Interstate Rule, 2005-2013
(Electric price in cents/kwh deflated by CPI)



Source: DOE/EIA, Electric Power Monthly (2013 data through September.) Includes states covered by both rules and that generated more than 40% of their electricity from coal in 2011. Excludes Maryland, which was subject to the 2006 Maryland Healthy Air Act and the expiration of rate caps.

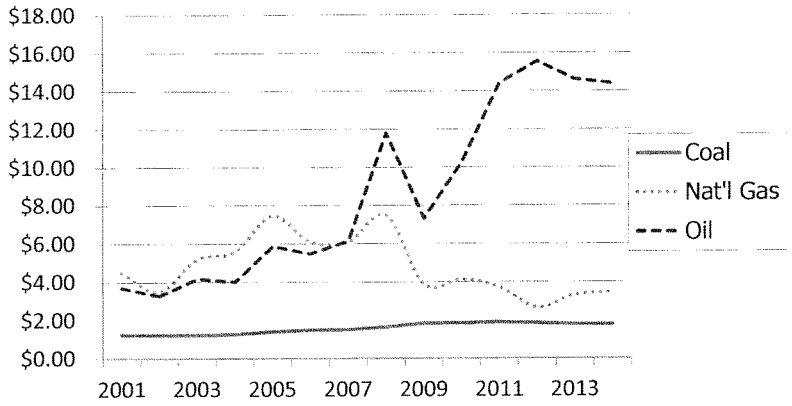
These electric price increases are due to a variety of factors, including costs of compliance with state and federal environmental regulations, fuel prices, and rate case determinations.

Current and prospective EPA rules are expected to result in additional electricity price increases in many areas of the country.[11] For example, EPA estimates the annual costs of compliance with one recent Clean Air Act regulation – the utility Mercury and Air Toxics Standards rule – at $9.6 billion ($2007) in 2016.[12] The projected annual cost of this rule is 45% greater than EPA's $6.6 billion ($2006) estimate of the annual costs of compliance with all utility Clean Air Act requirements in 2010.[13]

Electric utility fuel cost trends

As Chart 4 illustrates, real (2001$) coal prices at electric utilities have remained stable relative to competing fuels such as natural gas and petroleum.[14] Natural gas prices have declined sharply in the past five years due to increased supply, and have helped to restrain the rate of residential electricity price increases.

Chart 4
Electric utility fuel costs, 2001-2014
(Constant 2001$ per Million BTU)



Source: DOE/EIA, Electric Power Annual (2012) and Short-Term Energy Outlook (January 2014).

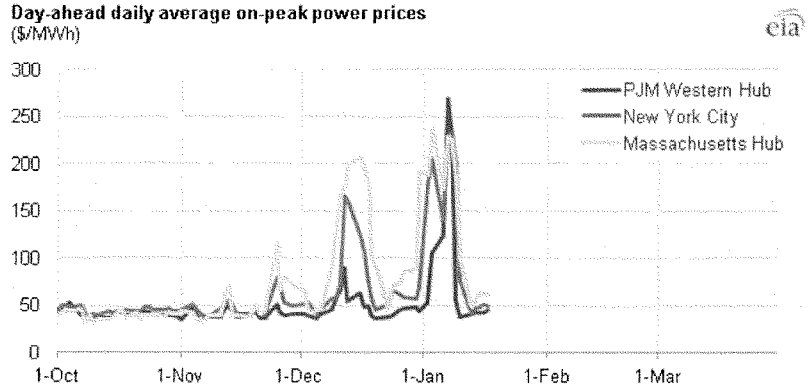
EIA forecasts that domestic coal will cost $2.38 per million British Thermal Units (MMBTU) delivered to power plants in 2014, an increase of 1% over 2013.[15] The cost of natural gas at utility plants in 2014 is projected at $4.64/MMBTU, a 6% increase over 2013 delivered gas prices.[16]

EIA projects that natural gas wellhead prices will increase due to projected LNG exports and increased domestic demand. EIA's 2014 Annual Energy Outlook (AEO) reports that:

> The Henry Hub spot price for natural gas in the *AEO2014* Reference case is higher than projected in *AEO2013* through 2037, with price increases in the near term driven by faster growth of consumption in the industrial and electric power sectors and, later, growing demand for export at LNG facilities. A sustained increase in production follows, leading to slower price growth over the rest of the projection period.
>
> The Henry Hub spot natural gas price in *AEO2014* reaches $4.80 per million Btu (MMBtu) (2012 dollars) in 2018, which is 77 cents/ MMBtu higher than in *AEO2013*. The stronger near-term price growth is followed by a lagged increase in supply from producers, eventually causing prices to settle at $4.38/MMBtu in 2020, which is still notably higher than in *AEO2013*.[17]

Recent natural gas price spikes due to cold winter weather in the eastern U.S. have led to extreme price volatility in regional electric markets, both in the gas-dependent Northeast and in the Mid-Atlantic and PJM regions. Chart 5 below shows the trend of electric prices in these regions in from October 2013 to early January 2014:

Chart 5
Northeast and Mid-Atlantic electricity prices, Oct 2013-Jan 2014



Source: DOE/EIA, Today in Energy, January 21, 2014.

The extreme price volatility reflected in these recent power prices is due to major increases in power demand to meet increased heating requirements, shortages in natural gas supply and transmission capability to some areas of the Northeast, and the unexpected outages of power plants and natural gas equipment. The scheduled retirements of more than 60 Gigawatts of existing coal-based capacity in the eastern U.S.[18] in response to EPA's 2011 Mercury and Air Toxics Standards Rule and other factors will add further upward pressure to power prices, especially during peak demand periods.

