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REVIEW OF THE PRESIDENT'S CLIMATE ACTION PLAN

UNITED STATES SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED THIRTEENTH CONGRESS, SECOND SESSION

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Statement of Senator Boxer

Oversight Hearing on Review of President's Climate Action Plan

January 16, 2014

(Remarks as prepared for delivery)

Today's hearing will cover three topics: First, the President's Climate Action Plan, which is a critical issue. We have four Administration agencies today.

Senator Vitter and the minority Members of this Committee stated in their December 18, 2013, year-end report:

> "Vitter and the EPW Republicans will continue pushing for an oversight hearing on the Administration's climate agenda that includes witnesses from federal agencies."

Second, today's hearing will include the budget for the Environmental Protection Agency (EPA).

Third, we have set aside time for Members of this Committee to ask about John Beale, an outrageous con man who was finally caught and convicted. We held a briefing on this on September 30th. All Members of this Committee were invited to that briefing. I asked many questions and Senator Vitter asked over 50 questions. However, Senator Vitter has more questions on this subject, and so we are covering that subject too.

The broad scope of this hearing was formally agreed to by the Ranking Member of this Committee.

The *Wall Street Journal* said in its editorial today that I am living in an "EPA fairy tale" for commending EPA Administrator Gina McCarthy for shining a light on the actions of a rogue employee. This is what Patrick Sullivan, the Assistant Inspector General for Investigations at EPA, said about Administrator McCarthy's role:

> Mr. Sullivan: "To our knowledge, the first senior person to express concerns was Ms. McCarthy."

Now let me turn to the President's Climate Action Plan.

In his plan released on June 25, 2013, President Obama called for action to fight climate change so we do not condemn future generations to a planet that is beyond repair. I couldn't agree more, because climate change is a catastrophe that is unfolding before our eyes.

The President's plan lays out a roadmap for action. It calls for a wide range of reasonable steps to reduce carbon pollution, grow the economy through clean energy, prepare for future impacts such as rising sea levels and storm surges, and lead global efforts to fight climate change.

When the President announced his Climate Action Plan, many companies issued statements of support, including Walmart, Honeywell, DuPont, Dominion Resources, American Electric Power, and other business leaders.

More than 500 companies, such as GM, Nike, Mars, Nestle and Unilever, have stated that tackling climate change is one America's greatest economic opportunities in the 21st century.

In addition to many of the nation's largest companies, the American people have also weighed in on the need to address this growing threat, and they want action now.

A *USA Today* poll in December found that 81% of Americans think climate change will be a serious problem if nothing is done to reduce it. And 75% of Americans say the U.S. should take action on climate change even if

other nations do less.

That poll also found that Americans overwhelmingly support clean energy solutions, like generating electricity from solar and wind.

I am encouraged that significant action to address climate change is already underway, including establishing limits on carbon pollution from cars and trucks. The Obama Administration is also working on carbon pollution limits for new and existing power plants. Together, these efforts address the nation's two largest sources of carbon pollution.

A new peer reviewed study in the journal *Nature* finds that unless we control carbon pollution, the most severe predictions by scientists and climate experts on rising temperatures will occur by the end of the century, resulting in the most significant and dangerous impacts from climate change – an increase of more than 7 degrees Fahrenheit by 2100.

In my home state of California, scientists have been telling us for years that climate change would bring substantially higher temperatures, droughts, floods, more extreme wildfires, and rising sea levels. And we have seen it happen before our eyes.

Future generations will look back to this moment and judge us by whether we started to act on this issue today.

I look forward to hearing from today's witnesses, who are leading their agencies' efforts to reduce carbon pollution. It is good for the environment, it is good for the economy, and it is good for human health.

Opening Statement of Regina McCarthy
Administrator
U.S. Environmental Protection Agency

Hearing on the President's Climate Action Plan
Committee on Environment and Public Works
U.S. Senate
January 16, 2014

Chairman Boxer, Ranking Member Vitter, members of the Committee: Thank you for the opportunity to testify today.

In June of last year, the President reaffirmed his commitment to reducing carbon pollution when he directed many federal agencies, including the Environmental Protection Agency, to take meaningful steps to mitigate the current and future damage caused by carbon dioxide emissions and to prepare for the anticipated climate changes that have already been set in motion.

Climate change is one of the greatest challenges of our time. Based on the evidence, more than 97% of climate scientists[1] are convinced that human-caused climate change is occurring. If our changing climate goes unchecked, it will have devastating impacts on

[1] W. R. L. Anderegg, "Expert Credibility in Climate Change," Proceedings of the National Academy of Sciences Vol. 107 No. 27, 12107-12109 (21 June 2010); DOI: 10.1073/pnas.1003187107.
P. T. Doran & M. K. Zimmerman, "Examining the Scientific Consensus on Climate Change," Eos Transactions American Geophysical Union Vol. 90 Issue 3 (2009), 22; DOI: 10.1029/2009EO030002.
N. Oreskes, "Beyond the Ivory Tower: The Scientific Consensus on Climate Change," Science Vol. 306 no. 5702, p. 1686 (3 December 2004); DOI: 10.1126/science.1103618.

the United States and the planet. Reducing carbon pollution is critically important to the protection of Americans' health and the environment upon which our economy depends.

Responding to climate change is an urgent public health, safety, national security, and environmental imperative that presents an economic challenge and an economic opportunity. As the President has stated, both the economy and the environment must provide for current and future generations, and we can and must embrace cutting carbon pollution as a spark for business innovation, job creation, clean energy and broad economic growth. The United States' success over the past 40 years makes clear that environmental protection and economic growth go hand in hand.

The President's Climate Action Plan directs federal agencies to address climate change using existing executive authorities. The Plan has three key pillars: cutting carbon pollution in America; preparing the country for the impacts of climate change; and leading international efforts to combat global climate change.

Cutting Carbon Pollution

EPA plays a critical role in implementing the Plan's first pillar, cutting carbon pollution. Over the past four years, EPA has begun to address this task under the Clean Air Act.

Our first steps addressed motor vehicles, which annually emit nearly a third of U.S. carbon pollution. EPA and the National Highway Traffic Safety Administration, along with the auto industry and other stakeholders, worked together to set greenhouse gas and fuel economy standards for Model Year 2012 to 2025 light-duty vehicles. Over the life of these vehicles, the standards will save an estimated $1.7 trillion for consumers and businesses and cut America's oil consumption by 12 billion barrels, while reducing greenhouse gas emissions by 6 billion metric tons.

EPA's and NHTSA's standards for model year 2014 through 2018 heavy-duty trucks and buses present a similar success story. Under the President's Plan, we will be developing a second phase of heavy-duty vehicle standards for post 2018 model years.

Building on this success, the President asked EPA to work with states, utilities and other key stakeholders to develop plans to reduce carbon pollution from future and existing power plants.

Power plants are the single largest source of carbon pollution in the United States. In March 2012, the EPA first proposed carbon pollution standards for future power plants. After receiving over 2.5 million comments, we determined to issue a new proposed rule based on this input and updated information.

In September 2013, the EPA announced its new proposal. The proposed standards would establish the first uniform national limits on carbon pollution from future power plants. They will not apply to existing power plants. The proposal sets separate national limits for new natural gas-fired turbines and new coal-fired units. New large natural gas-fired turbines would need to emit less than 1,000 pounds of CO2 per megawatt-hour, while new small natural gas-fired turbines would need to emit less than 1,100 pounds of CO2 per megawatt-hour. New coal-fired units would need to emit less than 1,100 pounds of CO2 per megawatt-hour. Operators of these units could choose to have additional flexibility by averaging their emissions over multiple years to meet a somewhat tighter limit.

The standards reflect the demonstrated performance of efficient, lower carbon technologies that are currently being used today. They set the stage for continued public and private investment in technologies like efficient natural gas and carbon capture and storage. The proposal was recently published in the Federal Register on January 8, and the formal public comment period is now open. We look forward to robust engagement on the proposal and will carefully consider the comments and input we receive as a final rule is developed.

As noted, the proposed rule would apply only to future power plants. For existing plants, we are engaged in outreach to a broad

group of stakeholders who can inform the development of proposed guidelines, which we expect to issue in June of this year. These guidelines will provide guidance to States, which have the primary role in developing and implementing plans to address carbon pollution from the existing plants in their states. We recognize that existing power plants require a distinct approach, and this framework will allow us to capitalize on state leadership and innovation while also accounting for regional diversity and providing flexibility.

The EPA's stakeholder outreach and public engagement in preparation for this rulemaking is extensive and vigorous. We held eleven public listening sessions around the country at EPA regional offices and our headquarters in Washington, DC. We have participated in numerous meetings with a broad range of stakeholders across the country. And all of this is happening well before we propose any guidelines. When we issue proposed guidelines in June, the more formal public process begins – including a public comment period and an opportunity for a public hearing – which will provide yet further opportunity for stakeholders and the general public to provide input.