Consumer Energy Cost Estimates

The distribution of U.S. households by income categories provides the basis for estimating the effects of energy prices on consumer budgets in 2014. EIA's quadrennial Surveys of Residential Energy Consumption[19] are the principal sources for estimating energy expenditures for residential heating, cooling, electricity, and other household energy services. For this report, the most recent EIA 2009 survey (2012) is updated with Census Bureau 2012 population data and EIA's January 2014 forecast of 2014 residential energy prices.

EIA's 2001 Survey of Household Vehicles Energy Use[20] provides benchmark data on transportation energy costs by household income category based on gallons of gasoline used per household. These gasoline consumption data are updated using Census Bureau 2012

population data and EIA's January 2014 national average retail gasoline price forecast for 2014 of $3.52 per gallon.

It is assumed that household gasoline usage in 2014 will be 17% below the levels of the EIA 2001 survey, reflecting a population-adjusted decline of motor gasoline sales over this period. The more recent 2009 National Highway Transportation Survey (2011) confirms the aggregate gasoline expenditure estimates for 2014 in this report.[21]

Residential and transportation energy expenses

The principal residential energy expenses are for electricity and natural gas for heating, cooling, lighting, and appliances. Some homes also use propane fuel (LPG) and other heating sources, such as home heating oil, kerosene, and wood.

Gasoline accounts for the largest single increase in consumer energy costs over the past decade. In 2014, the average U.S. family will spend an estimated $2,617 (2001$) on gasoline, compared with $1,688 in 2001. This 55% increase in real expenditures for gasoline takes into account a 17% reduction in average household gasoline consumption since 2001.

The increase in gasoline prices follows a long-term trend of increased market shares of pickup trucks and sport utility vehicles (SUVs), and an increase in the average number of vehicles owned per household.[22] While average vehicle efficiency has been improving in recent model years,[23] and will continue to improve due to new CAFE standards, many families continue to own low-efficiency vehicles with low trade-in values. The average age of vehicles on the road has increased to 11 years, a trend that is expected to continue.[24]

The impacts of residential and transportation energy costs on low- and middle-income families and for all households are summarized in Table 3 and in Appendix Tables 1 (current dollars) and 2 (constant 2001 dollars). For households with gross annual incomes below $50,000 – representing one-half or more of U.S. households since 2001 – total energy costs will increase by 27% in constant dollars between 2001 and 2014, while estimated average real after-tax household incomes will decline by 22%. Total U.S. household energy costs will increase by 33% in real terms. Meanwhile, average real after-tax household income is projected to decline by 10%.

Table 3
Estimated after-tax income and energy costs by income category,
2001, 2005, and Projected 2014
(In constant 2001 dollars)

Pre-tax annual income (EIA Survey basis):	<$30K	<$50K	U.S. Total
Est. avg. after-tax income			
2001	$14,624	$21,635	$45,127
2005	$13,286	$19,890	$43,428
2014	$11,284	$16,883	$40,512
Pct. Chg. 2001-14	-23%	-22%	-10%
Residential energy expenditures			
2001	$1,204	$1,299	$1,530
2005	$1,328	$1,423	$1,681
2014	$1,280	$1,367	$1,676
Pct. Chg. 2001-14	6%	5%	10%
Transport energy expenditures			
2001	$1,103	$1,306	$1,688
2005	$1,624	$1,926	$2,537
2014	$1,620	$1,944	$2,617
Pct. Chg. 2001-14	47%	49%	55%
Total energy expenditures			
2001	$2,307	$2,605	$3,218
2005	$2,952	$3,349	$4,218
2014	$2,900	$3,312	$4,292
Pct. Chg. 2001-14	26%	27%	33%

Source: Appendix Table 2.

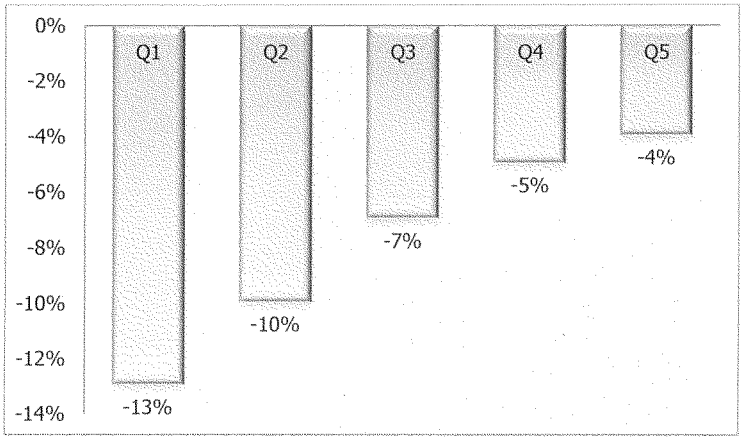
Rising Energy Costs and Declining Real Incomes

Increasing energy costs are straining low- and middle-income family budgets. Heating, cooling, and transportation are necessities of life, and increased energy costs are impacting low- and middle-income family budget choices among energy and other necessities such as health care, housing, and nutrition.