Cutting Methane Emissions

The Climate Action Plan calls for the development of a comprehensive, interagency strategy to address emissions of methane,

a powerful greenhouse gas that also contributes to ozone pollution, but which has substantial economic value. EPA is working with other agencies to assess emissions data, address data gaps, and identify opportunities to reduce methane emissions through incentive-based programs and existing authorities.

Curbing Emissions of HFCs

The Plan also calls on the US to lead through international diplomacy as well as domestic action to reduce emissions of hydrofluorocarbons (HFCs), potent greenhouse gases whose emissions are otherwise expected to nearly triple by 2030. Moving forward, the EPA will use its authority under the Clean Air Act to encourage the investment, purchase, and use of climate-friendly alternatives.

Preparing for Impacts of Climate Change

Even as we work to avoid dangerous climate change, we must strengthen America's resilience to climate impacts we're already experiencing and those that can no longer be avoided. The President's Plan calls for a broad array of actions on this front. EPA is incorporating research on climate impacts into the implementation of our existing programs and developing information and tools to help decision-makers – including State, local and tribal governments – to better

understand and address these impacts. Further, EPA is working closely with our federal agency counterparts on several other aspects of building our national resilience, including developing the National Drought Resilience Partnership, ensuring the security of our freshwater supplies, protecting our water utilities, and protecting and restoring our natural resources in the face of a changing climate.

International Efforts

Our changing climate is also a global challenge, and the President's Plan recognizes that the United States must couple action at home with leadership abroad. Working closely with the State Department, EPA continues to engage our international partners in reducing carbon pollution through an array of activities. These include public-private partnership efforts to address emissions of methane and other short-lived climate pollutants under the Climate and Clean Air Coalition and the Global Methane Initiative, as well as bilateral cooperation with major economies.

Conclusion

The President's Plan provides a roadmap for federal action to meet the pressing challenge of a changing climate – promoting clean

energy solutions that capitalize on American innovation and drive economic growth. EPA looks forward to working with other federal agencies and all stakeholders on these critical efforts.

Thank you again for the opportunity to testify, and I look forward to answering your questions.

Testimony of Nancy H. Sutley
Council on Environmental Quality
Before the
Committee on Environment and Public Works
Hearing on the President's Climate Action Plan
January 16, 2014

Chairman Boxer, Ranking Member Vitter, and Members of the Committee, thank you for the opportunity to discuss the President's Climate Action Plan.

The President believes that we have a moral obligation to our children to do what we can to reduce carbon pollution for the sake of their future. That is why four years ago, he made a commitment to reduce United States greenhouse gas emissions in the range of 17 percent below 2005 levels by 2020. We are making significant progress towards meeting that goal. Our emissions of carbon pollution have fallen significantly, even as our economy has continued to grow.

The Climate Action Plan builds on the many steps that this Administration has taken to cut carbon pollution and strengthen our economy by supporting and creating domestic clean energy jobs.

The Plan has three key pillars: cutting carbon pollution at home, preparing the Nation for the impacts of climate change we can't avoid, and leading international efforts to address global climate change.

As you know, the Council on Environmental Quality's (CEQ) unique statutory mission is to play a coordinating role among Federal agencies under the National Environmental Policy Act (NEPA), as well as oversee implementation of the Administration's broader environmental policy goals. At CEQ, we have supported the Federal Agencies in developing cross-cutting initiatives that have laid the groundwork for many aspects of the Climate Action Plan. Now, we are helping to oversee the plan's implementation and ensure its success.

I know my colleagues Gina McCarthy, Dan Ashe, and Dan Tangherlini will share their respective agencies work in implementing the Plan. I will focus my testimony on our broader Administration efforts to implement the Plan.

Cutting Carbon Pollution

A key part of the Plan is to reduce carbon pollution in the U.S, and the Administration is already making significant progress in this area.

In the last five years, the United States more than doubled renewable energy generation from wind, solar and geothermal sources. In fact, renewable energy is quickly growing as a significant source of electric power generation in the Nation. In 2012, wind energy was the largest source of new capacity, with nearly 8,000 MW installed. To continue this progress, we've set a goal to double electricity production from wind, solar and geothermal sources again by 2020.

To help meet this goal, the Department of the Interior (DOI) is working to permit an additional 10 GW of renewable energy projects on public lands by 2020, enough to power 6 million homes. Since June of last year, DOI has approved enough renewable energy projects to power more than 200,000 homes. DOI has also held the first competitive offshore wind lease sales in Rhode Island, Virginia and Massachusetts.

We're also focusing our efforts on the demand side. Energy efficiency is one of the clearest and most cost-effective opportunities to save families money, make our businesses more competitive, and reduce carbon pollution.

We have established the toughest new fuel economy standards in U.S. history, which will approximately double the efficiency of our cars and trucks by the middle of the next decade. These standards will save the average driver more than $8,000 dollars at the gas pump over the lifetime of a model year 2025 vehicle, helping the United States to once again take the lead in developing, building and selling the world's most advanced cars. The Administration has also established first-ever fuel efficiency and greenhouse gas standards for heavy-duty trucks, buses and vans. The Plan commits the Administration to building on this progress with a second round of standards for heavy duty trucks, in order to reduce pollution, cut oil consumption, and save money for truck operators.

In addition, the Plan calls for setting greenhouse gas emissions (GHG) standards for new and existing power plants and Administrator McCarthy will discuss EPA's efforts to implement the Plan in her testimony.

The Plan also sets a goal to reduce carbon pollution through efficiency standards for appliances and Federal buildings by at least 3 billion metric tons

cumulatively by 2030. That's the equivalent of reducing more than half of the carbon pollution in one year from the U.S. energy sector.

Since August, the Department of Energy (DOE) has issued five proposed energy conservation standards for appliances and equipment and finalized energy conservation standards for an additional product category. Savings from these rules if finalized as proposed, combined with final rules already issued under this Administration, would surpass 70 percent of the President's goal for emissions reductions from energy conservation standards. When combined with the other standards issued by this Administration, they will help cut consumers' electricity bills by hundreds of billions of dollars.

The Plan also expands the Better Buildings Challenge, which is focused on cutting energy use in commercial, institutional, and industrial buildings. Under the Challenge expansion announced last month, 50 new multifamily housing partners – representing roughly 200,000 units and over 190 million square feet – have committed to cutting their energy use by 20 percent in ten years.

At the U.S. Department of Agriculture (USDA), Secretary Tom Vilsack recently announced $250 million in new lending opportunities to help rural homeowners and businesses invest in affordable, cost-effective energy efficiency improvements and renewable energy systems through USDA's Energy Efficiency and Loan Conservation program.

As we work to support these new opportunities in the private sector, we're also focused on making sure the Federal government is leading by example. The Federal government is the single largest consumer of energy in the United States. Since 2008, Federal agencies have reduced their greenhouse gas emissions by approximately15 percent. Just over a month ago, the President directed agencies to redouble those efforts by consuming 20 percent of their electricity from renewable sources by 2020, more than doubling their current goal. The General Services Administration plays an important role in these efforts.

Preparing for the Impacts of Climate Change

Even as we make efforts to cut carbon pollution, we also need to take action to address current and anticipated impacts of climate change that cannot be avoided.

It is difficult to link a particular weather event to climate change, but we do know that as Earth continues to warm, we can expect more frequent extreme weather events, including large storms, severe droughts, and heat waves. These events can be destructive, contributing to conditions that result in catastrophic wildfires, storm surges, and floods, which in turn threaten the health and well-being of our people and our local, regional, and national economies.

In 2012, according to the National Oceanic and Atmospheric Administration, there were 11 weather and climate disaster events in the United States with losses exceeding $1 billion each. These 11 events cumulatively caused over $110 billion in damages and 377deaths.[1] Impacts of related changes in precipitation and temperature patterns include changes in the distribution of plant diseases and pests that threaten forest and crop production and changes in the distribution and migration of commercially important fisheries. It is simply irresponsible to ignore the toll that these and other climate change effects are taking on our country.

Last summer, the Administration released a Hurricane Sandy Rebuilding Strategy to help the Sandy-affected region rebuild and increase its resilience in order to reduce risks associated with sea-level rise and storm surges to vulnerable coastal communities. The strategy serves as a model for communities across the Nation facing greater risks from more frequent, extreme weather and other impacts of climate change. This means building for the next storm, not the last storm, and planning for expected future sea levels, storm surges and extreme heat and precipitation, which pose new risks to the Nation. As a part of these efforts, the Department of Housing and Urban Development and its partner agencies are investing in infrastructure that is safer and more resilient, and the Federal Transit Administration recently announced $3 billion in grants to similarly strengthen public transit systems affected by the storm.