As energy costs have risen over the past decade, the real, inflation-adjusted incomes of American families have declined. The U.S. Census Bureau reports in its latest assessment of income and poverty that real median household income declined slightly between 2011 and 2012, a third consecutive year of declining family incomes. Real median household income has declined by 8.3% since 2007.[25]

The Bureau of Labor Statistics measures average household incomes by income quintile. BLS data for 2001-2012, expressed in constant 2012 dollars, show a steady decline in real average pre-tax household incomes across all five income quintiles, including the top-5% of households. As indicated by Chart 6, the largest declines in real household incomes have occurred in the two lowest income quintiles, among households least able to afford energy cost increases. The 20% of households in the lowest quintile had gross incomes of $13,146 in 2001. After a 13% decline, these households had real average incomes of $11,490 in 2012. Households in the second quintile experienced a 10% decline of real income, from $33,030 in 2001 to $29,696 in 2012.

Chart 6
Percent change in real household income by income quintile, 2001 to 2012
(Percent change in average income in 2012$)

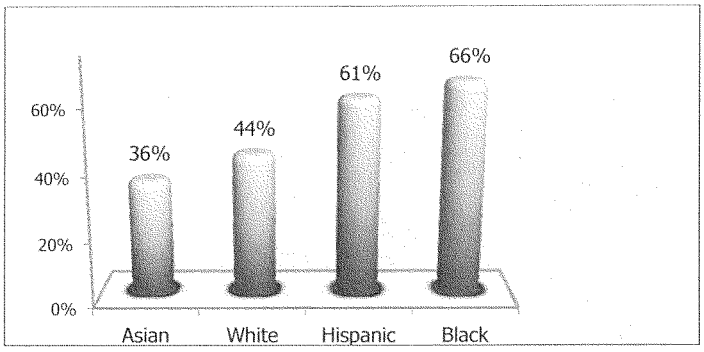


Source: U.S. Bureau of Labor Statistics.

Energy Cost Impacts on Minorities

EIA's residential energy consumption surveys do not provide energy consumption expenditures by income group combined with minority status. However, as shown in Chart 7, the unequal distribution of household incomes is a principal factor leading to disproportionate energy cost impacts on many minority families. More than 60% of Hispanic households and two-thirds of Black households had pre-tax household incomes below $50,000 in 2012, compared with 36% for Asian families and 44% for white households.

Chart 7
Percentage of Households with Pre-Tax Incomes below $50,000, 2012



Source: U.S. Bureau of the Census, Current Population Survey (August 2013).

The Census Bureau finds that real median household incomes for both white and minority households have not returned to their pre-2001 recession peaks.[26] Household income in 2012 was 6.3 percent lower for non-Hispanic Whites (from $60,849 in1999), 15.8 percent lower for Blacks (from $39,556 in 2000), 7.7 percent lower for Asians (from $74,343 in 2000), and 11.8 percent lower for Hispanics (from $44,224 in 2000).

Table 4 summarizes 2012 household incomes for Asian, Black, Hispanic, and white families by gross annual income bracket. The average incomes of Hispanic and Black households were 25% and 33% lower, respectively, than the average income of U.S. households. Asian households, on the other hand, had average annual incomes 28% higher than the U.S. average income of $69,677. Based on these income inequality data, disproportionate numbers of Black and Hispanic families appear to be more vulnerable to energy price increases than Asian or white families.

Table 4. Distribution of U.S. households by
pre-tax annual income, 2012

Pre-tax annual income: Percentage of households	<$10K	$10-<$30K	$30-<$50K	<$50K	≥$50K	Totals
Asian	7%	15%	15%	36%	64%	100%
Black	15%	30%	20%	66%	34%	100%
Hispanic	10%	28%	22%	61%	39%	100%
White	5%	21%	18%	44%	56%	100%
U.S. average	7%	23%	19%	49%	51%	100%

**Source:* U.S. Bureau of the Census, Current Population Survey (August 2013).

Impacts on Senior Citizens

In 2012, 29% of U.S. households received Social Security benefits. The average basic Social Security income of these 34 million households was $16,977.[27] Some 18% of U.S. households also received retirement income averaging $23,335.[28]

Fixed-income seniors are a growing proportion of the U.S. population, and are among the most vulnerable to energy cost increases due to their relatively low average incomes. In 2012, the median gross income of 27.9 million households with a principal householder aged 65 or older was $33,848, one-third below the national median household income.[29] The $33,848 median income of senior U.S. households in 2012 means that half of these households depend on incomes below this level.

Lower-income senior households that depend mainly on fixed incomes are among those most vulnerable to energy price increases. Food, health care, and other necessities compete with energy costs for a share of the household budget.

Conclusion

Shrinking real household incomes among American families are magnifying the impacts of rising energy costs on family budgets. Government support for energy assistance programs has declined markedly due to fiscal pressures, increasing the vulnerability of millions of American families to energy cost increases.

Acknowledgment – This report was prepared for ACCCE by Eugene M. Trisko, who has conducted these analyses annually since 2000. Mr. Trisko is an attorney and energy economist who represents labor and industry clients. He previously served as an energy economist with Robert Nathan Associates, an attorney in the Bureau of Consumer Protection of the U.S. Federal Trade Commission, and as an expert witness on utility cost of capital.

Notes

[1] Data on residential energy consumption patterns by income are derived from U.S. Department of Energy, Energy Information Administration, "Survey of Residential Energy Consumption," (2001, 2005 and 2009 surveys), available at http://www.eia.doe.gov/emeu/recs/contents.html. Data for 2009 energy consumption by household income are updated to projected 2014 values based on changes in household income and population, and changes in consumer residential energy prices between 2009 and 2014 from EIA's "Short-Term Energy Outlook" (January 2014).