In order to help prepare the Nation for the impacts of climate change, the President recently signed Executive Order 13653 directing agencies to help American communities strengthen their resilience to extreme weather and prepare for other impacts. Specifically, agencies are directed to modernize Federal programs to better support local preparedness for climate change impacts, manage our natural lands to improve resilience, and develop information, data, and tools to help communities and other decision makers By way of example, resource agencies are looking at how to make our lands and waters more resilient to climate

[1] http://www.ncdc.noaa.gov/billions/overview

impacts as well as how to use natural infrastructure, such as wetlands, vegetated sand dunes, and healthy forests, to bolster our communities in the face of extreme weather and other impacts. These efforts build on important steps we have already taken. For example, in early 2013, to help advance these types of efforts, the Administration along with States and Tribal governments completed the National Fish Wildlife and Plant Climate Adaptation Strategy to help safeguard the nation's valuable natural resources and the communities that depend on them.

The Executive Order also established a State, Local and Tribal Leaders Task Force on Climate Preparedness and Resilience, composed of 26 elected officials from across the country. The Task Force has already begun working to advise the Administration on how the Federal Government can remove barriers to climate change resilient investments; modernize Federal programs, grant and loans to better support local efforts; and develop the tools necessary to help communities prepare for climate change on the local level. As a co-chair of the Task Force, I believe these recommendations will be vital to ensuring the Federal government responds to the needs and priorities of communities when addressing the challenges of climate change.

Agencies are also analyzing the impacts of climate change on key sectors of our economy and developing strategies to address them. Last summer, the DOE released a report outlining the impacts of climate change on the energy sector, which included recognition of the damage Gulf Coast hurricanes are inflicting on offshore platforms, pipeline infrastructure, and refineries. On the Mississippi and Ohio rivers, shipping disruptions have occurred due to both high water floods and low-flow droughts. And in Nebraska, the Fort Calhoun nuclear plant had to curtail power production because of flooding problems. DOE has outlined strategies that could help address vulnerabilities like these in the future.

In November, we launched the National Drought Resilience Partnership, to help communities better prepare for increasing droughts to reduce impacts on families and businesses. The Partnership will make it easier to access Federal drought resources, such as monitoring, forecasts, outlooks, and early warnings, as well as longer-term drought resilience strategies in critical sectors.

Similar efforts to protect and strengthen economic sectors will focus on the public health, transportation, agriculture, and water resource sectors.

Finally, under this Administration, <u>all</u> agencies are examining how a changing climate will impact their missions. In February of 2013, Federal agencies

released their first-ever Climate Change Adaptation Plans, outlining strategies to reduce their vulnerability to the impacts of climate change, such as sea level rise and more severe weather patterns. For example, during a period of record rainfall in June of 2006, the Internal Revenue Service's headquarters building was flooded and sustained extensive damage to its infrastructure. Costs for repairs were in the tens of millions of dollars, and it was necessary to close the building until December 2006 to complete them. Agency adaptation plans now highlight actions to proactively plan to avoid these impacts.

Leading Internationally

The President understands that the effects of climate change will not be confined within the borders of any one country, and our response must be global. In addition to our efforts under the Plan to reduce domestic carbon pollution and help our Nation's communities prepare for the effects of climate change, we are committed to playing a leadership role that can support a strong international response to this challenge.

The Administration is working through multiple channels, such as the United Nations Framework Convention on Climate Change, as well as multi-lateral and bi-lateral initiatives focused on tackling the key drivers of greenhouse gas emissions. Our leadership can leverage more ambitious action by other countries – and the faster other nations reduce their emissions, the more moderate the long-term climate impacts will be on our own citizens, communities, and businesses. That's why American leadership on climate pays dividends back at home.

Closing

The impacts of climate change are being shouldered by communities, families and businesses across our country, and my testimony today highlights just a few of the many efforts taken by the Administration to address the threat of climate change, while building a foundation for continued economic growth. I am proud of the steps we've taken. For the sake of our economy and the legacy we leave for our children, it's vital that we address this problem head on, and I think the President's Plan does just that.

I look forward to taking your questions.

U.S. General Services Administration

Dan Tangherlini
Administrator

Senate Committee on Environment and Public Works
"Review of the President's Climate Action Plan"
January 16, 2014

Good morning Chairman Boxer, Ranking Member Vitter, and Members of the Committee. I appreciate being invited here today to testify on this important topic.

Last year, the U.S. Government Accountability Office added climate change to its High Risk List, citing that it presents "a significant financial risk to the federal government." According to the National Climatic Data Center, in 2012 weather and climate disaster events caused over $110 billion in damages, making it the second costliest year on record.

This Administration is committed to reducing the damage caused by climate change, and to preparing for its impacts, both in the long term as well as those we are already experiencing. In June 2013, the President reaffirmed this commitment with a Climate Action Plan that directs agencies to: cut carbon pollution; prepare for the impacts of climate change; and lead international efforts to address global climate change.

The U.S. General Services Administration (GSA) is one of the many Federal agencies doing its part to assist in this effort. As the landlord and caretaker of federal properties, GSA owns or leases 9,624 assets, which includes maintaining an inventory of more than 370 million rentable square feet of workspace, and preserving more than 481 historic properties. This large and diverse portfolio presents many opportunities for GSA to increase energy efficiency, reduce our contribution to climate change, save millions of dollars in energy costs and to plan and implement risk management.

As part of the President's Climate Action Plan, GSA is improving the efficiency of our Federal buildings, identifying and preparing for climate risks, and working to ensure that we share lessons learned with our partner agencies.

Reducing Impact on Climate Change –

GSA reduces energy consumption across its portfolio through a variety of means. GSA leverages technology such as advanced metering, remote building analytics and smart building systems to uncover deeper energy savings opportunities. Advanced meters, which provide real time energy use information, have been installed in 450 buildings, representing 80% of GSA's total electricity consumption metered. Continuous enhancements to the system, ongoing training of users, use of detailed historical data and expert modeling are all proven methods which are increasing energy efficiency at lesser cost.

GSA uses rapid building assessments to perform sophisticated energy audits that require no onsite work or new device installations. Such remote analytics have resulted in significant cost savings over traditional audits and have identified additional energy savings opportunities.

The President's Climate Action Plan also highlights other important tools we can use to improve the efficiency of our buildings, including continued use of Energy Savings Performance

Contracts (ESPCs). An ESPC engages the private sector in an agency's efforts to achieve energy efficiency improvements. The private sector provides the upfront capital to make energy efficiency upgrades in a facility, and is paid by the Federal agency from the guaranteed energy savings under the contract. Once the contract ends, the agency continues to benefit from the reduced energy costs. In December 2011, the President challenged Federal agencies to enter into a combined $2 billion worth of ESPCs by December 31, 2013. GSA exceeded its own target of $175 million with $191 million in contracts awarded. These contracts, which range from 12 to 23 years in duration, are projected to reduce GSA's annual energy consumption by 365 billion Btus, or about the amount of energy used in 3,380 single family homes per year, resulting in direct savings (lower utility payments) of $10.6 million per year.

The President's Climate Action Plan sets new goals on the Federal use of Renewable Energy, increasing the current goal from 7.5 percent to 20 percent by 2020. In FY 2013, 46.1 percent of electricity procured or generated by GSA came from renewable sources (nearly 1,200 GWh). Over 24 GWh of this renewable electricity was generated at our own facilities. GSA expects to generate nearly 29 GWh per year once on-site renewable projects currently underway are fully operational. This amount of on-site renewable energy is enough to power nearly 2,600 homes.

Through the use of Green Button data, the President's Climate Action Plan also highlights the importance of collecting data to promote better energy management. Green Button is an industry-led effort, in response to the Administration's call-to-action, that looks to meet the challenge of providing electricity consumers with secure, easy to understand information on their energy usage. As directed in the December 2013 Presidential Memorandum on Federal Leadership in Energy Management, GSA will partner with the Department of Energy and Environmental Protection Agency to prepare and initiate a pilot Green Button initiative at Federal facilities. Following the pilot, DOE, in coordination with EPA, is required to issue guidance on use of the Green Button standard at Federal facilities. GSA will leverage the Green Button standard within its federal facilities to increase the ability to manage energy consumption, reduce greenhouse gas emissions, and meet sustainability goals.

Taken together, these efforts have led to a significant reduction in GSA's energy use intensity and greenhouse gas emissions. In FY 2013, GSA achieved a cumulative reduction in energy usage per square foot of 24.8 percent,[1] ahead of statutory targets. Since Fiscal Year 2011, these reductions have saved $192.7 million in avoided direct energy costs.[2] Also, in FY 2013, GSA achieved an approximately 50 percent reduction in greenhouse gas emissions, exceeding our FY 2020 target.[3] That is the equivalent of more than 60,000 homes powered for one year.

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[1] Per the Energy Independence and Security Act of 2007, this reflects a reduction in "covered facilities" from a baseline of Fiscal Year 2003.

[2] Based on energy use consumption in FY 2003 multiplied by the current price of energy, subtracted from actual costs.

[3] Executive Order 13514 required Federal agencies to set a target for reductions to Scope 1 and 2 GHG emissions. In Fiscal Year 2010, GSA established a 28.7 percent reduction target from a Fiscal Year 2008 baseline.

Preparing for the Impacts of Climate Change –

GSA is also preparing for the potential impacts of climate change as part of the President's Climate Action Plan. While it is impossible to predict the precise occurrence and costs of each and every climate risk, it is imperative to develop a robust risk management approach.

One such area of focus has been preparing for future floods. GSA is actively coordinating with the U.S. Army Corps of Engineers (USACE), U.S. Global Change Research Program (USGCRP), Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Administration (NOAA), and Federal Interagency Floodplain Management Task Force to incorporate the most recent and relevant flood-risk reduction strategies into GSA's operations. We are in the process of updating GSA's internal floodplain management guidance and are taking into consideration updated FEMA floodplain maps and additional guidance on using climate projections.

GSA is also working to boost the resilience of buildings and infrastructure. We are in the process of prioritizing our most mission critical and vulnerable facilities, looking into cost-effective climate-resilient investments, and investigating solutions that reduce both climate change risks and greenhouse gas emissions. A pilot project is currently in place to incorporate climate risk reduction factors into a new land port of entry facility. GSA will take lessons learned from this pilot and share with other agencies.

We believe these efforts will ensure GSA, and the Federal government broadly, is more prepared to address the long-term consequences of climate change.

Conclusion –

The President's Climate Action Plan represents a commitment to reduce and respond to the impacts of climate change. As a major landholding agency of the Federal government, GSA plays an important role in mitigating and preparing for these adverse effects. Through improved energy efficiency and risk planning, we hope to continue to make progress on both of these critical efforts.

I am pleased to be here today, and I am happy to answer any questions you may have. Thank you.

TESTIMONY OF DAN ASHE, DIRECTOR,
U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR
BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
REGARDING THE PRESIDENT'S CLIMATE ACTION PLAN

January 16, 2014

Introduction

Chairman Boxer, Ranking Member Vitter, and Members of the Committee, I am Dan Ashe, Director of the U.S. Fish and Wildlife Service (Service), within the Department of the Interior (Department). Thank you for the opportunity to testify on the President's Climate Action Plan.

Over the past 50 years, the phenomenon of climate change has been a significant driver for changes across our landscapes and ecosystems, which have impacted our nation's living resources – our fish, wildlife, and plants. Examples include shifts in precipitation, with more frequent and severe storms, flooding, droughts, and wildfires. Average temperatures of coastal and fresh waters are rising, and we are also experiencing rising sea levels, loss of sea ice, ocean acidification, and increased coastal flooding and erosion[1]. From the Arctic to the Everglades, these impacts are affecting wildlife species and habitat critical to the American people. As the climate continues to change over the next century, so too will the impact on species and the ecosystems they rely on. And while my testimony focuses on the impacts the Fish and Wildlife Service is seeing, it is important to note that we are seeing these dynamics play out on other federal lands and private lands alike. The federal government has an important role to play in natural resource climate preparedness and the President's Climate Action Plan recognizes this.

For example, the Department manages 35,000 miles of coastline, including 180 marine and coastal National Wildlife Refuges, making sea level rise a critical concern. National Wildlife Refuges along our nation's coasts are experiencing a rise in sea level that is destroying coastal habitats used by migrating and wintering waterfowl. Rare species that depend on these areas year-round are losing their habitat, too, as are Federally protected marine species, like polar bears and walrus. The dramatic loss of sea ice in northern latitudes – where the impacts of climate change are most profound – has reduced important feeding habitat for these species. Other refuges throughout the country are experiencing extreme drought, which, while not entirely due to climate change, starkly illustrates the impacts of climate change-driven losses of available water to fish and wildlife. Conflicts over water-needs continue to emerge, particularly as the south-central states and Pacific southwest struggle with drought-limited water sources.

The President's Climate Action Plan (Plan) released in June 2013 serves as a blueprint for responsible national and international action to slow the effects of climate change using existing authorities. Building on efforts underway in the states and local communities across the country,

[1] U.S. Global Change Research Program

the Plan cuts carbon pollution while helping the nation prepare for, and ameliorate, future impacts. This is a critical and ambitious effort to address one of the major challenges of the 21st century. The Plan's recognition of the importance of protecting natural resources and promoting resilience in fish and wildlife and their habitats is an integral part of our nation's comprehensive response to climate change.

The Plan has three key pillars:

1) Cut Carbon Pollution in the United States;
2) Prepare the United States for the Impacts of Climate Change; and
3) Lead International Efforts to Combat Global Climate Change and Prepare for its Impacts.

The Department plays a key role in the implementation of the Climate Action Plan. Under the plan, the Department has several responsibilities, including reducing methane emissions; accelerating clean energy permitting; contributing to efforts to prepare the U.S. for the effects of climate change; protecting wildlife; helping Indian tribes adapt to climate change; and developing actionable climate science.

The Service has already made significant progress toward preparing for climate change, the second key pillar of the Plan. We are actively working with states, local communities, and the private sector to meet the goals of this important action plan. Below are examples of actions the Service is undertaking that focus on our efforts to help put fish, wildlife, and plants in the best position to adapt to the effects of climate change.

Preparing the United States for the Impacts of Climate Change

The Plan calls on agencies to identify vulnerabilities of key sectors to climate change. The mission of the Service is, working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. Our focus under the Plan is the effects of climate change on fish, wildlife, and plants and how we must act to ensure that these resources are conserved for the American people over the long term. In 2010, the Service was among the first federal agencies to develop a Climate Change Strategic Plan, which referred to climate change as, "the greatest challenge to fish and wildlife conservation in the history of the Service." This Strategic Plan established a basic framework to help ensure the sustainability of fish, wildlife, plants and habitats in the face of accelerating climate change.

<u>Climate Adaptation Strategy</u> – Language in the Conference Report for the Fiscal Year 2010 Interior, Environment and Related Agencies Appropriations Act (House Report 111–316, pages 76–77) recognized the imperative to address the impacts of climate change on natural resources. The Conference Report urged the Council on Environmental Quality (CEQ) and the Department to ''develop a national, government-wide strategy to address climate impacts on fish, wildlife, plants, and associated ecological processes'' and ''provide that there is integration, coordination, and public accountability to ensure efficiency and avoid duplication.'' Taking this charge, the President's Interagency Climate Change Adaptation Task Force, convened by CEQ, called for the development of a climate adaptation strategy for fish, wildlife, and plants in its 2010 Progress Report to the President, as did the Service's Strategic Plan.

In response, the Service helped chair and develop the interagency National Fish, Wildlife and Plants Climate Adaptation Strategy (Strategy), released in March of 2013. This Strategy identifies key vulnerabilities and presents a unified approach – reflecting shared principles and science-based practices – to reduce the negative impacts of climate change on fish, wildlife, plants, our natural resource heritage, and the communities and economies that depend on them.

Our efforts to develop the Strategy were co-led by the National Oceanic and Atmospheric Administration (NOAA) and the New York State Department of Environmental Conservation, representing state fish and wildlife agencies. The Strategy was developed in close coordination with other federal adaptation efforts such as the National Ocean Policy Implementation Plan and the Freshwater National Action Plan (led by the U.S. Geological Survey and the Environmental Protection Agency), and it draws from existing adaptation efforts by states, Federal agencies and others.

The Service is now co-leading (along with NOAA and the Association of Fish and Wildlife Agencies, and with support from CEQ) a Joint Implementation Working Group that is promoting implementation of the Strategy and will be responsible for reporting on Strategy implementation and future revisions. The fact that state agencies are integrating the recommendations of the Strategy into state planning is a testament to its value.

Vulnerability Assessments – The Service is actively conducting vulnerability assessments for species and habitats across the country to improve understanding of how climate change will affect our trust resources in the coming years. Climate change vulnerability assessments are used in conjunction with analyses of non-climate stressors to assess the overall vulnerability of species and habitats and plan for needed management activities.

In 2011, the agency worked with partners to develop the report "Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment." This report seeks to help resource managers understand the impacts of climate change on species and ecosystems and to support efforts to safeguard these valuable natural resources.