[2] Household incomes by gross income category are calculated from the 2012 distribution of household income in U.S. Bureau of the Census, Current Population Survey, "Annual Social and Economic Supplement" (2013).

[3] Congressional Budget Office (CBO), "Effective Federal Tax Rates Under Current Law, 2001 to 2014" (August 2004); "Effective Federal Tax Rates 1979-2006" (April 2009). Effective federal tax rates for the income categories in this paper were interpolated from CBO's tax rates by income quintile based on the distribution of 2001, 2005, 2009, and 2012 household incomes. State income tax rates were

estimated from tax rates summarized in Federation of Tax Administrators, http://www.taxadmin.org/fta/rate/ind_inc.html.

[4] Effective federal tax rates for 2014 are estimated from CBO's estimates for 2009 adjusted for payroll and other tax increases in the American Taxpayer Relief Act of 2012 (January 1, 2013), as analyzed by the Urban-Brookings Tax Policy Center (January 1, 2013, ATRA versus patched 2012 base.) See, http://www.taxpolicycenter.org/numbers/displayatab.cfm?Docid=3755&DocTypeID=1.

[5] U.S. Bureau of the Census, Current Population Reports, Table HHINC-06 (2013).

[6] See, http://www.neada.org/appropriations/index.html.
http://www.acf.hhs.gov/programs/ocs/resource/low-income-home-energy-assistance-program-provides-help-for-struggling

[7] See, http://www.acf.hhs.gov/programs/ocs/resource/low-income-home-energy-assistance-program-provides-help-for-struggling

[8] See, http://www.acf.hhs.gov/programs/ocs/news/liheap-fact-sheet-for-fy-2014

[9] Since 2000, the electric utility sector has complied with the federal acid rain program enacted in the 1990 Clean Air Act Amendments, EPA's 1998 Ozone Transport Rule reducing nitrogen oxide emissions in 19 eastern states, Phase I of EPA's 2005 Clean Air Interstate Rule requiring further reductions of sulfur dioxide and nitrogen oxide emissions in the eastern U.S., and a variety of other federal and state air and water quality standards.

[10] Energy Ventures Analysis, Inc., Coal-fired Power Investment in Air Pollution Controls (October 1, 2013), Appendix Fig. A-1.

[11] See, U.S. EPA, "The Benefits and Costs of the Clean Air Act from 1990 to 2020" (2011) at Table 3-2 (electric utility direct annual compliance costs increased from an estimated $1.4 billion ($2006) in 2000 to $6.6 billion ($2006) in 2010.) Since 2000, the utility sector has complied with the federal acid rain program enacted in the 1990 Clean Air Act Amendments, EPA's 1998 Ozone Transport Rule reducing nitrogen oxide emissions in 19 eastern states, Phase I of EPA's 2005 Clean Air Interstate Rule requiring further reductions of sulfur dioxide and nitrogen oxide emissions in the eastern U.S., and a variety of other federal and state air and water quality standards.

[12] U.S. EPA, "Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards," (December 2011) at ES-14.

[13] U.S. EPA, "The Benefits and Costs of the Clean Air Act," *supra.*

[14] U.S. DOE/EIA, "Electric Power Annual 2010," (historical tables, 2011) and "Short-Term Energy Outlook," (January 2014).

[15] U.S. DOE/EIA, "Short-Term Energy Outlook" (January 2014), Table 2.

[16] *Id.*

[17] U.S. DOE/EIA, "Annual Energy Outlook 2014 Early Release," (December 2013).

[18] Edison Electric Institute, "Coal Fleet Announcements," December 16, 2013 (68 Gigawatts of announced capacity retirements, representing 20% of the total coal fleet, between 2010 and 2022).

[19] U.S. DOE/EIA, "Residential Energy Consumption Survey, 2009," (2012). Data in this report for households with incomes below $60,000 were provided to the author by EIA.

[20] U.S. DOE/EIA, "Household Vehicles Energy Use: Latest Data & Trends" (November 2005), available at http://www.eia.doe/gov/emeu/rtecs/nhts_survey/2001/.

[21] U.S. Department of Transportation, National Household Travel Survey, Summary of Travel Trends (June 2011) at Table 34 (average household gasoline expenditures increased from $1,275 in 2001 (2001$) to $3,308 (2009$) in 2009.) The average price of gasoline in the NHTS 2009 survey was $2.96/gallon, compared with the $3.52/gallon price that EIA projects for 2014. The 2009 NHTS report does not provide gasoline expenditure or consumption data by household income category.

[22] *Id.*, at Fig. 1, Tables 1, 20.

[23] *See*, U.S. EPA, Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 - 2013 (2013), available at http://epa.gov/otaq/fetrends.

[24] R.L. Polk & Co. reports that the average age of automobiles on the road reached a record of 11.4 years in 2013, reflecting a rising trend for the past 10 years. Polk expects the number of vehicles 12 years and older to keep expanding, growing by more than 20% by 2018. *See*, http://money.cnn.com/2013/08/06/autos/age-of-cars/.
[25] U.S. Census Bureau, "Income, Poverty, and Health Insurance Coverage in the United States: 2012" (2013), at 5.
[26] U.S. Census Bureau, "Income, Poverty, and Health Insurance Coverage in the United States: 2012" (2013), at 8.
[27] U.S. Census Bureau, "American Community Survey – 2012 American Community Survey 1-Year Estimates," (2013).
[28] *Id.*
[29] U.S. Census Bureau, "Income, Poverty, and Health Insurance Coverage in the United States: 2012" (2013), Table 1.