Safeguarding Communities and Economies – The Plan recognizes that protecting America's ecosystems is critical to safeguarding the communities and economies that depend on them, and that healthy natural resources can help reduce the impacts of climate change on people as well as nature. Every year, coastal habitats such as coral reefs, wetlands, and mangroves provide protection for people, infra-structure, and communities from storms, erosion, and flood, avoiding potentially billions of dollars of damage. Forests help provide clean drinking water for many cities and towns, while our urban forests help alleviate urban heat island effects and manage stormwater. Hunting, fishing, and other wildlife-related recreation in the United States is estimated to contribute over $140 billion to our Nation's economy annually, which is approximately one percent of the Nation's gross domestic product[2]. The Service works to protect these natural ecosystems and promote resilience in fish and wildlife populations, forests

[2] USFWS 2011 National Survey of Fishing, Hunting, and Wildlife Associated Recreation

and other plant communities, and freshwater resources in part to ensure they can continue to provide these important benefits to people and communities.

Addressing sea level rise: At Alligator River National Wildlife Refuge on the North Carolina coast the Service is working with partners to evaluate the effects of different adaptation strategies on areas impacted (or likely to be impacted) by sea level rise, to determine how to make the shoreline more resilient to rising sea levels. The strategies include constructing oyster reefs to buffer shorelines from waves and storm surges, restoring the natural hydrologic regime and associated wetland systems, and planting salt- and flood-tolerant species. The goal of this project is to facilitate a transition to salt marsh and open-water habitats that is an inevitable consequence of sea level rise in this area. The project will lead to outcomes that will inform adaptation efforts in other parts of coastal North Carolina as well as throughout the United States and around the world.

Within the boundaries of the Blackwater National Wildlife Refuge on Maryland's Eastern Shore, 5,000 acres of marsh have been lost since the late 1930s from a combination of factors including destruction by nutria, an introduced species, land subsidence, and rising sea levels. For two years, the Service has been working with Federal, state and local partners and individual experts to assess the process of sea level rise and set forth key strategies to enable these tidal marshes to persist for the benefit of people and the special birds that need this habitat for survival, as well as Chesapeake Bay fisheries that depend on these wetlands for shelter and food Steps can be taken to slow the rate of loss of these tidal marshes and improve their health, and to ensure the marsh has room to move and re-establish as the sea level rises. Techniques include adding thin sediment layers through hydraulic pumping to increase the marsh surface elevation and fill in eroded areas, etching shallow channels to connect the failing marsh areas to existing tidal creeks and lower their water levels, acquiring upland areas to allow the marsh to rise, and controlling growth of invasive plants that crowd out more desirable native grasses favored by salt marsh birds.

Restoring the Gulf: In the Gulf of Mexico, climate change, sea level rise, subsidence, habitat conversion and fragmentation, decreasing water quality and quantity, and invasive species have diminished the resilience of the ecosystem. In Louisiana, coastal wetlands in the world's third largest delta are being lost every day, taking with them nature's best storm protection and water filter as well as habitat teeming with sea life that helps support the region's critical commercial fisheries. Natural disasters like hurricanes and manmade disasters like oil spills only exacerbate these losses.

In the wake of the April 2010 Macondo 252 Deepwater Horizon oil spill, the Service is working with state, tribal and other federal partners to identify and determine the extent of injuries suffered by natural and cultural resources. Through the Natural Resource Damage Assessment process, and the Gulf Coast Ecosystem Restoration Council, the Service and these other governments and agencies will seek to recover damages from those responsible and plan and carry out natural resource restoration, which will include anticipating the effects of climate change on long-term restoration projects.

In addition, the Service is working to build resilience in the Gulf by using the National Wildlife Refuges as key ecological links in connecting existing conservation lands, larger landscapes, buffer areas and corridors in order to make the system more resilient and provide fish and wildlife species the ability to migrate and move across the landscape.

Reducing wildfire risk: The Plan directs agencies to work with tribes, states, and local governments to take steps to reduce wildfire risks, which are exacerbated by heat and drought conditions partially resulting from climate change. Because some fish and wildlife species depend on habitats that are maintained or rejuvenated by fire, the Service uses prescribed burning to stimulate a vigorous regrowth of healthy, nutritious plants that provide better food and cover for these species. More frequent, managed fires can also help reduce the fuel built up in natural communities that might otherwise be subject to large and extremely hot and destructive wildfires.

The Service's fire program is responsible for protecting more than 75 million burnable acres; many of these are small coastal and urban tracts with extensive wildland-urban interface areas along the East, West, and Gulf Coasts and in the Midwest. The Service's fire management program includes hazardous fuels reduction, wildfire management, and wildfire prevention.

And in November of last year, DOI joined six other agencies to announce the National Drought Resilience Partnership to make it easier for communities seeking help to prepare for future droughts and reduce drought impacts. This Partnership enhances the efforts of Federal agencies already working with communities, businesses, and farmers and ranchers to build resilience to drought and help prepare their communities for future drought events.

The Service is also working with states, universities and non-profit partners on America's Longleaf Restoration Initiative, working to expand the longleaf pine forest in the Southeastern United States. A prime example of the importance of large-landscape restoration, one of the goals of the initiative is to establish functional connectivity across large geographic areas to conserve large-area dependent species and resilience to known and potential environmental stresses, including hurricanes, catastrophic fire and climate change. Research conducted by the U.S. Forest Service has suggested that longleaf pine is especially adapted to climate change, in part due to its resistant to drought and high temperatures.

Recovering from Hurricane Sandy: The Plan pilots innovative strategies in the Hurricane Sandy-affected region to strengthen communities against future extreme weather and other climate impacts. Coastal wildlife refuges and marshes provide protection and buffering for inland areas from storms, such as the devastating Hurricane Sandy. In October of 2013, Secretary of the Interior Sally Jewell announced that a total of $162 million would be invested to help heal the devastation caused by Hurricane Sandy and make our coastal areas more resilient against future storms and a changing climate. Secretary Jewell stated that "our public lands and other natural areas are often the best defense against Mother Nature."

Service projects are designed to increase resilience by restoring coastal marshes, conducting beach and dune restoration, providing aquatic connectivity in streams and rivers, and by

providing integrated science decisions that bring partners and science together to reduce redundancy and increase the effectiveness of conservation actions.

By restoring aquatic connectivity and preserving and rebuilding natural ecosystems, services will be provided that better protect and benefit wildlife, communities, and the economy. For example, the Service has been working to clean up trees and debris left behind by Hurricane Sandy and restore protective coastal marshes at multiple refuges including Wertheim, Target Rock and Elizabeth A. Morton National Wildlife Refuges in New York. The Service is also working to restore and enhance tidal marshes, replace invasive plants with native ones, preserve wildlife habitat and mitigate damage from future storms to coastal communities and infrastructure.

Cutting Carbon Pollution in America

The Service plays a role in helping to cut carbon pollution though improvements in infrastructure and operations, and carbon sequestration.

Infrastructure and Operations/Reducing Carbon Pollution – The Plan sets a goal for the Federal government to be a leader in clean energy and energy efficiency, as well as to increase the resilience of federal facilities and infrastructure. The Service is contributing to this goal by substantially lowering its building energy intensity (energy consumption per square foot of building space) and its potable water consumption intensity (gallons per square foot); reductions that meet or exceed the requirements of Executive Order 13514, *Federal Leadership in Environmental, Energy and Economic Performance*.

The Plan commits the federal government to building a 21st-Century transportation sector. The Service has taken considerable steps to improve the composition of our motor vehicle fleet by replacing over 10 percent of our motor vehicle fleet with more fuel efficient vehicles during FY2010. This change of fleet composition is expected to reduce petroleum fuel use by approximately 185,000 gallons of petroleum fuel per year and reduce GHG emissions by approximately 1,639 metric tons of carbon dioxide annually.

Biological Carbon Sequestration – The Plan commits to protecting our forests and critical landscapes, and to preserving the role of forests and coastal wetlands in mitigating climate change. The Service has made a considerable investment in biological carbon sequestration through our continuing efforts to restore and create fish and wildlife habitats under our statutory mandates. These efforts are important to our mission to conserve the wildlife of America and they also contribute to the reduction of greenhouse gas concentrations in the atmosphere.

We have implemented biological carbon sequestration projects across the Nation, including the reforestation of more than 80,000 acres of refuge lands in the Lower Mississippi River Valley, an important bottomland hardwood forest ecosystem in Mississippi, Louisiana, Arkansas, and Missouri, since the early 1990s. These projects are restoring valuable habitats for wildlife – including endangered species – while capturing and storing thousands of tons of carbon over their lifetimes.

Conclusion

The President's Climate Action Plan supports three common-sense and essential areas of ongoing efforts by the Service: (1) conserving the wildlife of America for the long term by leading efforts to help fish and wildlife adapt to the effects of climate change; (2) reducing GHG emissions by improving the energy efficiency of our infrastructure and vehicle fleet; and (3) removing carbon from the atmosphere through biological carbon sequestration. The Service is embracing the challenge presented by climate change to the Nation's fish and wildlife resources and we look forward to working with this Committee and the Congress to enhance this most important work.

Testimony of Bill Ritter, Jr, 41st Governor of Colorado
U.S. Senate Committee on Environment and Public Works

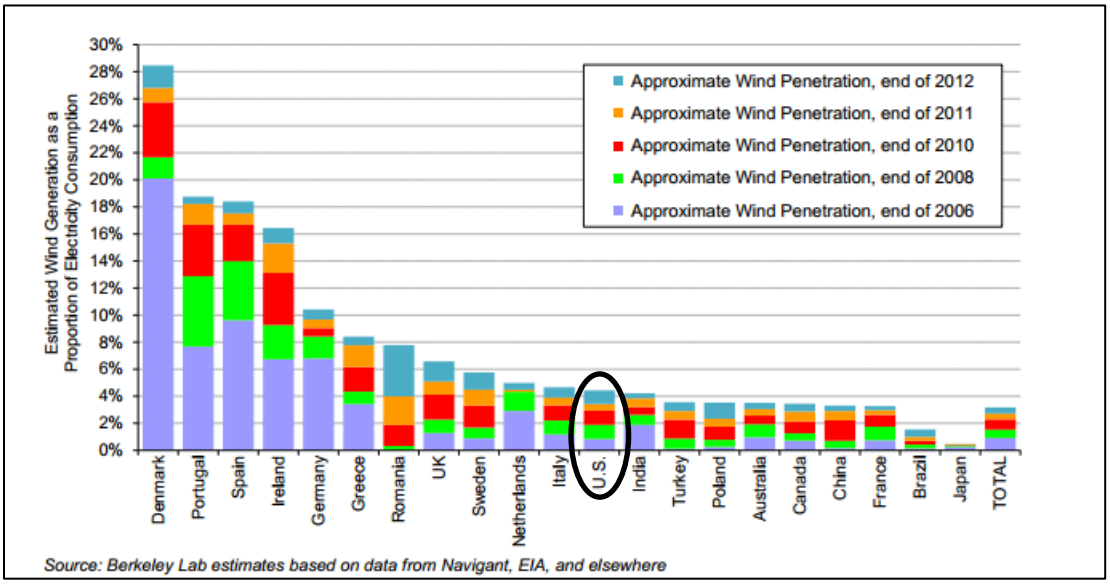
January 16th, 2014

Chairman Boxer, Ranking Member Vitter and members of the Committee:

Thank you for the opportunity to speak to you today and to offer my perspective on how states are leading the U.S. in implementing clean energy. The Center for the New Energy Economy, which I founded in 2011, works directly with governors, legislators, regulators, and other decision makers. We provide technical assistance to help states create the policies and practices to facilitate America's transition to a clean-energy economy. Through this work, we have developed an insight into trends in state advanced energy policy which I would like to share with you today.

States lead, but the U.S. lags

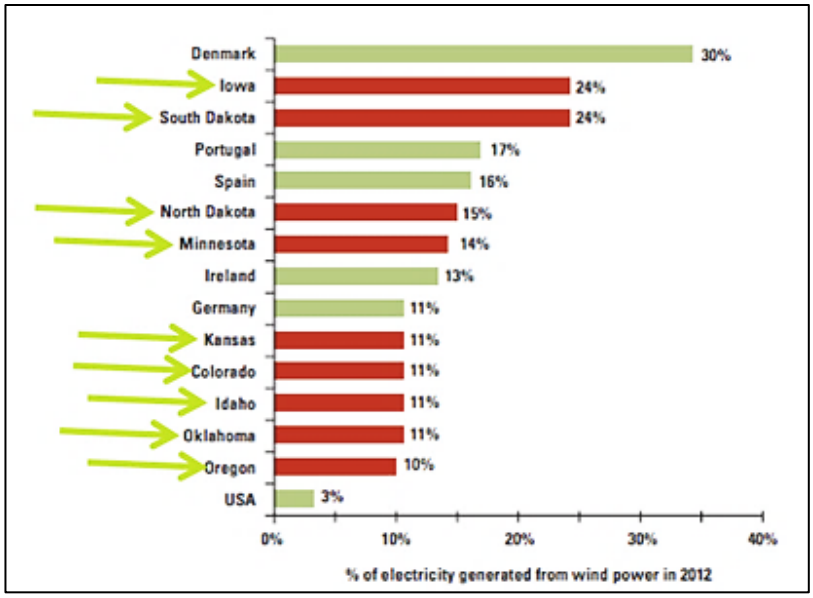
When viewed from an international context, the U.S. is seen as lagging the rest of the developed world in a committed approach to deploying clean energy technologies. The chart from Lawrence Berkeley National Laboratory shows year end 2012 percentages of energy generation from wind energy for developed countries.



Despite the fact that climate is a global issue, states are leading the U.S. forward. Today, 220 million Americans live in a state with a Renewable Portfolio Standard (RPS) and 240 million live in states with a plan to reduce greenhouse gas emissions[1,2]. When taken in

[1] Twenty nine states, Washington D.C. and two territories have Renewable Portfolio Standards. Database of State Incentives for Renewables and Efficiency.

aggregate, the population of states that have an RPS is equal to the fifth largest country in the world. For those states with commitments to reduce greenhouse gas emissions, the combined population would be the fourth largest country in the world. As a percentage of electricity generated, for example, U.S. States assume leadership internationally for wind generation (see right).



The American people and their state leaders recognize and acknowledge the wisdom in reducing pollution for myriad reasons including economic opportunity, public health, and reduced risk for the consumer as well as the critical issue of addressing global climate change.

The state perspective

In 2013 alone, there were over 3,200 advanced energy bills introduced across the country – a volume of legislation that illustrates how important clean energy is to state policymakers. Of the 3,200 introduced bills, nearly 600 were signed into law by the nation's Governors. My Center built and maintains a state legislative database called the Advanced Energy Legislation Tracker, which catalogues and tracks all advanced energy legislation introduced around the country[3].

One of the noteworthy legislative trends in 2013 was the degree to which states defended their RPS policies[4]. There were more than 120 RPS-related bills introduced around the country this session. Of those, 26 bills were attempts to dismantle or altogether eliminate RPS policies. None of these 26 legislative proposals were successful[5]. In fact, the end result of the 2013 session was that Colorado, Minnesota, Nevada and Maryland each increased

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[2] Twenty five states have Energy Efficiency Resource Standards. American Council for and Energy-Efficient Economy.

[3] Advanced Energy Legislation Tracker. Center for the New Energy Economy. www.aeltracker.org

[4] Center for the New Energy Economy. State Renewable Portfolio Standards Hold Steady or Expand in 2013 Session.

[5] The following states defended their RPS policies against rollback attempts in the 2013 session: California, Colorado, Connecticut, Hawaii, Kansas, Maryland, Minnesota, Missouri, Montana, North Carolina, Ohio, Oregon, Pennsylvania, Texas, Washington, West Virginia, Wisconsin.

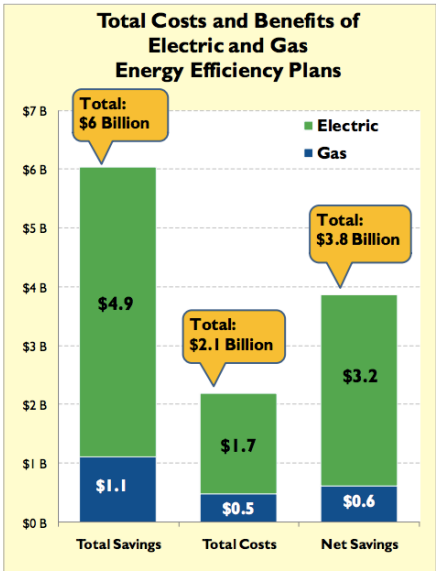
existing RPS policies. The fact that 26 attempts to rollback standards all failed this past year speaks to the benefits that these policies have brought to local and state economies. The bottom line is that the market for clean energy is larger than it was a year ago.

State Policy Highlights

In several states around the country, notable policy efforts are underway. In each of these instances, Governors and Legislatures are exercising impressive leadership in addressing the changing dynamics of the energy world. Here are a few examples:

New York – In September, Governor Cuomo announced the creation of a $1Bn fund to finance clean energy projects. While this fund represents the largest state finance effort, Governor Cuomo followed it up with an equally impressive commitment of $1Bn toward the NY Sun initiative. This program not only provides a streamlined process for consumers to install solar energy and seamlessly finance projects, it also streamlines the permitting and approval process for solar installations, greatly reducing costs for solar companies and, similarly, for their customers.

These programs promise to vault New York into a leadership position in solar energy installations.



Massachusetts –Governor Patrick's administration has been a shining star on energy issues, fundamentally transforming Massachusetts into a national leader during his administration. Beginning with the landmark Green Communities Act of 2008, renewable energy installations have skyrocketed along with high performance building standards and most notably, a complete transformation of energy efficiency programs in the state. As the figure to the left demonstrates, the state's leading suite of energy efficiency policies has saved Massachusetts citizens nearly $4 Billion dollars and earned the state a number one ranking three years in a row from The American Council for and Energy Efficient Economy (ACEEE).