APPENDIX TABLE 1 - 2001, 2005, 2009, AND 2014 HOUSEHOLD INCOME AND ENERGY EXPENSES (CURRENT DOLLARS)

2001 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS (CURRENT DOLLARS)

						SUBTOTALS		
EIA SURVEY CATEGORIES:	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	<$30K	<$50K	>/=$50K
Households (Mil.)	9.8	28.9	23.6	47.0	109.3	38.7	62.3	47.0
Pct of total households	9.0%	26.4%	21.6%	43.0%	100.0%	35.4%	57.0%	43.0%
Avg pre-tax income	$5,733	$19,707	$39,201	$107,649	$60,488	$16,168	$24,893	$107,649
Effec. fed tax rate %	2.0%	9.0%	14.9%	22.3%	21.0%	7.2%	10.1%	22.3%
Est. state tax rate%	1.5%	2.6%	4.0%	6.3%	4.4%	2.3%	3.0%	6.3%
Est. after-tax income	$5,532	$17,421	$31,792	$76,861	$45,127	$14,624	$21,635	$76,861
Residential energy $	$1,039	$1,260	$1,456	$1,836	$1,530	$1,204	$1,299	$1,836
Residential electric $	$628	$772	$922	$1,172	$963	$736	$806	$1,172
Other resid. energy $	$411	$488	$534	$664	$567	$469	$493	$664
Transport energy $	$934	$1,160	$1,638	$2,195	$1,688	$1,103	$1,306	$2,195
Total energy $	$1,973	$2,420	$3,094	$4,031	$3,218	$2,307	$2,605	$4,031
Energy % of after-tax inc.	35.7%	13.9%	9.7%	5.2%	7.1%	15.8%	12.0%	5.2%
Resid. % of after-tax inc.	18.8%	7.2%	4.6%	2.4%	3.4%	8.2%	6.0%	2.4%
Trans. % of after-tax inc.	16.9%	6.7%	5.2%	2.9%	3.7%	7.5%	6.0%	2.9%

2005 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS (CURRENT DOLLARS)

EIA SURVEY CATEGORIES:	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	<$30K	<$50K	>/=$50K
Households (Mil.)	9.4	28.1	23.4	53.5	114.4	37.5	60.9	53.5
Pct of total households	8.2%	24.6%	20.5%	46.8%	100.0%	32.8%	53.2%	46.8%
Avg pre-tax income	$5,400	$19,695	$39,388	$106,947	$63,344	$16,112	$25,055	$106,947
Effec. fed tax rate %	2.0%	8.8%	14.1%	20.6%	20.1%	7.1%	9.8%	20.6%
Est. state tax rate%	1.0%	2.6%	4.0%	6.3%	4.5%	2.2%	2.9%	6.3%
Est. after-tax income	$5,238	$17,450	$32,259	$78,178	$47,771	$14,614	$21,879	$78,178
Residential energy $	$1,351	$1,498	$1,733	$2,173	$1,850	$1,461	$1,565	$2,173
Residential electric $	$785	$914	$1,098	$1,361	$1,150	$882	$965	$1,361
Other resid. energy $	$566	$583	$635	$812	$699	$579	$600	$812
Transport energy $	$1,513	$1,878	$2,652	$3,554	$2,790	$1,786	$2,119	$3,554
Total energy $	$2,863	$3,375	$4,385	$5,728	$4,640	$3,247	$3,684	$5,728
Energy % of after-tax inc.	54.7%	19.3%	13.6%	7.3%	9.7%	22.2%	16.8%	7.3%
Resid. % of after-tax inc.	25.8%	8.6%	5.4%	2.8%	3.9%	10.0%	7.2%	2.8%
Trans. % of after-tax inc.	28.9%	10.8%	8.2%	4.5%	5.8%	12.2%	9.7%	4.5%

2009 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS (CURRENT DOLLARS)

EIA SURVEY CATEGORIES:	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	<$30K	<$50K	>/=$50K
Households (Mil.)	8.4	27.1	22.7	59.0	117.2	35.5	58.2	59.0
Pct of total households	7.1%	23.1%	19.4%	50.3%	100.0%	30.3%	49.7%	50.3%
Avg pre-tax income	$5,049	$19,672	$39,061	$111,116	$68,424	$16,217	$25,143	$111,116
Effec. fed tax rate %	1.9%	5.2%	10.4%	17.8%	16.6%	4.4%	6.8%	17.8%
Est. state tax rate%	1.0%	2.6%	4.0%	6.3%	4.6%	2.2%	2.9%	6.3%
Est. after-tax income	$4,903	$18,138	$33,436	$84,337	$53,904	$15,140	$22,711	$84,337
Residential energy $	$1,546	$1,645	$1,856	$2,447	$2,083	$1,620	$1,711	$2,447
Residential electric $	$1,042	$1,083	$1,256	$1,610	$1,379	$1,073	$1,143	$1,610
Other resid. energy $	$504	$562	$600	$837	$704	$547	$568	$837
Transport energy $	$1,524	$1,897	$2,678	$3,582	$2,870	$1,804	$2,140	$3,582
Total energy $	$3,070	$3,542	$4,534	$6,029	$4,953	$3,424	$3,850	$6,029
Energy % of after-tax inc.	62.6%	19.5%	13.6%	7.1%	9.2%	22.6%	17.0%	7.1%
Resid. % of after-tax inc.	31.5%	9.1%	5.6%	2.9%	3.9%	10.7%	7.5%	2.9%
Trans. % of after-tax inc.	31.1%	10.5%	8.0%	4.2%	5.3%	11.9%	9.4%	4.2%

PROJECTED 2014 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS (CURRENT DOLLARS)

EIA SURVEY CATEGORIES:	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	<$30K	<$50K	>/=$50K
Households (Mil.)	8.9	28.0	23.0	62.5	122.4	36.9	59.9	62.5
Pct of total households	7.3%	22.9%	18.8%	51.1%	100.0%	30.2%	48.9%	51.1%
Avg pre-tax income	$4,762	$19,709	$39,191	$115,670	$71,274	$16,096	$24,953	$115,670
Effec. fed tax rate %	1.8%	4.5%	10.6%	19.5%	19.2%	3.8%	6.4%	19.5%
Est. state tax rate%	1.0%	2.6%	4.0%	6.3%	4.6%	2.2%	2.9%	6.3%
Est. after-tax income	$4,629	$18,310	$33,469	$85,827	$54,286	$15,120	$22,624	$85,827
Residential energy $	$1,655	$1,763	$1,985	$2,642	$2,246	$1,715	$1,832	$2,642
Residential electric $	$1,116	$1,158	$1,343	$1,730	$1,482	$1,133	$1,223	$1,730
Other resid. energy $	$539	$605	$642	$912	$764	$582	$609	$912
Transport energy $	$1,854	$2,309	$3,260	$4,369	$3,506	$2,171	$2,606	$4,369
Total energy $	$3,509	$4,072	$5,245	$7,011	$5,752	$3,886	$4,438	$7,011
Energy % of after-tax inc.	75.8%	22.2%	15.7%	8.2%	10.6%	25.7%	19.6%	8.2%
Resid. % of after-tax inc.	35.8%	9.6%	5.9%	3.1%	4.1%	11.3%	8.1%	3.1%
Trans. % of after-tax inc.	40.0%	12.6%	9.7%	5.1%	6.5%	14.4%	11.5%	5.1%

Sources: Population and income data from U.S. Bureau of the Census, Current Population Survey Supp. (2001, 2005, 2009, 2013 eds.) Residential energy costs are based on U.S. DOE Residential Energy Consumption Survey (2001, 2005, 2009 eds.) 2014 projections based on changes in 2009-2014 residential energy prices from U.S. DOE/EIA Short-Term Energy Outlook (January 2014). Transportation energy expenditures are estimated from U.S. DOE/EIA, Household Vehicle Energy Use: Latest and Trends (November 2005) and DOE/EIA Short-Term Energy Outlook (January 2014). Gasoline use per household in 2014 is reduced by 17% from 2001 levels based on DOE/EIA data on total gasoline consumption adjusted by households. Average effective federal tax rates are estimated from Congressional Budget Office, Effective Federal Tax Rates Under Current Law, 2001-2014 (August 2004), and Effective Federal Tax Rates, 1979-2006 (April 2009). Tax rates for 2013 are based on CBO 2009 effective rates compiled by the Tax Policy Foundation for 1979-2009 (October 24, 2012), adjusted for changes in the American Taxpayer Relief Act of 2012. State tax rates are estimated from www.taxadmin.org/fta/rate/ind_inc.html (various years).

APPENDIX TABLE 2 - 2001, 2005, 2009, AND 2014 HOUSEHOLD INCOME AND ENERGY EXPENSES (In 2001 $)

2001 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS

						SUBTOTALS		
EIA SURVEY CATEGORIES:	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	<$30K	<$50K	>/=$50K
Households (Mil.)	9.8	28.9	23.6	47.0	109.3	38.7	62.3	47.0
Pct of total households	9.0%	26.4%	21.6%	43.0%	100.0%	35.4%	57.0%	43.0%
Avg pre-tax income	$5,733	$19,707	$39,201	$107,649	$60,488	$16,168	$24,893	$107,649
Effec. fed tax rate %	2.0%	9.0%	14.9%	22.3%	21.0%	7.2%	10.1%	22.3%
Est. state tax rate%	1.5%	2.6%	4.0%	6.3%	4.4%	2.3%	3.0%	6.3%
Est. after-tax income	$5,532	$17,421	$31,792	$76,861	$45,127	$14,624	$21,635	$76,861
Residential energy $	$1,039	$1,260	$1,456	$1,836	$1,530	$1,204	$1,299	$1,836
Residential electric $	$628	$772	$922	$1,172	$963	$736	$806	$1,172
Other resid. energy $	$411	$488	$534	$664	$567	$469	$493	$664
Transport energy $	$934	$1,160	$1,638	$2,195	$1,688	$1,103	$1,306	$2,195
Total energy $	$1,973	$2,420	$3,094	$4,031	$3,218	$2,307	$2,605	$4,031
Energy % of after-tax inc.	35.7%	13.9%	9.7%	5.2%	7.1%	15.8%	12.0%	5.2%
Resid. % of after-tax inc.	18.8%	7.2%	4.6%	2.4%	3.4%	8.2%	6.0%	2.4%
Trans. % of after-tax inc.	16.9%	6.7%	5.2%	2.9%	3.7%	7.5%	6.0%	2.9%

2005 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS (IN 2001 $)