At the end of December, Governor Patrick announced a ground breaking grid modernization commitment for Massachusetts. All utilities will need to submit a grid modernization plan within six months and the Department of Public Utilities will begin to evaluate new utility business models that will align the state's public policy objectives with the utility's earnings on investment while planning for a greatly expanded electric vehicle infrastructure.

Nevada – In 2013, Governor Sandoval signed legislation to shut down the 800 MW Reid-Gardner coal plant, ending the state's commitment to burning coal for electricity. The

landmark legislation replaces the generation with a combination of renewable energy, natural gas and energy efficiency signaling a shift toward cleaner air, water and a strengthened economy for the state.

Arizona – The Arizona Corporation Commission (ACC) demonstrated a thoughtful approach to utility concerns with the state's growing and thriving solar. The utility claimed it was losing revenues from net metering (crediting of customers for power they feed into the grid from a solar installation on their home or business) in the state that were critical to paying for the utility's infrastructure. Arizona Public Service proposed a monthly fee of $75 on every solar customer to cover these infrastructure costs. The ACC recognized the need to quantify these costs and attribute them to the solar customers, but also were sensitive to the economic impact of crippling the growing solar industry in the state. As a compromise, the ACC proposed a 70¢/kW/month charge on solar customers ending a contentious and divisive debate over the future of solar in the state.

Ohio – Governor Kasich lead a successful revision to the state's oil and gas regulatory structure in 2012 putting in place a set of regulatory reforms in the state statutes that represent a responsible regulatory structure that will both allow the industry to thrive and grow while protecting the environment for future generations. In 2013, the legislature rejected efforts to undermine the state's energy efficiency and renewable energy requirements crediting the standards with saving consumers $300M each year. Two industry groups: Advanced Energy Economy Ohio and the Ohio Manufacturers Association lead the charge in opposition to undermining the state's efficiency standard raising concerns of the impact on consumers and the economy.

The Colorado Story

Colorado represents a state that has truly taken an "all of the above" strategy with an eye toward substantially reducing pollution while expanding economic opportunity in the state. Colorado is a natural gas producing state and we see natural gas as a critical component to reducing greenhouse gas pollution within the electric generation sector. We also see a critical role for both energy efficiency and renewable energy as a part of that effort.

As Governor, I signed 57 clean energy bills into law[6], including the following policies:

1. Reformed the Colorado Oil and Gas Commission to remove a statutory requirement that the industry have a majority of seats on the commission, expand the representation and put in place important regulatory measures to ensure best practices in siting and drilling for natural gas.

[6] A list of all clean energy bills signed into law by Governor Ritter http://cnee.colostate.edu/p/new-energy-legislation

2. Passed an EERS that makes energy efficiency the best financial investment a utility can make, sets goals for demand reductions and allows for bonuses for exceeding those goals.

3. Doubled the voter approved 10% RPS to 20% in 2007 and then tripled it to 30% in 2010. We did this while maintaining the critical price protections for consumers of no more than a 2% impact on rates.

4. Passed the "Clean Air, Clean Jobs Act" in 2010 which replaced nearly one gigawatt of Front Range coal generation with natural gas, efficiency and renewables while protecting ratepayers and decreasing harmful emissions of EPA Criteria Pollutants.

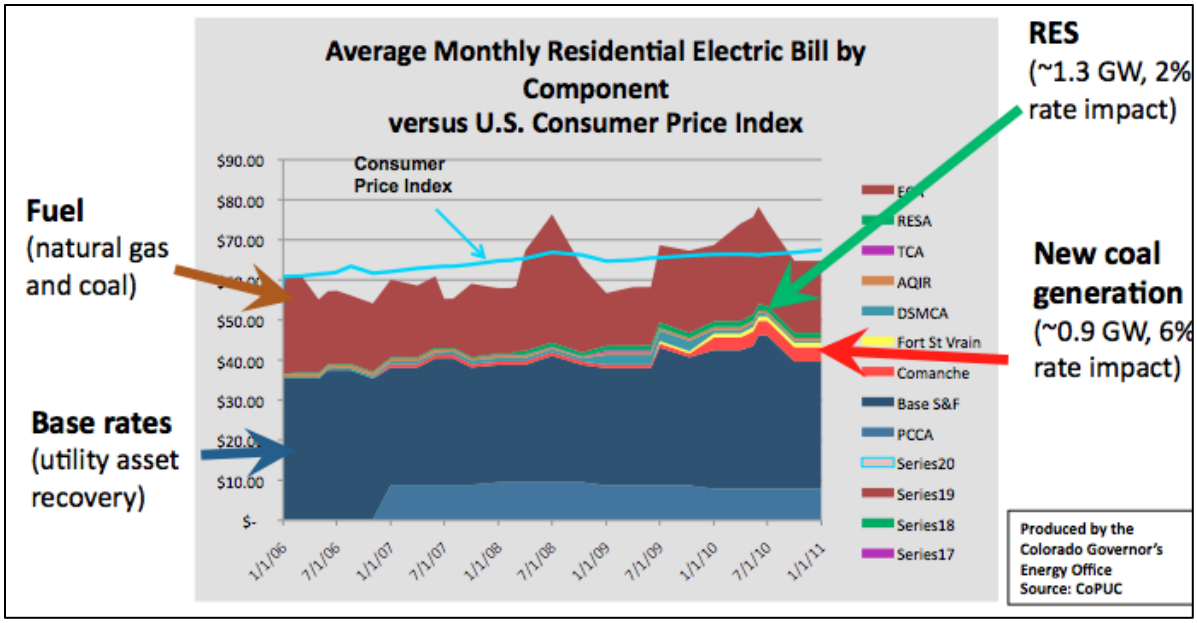
In 2007, I issued a Climate Action Plan through executive order that set a goal to reduce statewide greenhouse gas emissions to 20% below 2005 levels by 2020. We asked utilities to achieve these reductions within their generation fleets. At the time, this was perceived by some as a long stretch. Public Service Company of Colorado (PSCO - the Colorado subsidiary of Xcel Energy) recently announced that, due primarily to the policies noted above, they project a reduction in emissions by 2020 of 35% below 2005 levels from their Colorado fleet – greatly exceeding our climate action goal.

In their 2011 Electric Resource Plan, PSCO Energy stated: *"we have proposed to acquire an additional 200 MW of wind from the Limon II facility to capture the energy savings benefits from that facility"* – this request to the Colorado Public Utilities Commission was not made because of any RPS requirement, but rather on the grounds of economic and resource benefits.

Again in October of last year, Xcel Energy proposed to the PUC to procure 170 MW of solar and 450 MW of wind power strictly on economics, not for compliance with the RPS. The CEO of Public Service Company of Colorado, David Eves, told the Denver Business Journal "This is the first time that we've seen, purely on a price basis, that the solar projects made the cut – without considering carbon costs or the need to comply with a renewable energy standard – strictly on an economic basis."

Perhaps most importantly, Colorado has been able to accomplish this all of this without raising rates for consumers. Looking at consumer bills from 2006 to 2011 (chart below), consumer rates did not increase relative to the Consumer Price Index. This chart also illustrates the exposure to fluctuations in coal and natural gas contracts in consumer rates which represents financial risk to the Colorado ratepayer.

Colorado electricity rates were 19% below the national average when I took office and 21% below the national average when I left office. During that same time, the installed renewable energy capacity increased from 200MW to nearly 2,000 MW and is now going to more than 2,700 MW.



The job creation benefits of these policies are significant. In addition to the thousands of jobs created in the energy efficiency, renewable and natural gas sectors from these policies, we were able to attract one of the world's leading wind turbine manufacturers, Vestas, to locate their North American manufacturing headquarters to Colorado. Today, if a Vestas turbine is being installed anywhere in America, the blades, nacelles and towers are manufactured in Colorado, employing thousands of Colorado workers.

As policy makers, we do our best with the information available to create sound public policy. One can never be certain whether those policies achieved their objective until time bears out the results. The Colorado experience points to a tremendous success from both an economic and environmental perspective over just an eight-year period.
Stories like these are being developed in states across the country, ensuring that the U.S. will continue its foothold in the global clean energy economy. The Federal Government can assist states in scaling policies and advancing technologies and give the U.S. a more enviable presence in the global energy market place.

Future state policy opportunities

In 2014, I see three major policy opportunities for states to continue to lead the country in deploying clean energy.

Implementing the Clean Air Act, Section 111(d)

Section 111(d) of the Clean Air Act requires states to develop plans for *existing* sources of non-criteria pollutants for EPA approval (i.e., a pollutant for which there is no national ambient air quality standard, such as CO_2).[7] These are referred to as "111(d) plans" and

[7] EPA, Region 7, Section 111(d) Plans.

are similar to State Implementations Plans (SIPs) for criteria pollutants. Arguably one of the biggest near term opportunities for states to realize clean energy policy goals is to find a pathway for those policies in 111(d) plans submitted to EPA.