EIA SURVEY CATEGORIES:	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	<$30K	<$50K	>/=$50K
Households (Mil.)	9.4	28.1	23.4	53.5	114.4	37.5	60.9	53.5
Pct of total households	8.2%	24.6%	20.5%	46.8%	100.0%	32.8%	53.2%	46.8%
Avg pre-tax income	$4,909	$17,905	$35,807	$97,225	$57,585	$14,647	$22,778	$97,225
Effec. fed tax rate %	2.0%	8.8%	14.1%	20.6%	20.1%	7.1%	9.8%	20.6%
Est. state tax rate%	1.0%	2.6%	4.0%	6.3%	4.5%	2.2%	2.9%	6.3%
Est. after-tax income	$4,762	$15,863	$29,326	$71,071	$43,428	$13,286	$19,690	$71,071
Residential energy $	$1,228	$1,361	$1,575	$1,976	$1,681	$1,328	$1,423	$1,976
Residential electric $	$713	$831	$999	$1,237	$1,046	$802	$877	$1,237
Other resid. energy $	$514	$530	$577	$738	$636	$526	$546	$738
Transport energy $	$1,375	$1,707	$2,411	$3,231	$2,537	$1,624	$1,926	$3,231
Total energy $	$2,603	$3,068	$3,987	$5,207	$4,218	$2,952	$3,349	$5,207
Energy % of after-tax inc.	54.7%	19.3%	13.6%	7.3%	9.7%	22.2%	16.8%	7.3%
Resid. % of after-tax inc.	25.8%	8.6%	5.4%	2.8%	3.9%	10.0%	7.2%	2.8%
Trans. % of after-tax inc.	28.9%	10.8%	8.2%	4.5%	5.8%	12.2%	9.7%	4.5%

2009 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS (IN 2001 $)

EIA SURVEY CATEGORIES:	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	<$30K	<$50K	>/=$50K
Households (Mil.)	8.4	27.1	22.7	59.0	117.2	35.5	58.2	59.0
Pct of total households	7.1%	23.1%	19.4%	50.3%	100.0%	30.3%	49.7%	50.3%
Avg pre-tax income	$4,173	$16,258	$32,282	$91,831	$56,549	$13,402	$20,779	$91,831
Effec. fed tax rate %	1.9%	5.2%	10.4%	17.8%	16.6%	4.4%	6.8%	17.8%
Est. state tax rate%	1.0%	2.6%	4.0%	6.3%	4.6%	2.2%	2.9%	6.3%
Est. after-tax income	$4,052	$14,990	$27,633	$69,700	$44,549	$12,512	$18,769	$69,700
Residential energy $	$1,278	$1,360	$1,534	$2,022	$1,721	$1,339	$1,414	$2,022
Residential electric $	$861	$895	$1,038	$1,331	$1,140	$887	$945	$1,331
Other resid. energy $	$417	$464	$496	$692	$582	$452	$469	$692
Transport energy $	$1,260	$1,568	$2,213	$2,960	$2,372	$1,490	$1,768	$2,960
Total energy $	$2,537	$2,927	$3,747	$4,983	$4,093	$2,829	$3,182	$4,983
Energy % of after-tax inc.	62.6%	19.5%	13.6%	7.1%	9.2%	22.6%	17.0%	7.1%
Resid. % of after-tax inc.	31.5%	9.1%	5.6%	2.9%	3.9%	10.7%	7.5%	2.9%
Trans. % of after-tax inc.	31.1%	10.5%	8.0%	4.2%	5.3%	11.9%	9.4%	4.2%

PROJECTED 2014 HOUSEHOLD ENERGY EXPENSES BY INCOME CATEGORY - ALL U.S. HOUSEHOLDS (IN 2001 $)

EIA SURVEY CATEGORIES:	<$10K	$10K-<$30K	$30K-</=$50K	>/=$50K	TOTALS	<$30K	<$50K	>/=$50K
Households (Mil.)	8.9	28.0	23.0	62.5	122.4	36.9	59.9	62.5
Pct of total households	7.3%	22.9%	18.8%	51.1%	100.0%	30.2%	48.9%	51.1%
Avg pre-tax income	$3,554	$14,708	$29,247	$86,321	$53,190	$12,012	$18,622	$86,321
Effec. fed tax rate %	1.8%	4.5%	10.6%	19.5%	19.2%	3.8%	6.4%	19.5%
Est. state tax rate%	1.0%	2.6%	4.0%	6.3%	4.6%	2.2%	2.9%	6.3%
Est. after-tax income	$3,454	$13,664	$24,977	$64,050	$40,512	$11,284	$16,883	$64,050
Residential energy $	$1,235	$1,316	$1,481	$1,972	$1,676	$1,280	$1,367	$1,972
Residential electric $	$833	$864	$1,002	$1,291	$1,106	$846	$912	$1,291
Other resid. energy $	$402	$451	$479	$681	$570	$434	$455	$681
Transport energy $	$1,383	$1,723	$2,433	$3,261	$2,617	$1,620	$1,944	$3,261
Total energy $	$2,618	$3,039	$3,914	$5,232	$4,292	$2,900	$3,312	$5,232
Energy % of after-tax inc.	75.8%	22.2%	15.7%	8.2%	10.6%	25.7%	19.6%	8.2%
Resid. % of after-tax inc.	35.8%	9.6%	5.9%	3.1%	4.1%	11.3%	8.1%	3.1%
Trans. % of after-tax inc.	40.0%	12.6%	9.7%	5.1%	6.5%	14.4%	11.5%	5.1%

Sources: See Appendix Table 1. CPI adjustments to constant 2001 dollars from CPI Inflation Calculator (2014). CPI adjustment for 2014 estimated at 1.34.

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Jobs: The 'Real' Unemployment Rate Please? Anyone?

Comment Now

Recently the Chairman, CEO, Jim Clifton of the Gallop Polling Company wrote an article titled "The Big Lie: 5.6% Unemployment." He begins by saying "Here's something that many Americans — including some of the smartest and most educated among us — don't know: The official unemployment rate, as reported by the U.S. Department of Labor, is extremely misleading. There's no other way to say this. The official unemployment rate, which cruelly overlooks the suffering of the long-term and often permanently unemployed as well as the depressingly underemployed, amounts to a Big Lie." His main point is that the pain being felt across America is much worse than the published rate of 5.6% would indicate. He discusses several reasons why. This is something I have been talking about since the beginning of the Great Recession in talks across the country, in articles and on TV, with Congress, and the President and his Chief of Staff.

The charts below tell the "Rest of the Story", as the great Paul Harvey would always say, from 12/2007 to 11/2014.

Figure 1:

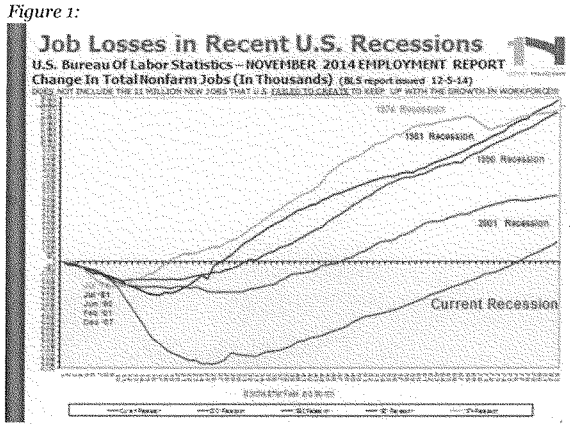
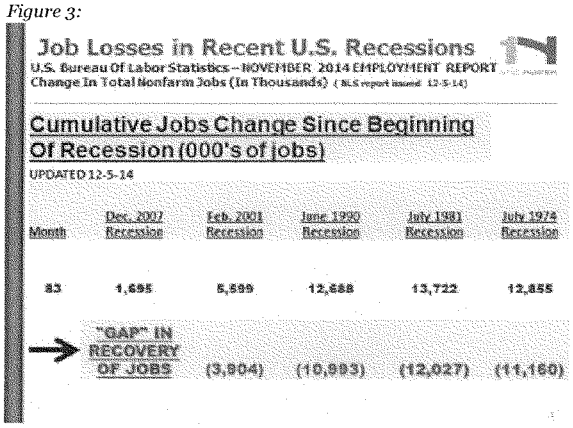


Figure 2:

Figure 3:



Job Losses in Recent U.S. Recessions

U.S. Bureau Of Labor Statistics – NOVEMBER 2014 EMPLOYMENT REPORT
Change In Total Nonfarm Jobs (In Thousands) (BLS report issued 12-5-14)

Cumulative Jobs Change Since Beginning Of Recession (000's of jobs)

UPDATED 12-5-14

Month	Dec. 2007 Recession	Feb. 2001 Recession	June 1990 Recession	July 1981 Recession	July 1974 Recession
83	1,695	5,599	12,688	13,722	12,855
"GAP" IN RECOVERY OF JOBS	(3,904)	(10,993)	(12,027)	(11,160)	

Figure 1 points out the relative severity of job losses and the recovery rate of jobs over the first 83 months (bottom axis) following the start of every recession since 1974. The massive loss in jobs (~9,000,000, left axis) and the agonizingly anemic recovery in jobs of the 2007 recession versus all the others is painfully obvious. The other point to notice is how the curves for each successive recession are lower, i.e., slower to recover jobs. I would contend that this is in large part due to the massive demise in Manufacturing here since the 70's. Which is in turn due mostly to failed trade policies and the movement of our middle class jobs overseas. A government that increasingly attacks and burdens our private sector so that we have lost our Global Competitiveness and not because of cheap labor, but because of over regulation, poor tax policies, failed trade policies, and more.

Figure 2 shows the 'REAL' unemployment rate when taking into account all the relevant and appropriate data. The rate is 15.8% and a more appropriate indication of the real pain being experienced by Americas working families.

Figure 3 indicates very clearly the **gap** in the jobs created between the various recessions over an 83 month period following the start of each recession. We are over 12 million jobs behind compared to the very bad 1981 recession and 3.9 million behind the milder 2001 recession.

So what can we learn from all this? A point I've been making for over 6 years. Unless you properly define the problem facing us we will never come up with the right solutions to turn things around as fast as we must. If we continue to insist that the unemployment rate is just 5.6% then "presto", we have no problem or only an easily solvable one that a job creation rate of

225,000 per month will take care of in 2-3 years. But if, as pointed out in the above graphs/tables, the Real rate is over 15%, then we will never get there in 10 years let alone 3 years. If it is really going to take 9-10 years at the current rate of job creation, especially since we need **135,000** per month just to keep up with the new entrants into the workforce each month, then our response needs to be much, much stronger and over a shorter time period.

What we really needed were solutions being implemented 6 years ago that would have given us twice the growth in GDP that we have seen and a monthly job creation rate of **500,000**.

500,000-135,000 = 365,000 X 6 years X 12 months = 26.280,000 jobs

Six years of 500,000 jobs created each month not 225,000 going forward is huge and nothing being done today will get us there. There are answers and solutions, but there will be more pain to get there and a huge change in how our federal government views private enterprise and the world of global trade.

My next column will discuss the possible solutions and some of the pain needed to succeed. I know the American people are up to the task. What I don't know is if our current and future leaders will be.