In practice, this would include establishing the right boundaries for compliance. Current thinking in the literature offers three possible compliance paths for states under the pending EPA rule. Those options are: 1) a performance based standard by plant with no flexibility on boundaries, or commonly referred to as "inside the fence line" compliance; 2) a performance based standard with flexibility on boundaries, or commonly referred to as an "outside the fence line" compliance approach[8]; and 3) a state-wide budget approach in which each state manages reductions among utilities within the state geographic boundary.[9]

It is my belief that, "outside the fence line" will enable the greatest innovation and the greatest potential for new clean energy markets. Furthermore, this compliance path could set the stage for states to adopt Integrated Resource Planning in managing clean and conventional resources together rather than in separate resource portfolios as they are managed today.

Which clean technologies will see an incremental market as part of 111(d) planning? What legislative changes should states be considering in the 2014 legislative session to allow them to consider the broadest options? To the extent that states may need to pass new legislation for compliance with the 111(d) rules, waiting until the 2015 session may impose too much risk if not enacted given that the final plans will be due to EPA in June of 2016. EPA is expecting to issue a draft rule next June, which is well into and past most state legislative sessions in 2014.

States would be well served to begin planning now, performing the necessary resource and portfolio analysis which will be necessary for taking the most appropriate action in compliance with Section 111(d).

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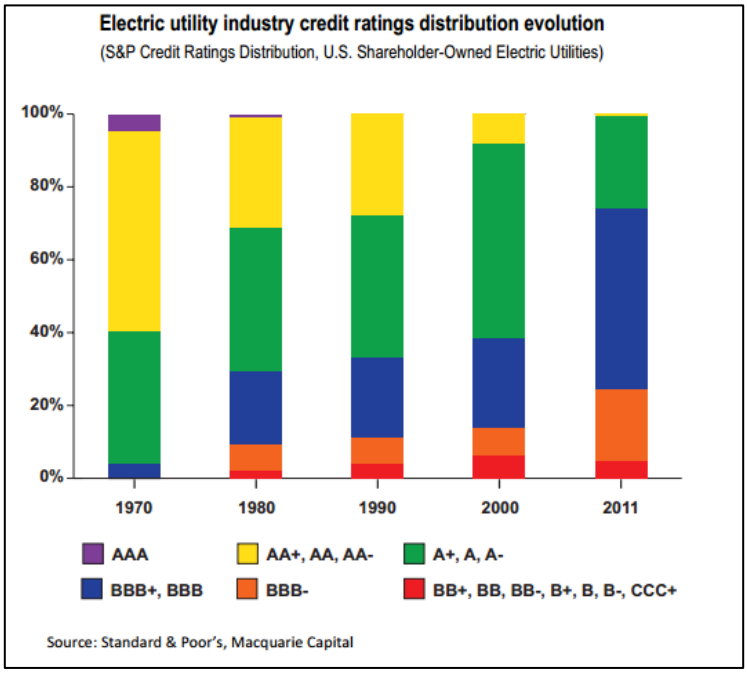
[8] It may be the case that "outside the fence line" compliance includes emissions reductions within a utility fleet of plants in order to achieve compliance rather than just the out of compliance plants. This option may include both emissions controls within a fleet to bring the average down and/or include non-central plant options such as EE, RE, DR, EVs, etc.

[9] M.J. Bradley & Associates. Structuring Power Plant Emissions Standards Under Section 111(d) of the Clean Air Act -- Standards for Existing Plants.

21st Century Utility Business Models

Utilities recognize the challenge before them and the increasing role of technology. At the heart of this challenge is the current application of a 20th Century regulatory model for a 21st Century economy.

Traditional, volume-based rate setting as a means of recovering embedded costs of depreciated assets is still common. When volume-based regulation was put in place, however, large-scale generation made sense and utility load was growing. Today, load is declining, productivity is increasing, consumers are asking for new products and services, and we are experiencing a growing trend toward distributed power sources.



Put another way, public objectives are not in line with the current utility revenue model. As a result, utilities have seen their credit ratings slip considerably over the last four decades (above).

Ultimately, we will need a 21st century utility revenue model that aligns with the expectations, desires and capabilities of a 21st century market. States are just beginning to move in this direction, most recently with great leadership from the Commonwealth of Massachusetts. This will become an increasingly pressing issue for states, utilities and utility regulators.

Access to Financing

In late 2011, investment in the clean tech sector surpassed $1 trillion dollars making clear the industry has taken root in the global economy.[10] Yet a tremendous amount of investment capital still remains on the sidelines waiting for consistent public policies that support clean energy. The current patchwork of state energy policy, financing programs, and regulatory structures combine for a complex market for institutional investors seeking opportunities. The underlying fabric that allows for scalable investment in the renewable energy sector is heavily dependent on access to reliable capital.

[10] Bloomberg New Energy Finance. Global Trends in Renewable Energy Investment in 2011.

In order to take full advantage of America's full renewable energy potential, we must usher in a new era of collaboration between state energy policy makers, the finance community and program implementers. In the 2013 legislative session alone, there were over 650 bills introduced to enable financing (including tax credits) for advanced energy of which nearly 100 became law. States are trying to unlock financing for clean energy.
For large scale investments for renewable generation, large capital markets such as Real Estate Investment Trusts (REITs) and Master Limited Partnerships (MLPs) are closed to renewable energy. As a result, renewable developers rely on tax equity markets which are much more limited in scope and scale. Access to these capital markets could further drive down the costs of renewable energy onto the grid.

For the large distributed market for renewable and efficiency retrofits, the Federal government can play an important role in providing credit enhancements through subordinated debt or loan loss reserves. Furthermore, the investment pool needs standardization of program design. By reducing credit risk for private capital and serving as a facilitator of consistent program design to attract private capital, costs can be reduced for citizens and businesses throughout the nation.

Closing Remarks

States continue to lead in the pursuit of a new energy economy for the nation – and in many ways that makes sense within our federalist system of government. But there are important roles for the Federal Government to ensure American leadership in the burgeoning global new energy economy.

A recent report from Pike Research estimated this global market at $1.2 trillion dollars in 2011 and growing at a terrific pace. We can be leaders in developing, implementing and marketing advanced energy technology to the world or we can buy the technology from others. In many ways, this is the choice before you.

I urge you to choose leadership.

Biography

Bill Ritter, Jr. is director of the Center for the New Energy Economy (CNEE) at Colorado State University. The Center launched on February 1, 2011, with Ritter as the founding director. The Center employs an assistant director, three senior policy advisors, an executive assistant and a part-time student research team.

The Center works directly with governors, legislators, regulators, planners, policymakers, and other decision makers. It provides technical assistance to help officials create the policies and practices to facilitate America's transition to a clean-energy economy.

Ritter is a member of the board of the directors of the Energy Foundation and a senior fellow and member of the board of directors of the Advanced Energy Economy Institute.

Ritter was elected as Colorado's 41st governor in 2006, and built consensus to tackle some of our state's biggest challenges. During his four-year term, Ritter established Colorado as a national and international leader in clean energy, by building a new energy economy. As a result of that work, Colorado created thousands of new jobs and established hundreds of new companies. Ritter enacted an aggressive business-development and job-creation agenda, focused on knowledge-based industries of the future: energy, aerospace, biosciences, information technology, and tourism.

Ritter earned his bachelor's degree in political science from Colorado State University (1978) and his law degree from the University of Colorado (1981). With his wife Jeannie, he operated a food distribution and nutrition center in Zambia. He then served as Denver's district attorney from 1993 to January 2005.

The Ritters have four children: August, Abe, Sam, and Tally.

What we know about climate change

Andrew E. Dessler
Professor of Atmospheric Sciences
Texas A&M University

My name is Andrew Dessler and I am a professor of atmospheric sciences at Texas A&M University. I have been studying the atmosphere since 1988 and I have published in the peer-reviewed literature on climate change, including studies of the cloud and water vapor feedbacks and climate sensitivity. In my testimony, I will review what I think are the most important conclusions the climate scientific community has reached in over two centuries of work.

Let me begin by describing some important points that we know with high confidence — and how that has led me to personally conclude that climate change is a clear and present danger.

1. The climate is warming.

By this I mean by this that we are presently in the midst of an overall increase in the temperature of the lower atmosphere and ocean spanning many decades. This can be seen in Figure 1, which shows the global average surface temperature, and Figure 2, which shows the heat content of the ocean (both figures plot anomalies, expressed in degrees Fahrenheit). A mountain of ancillary data supports these observations of warming: e.g., satellite measurements of the temperature of the lower atmosphere, loss of ice on the planet, observations of sea level rise.

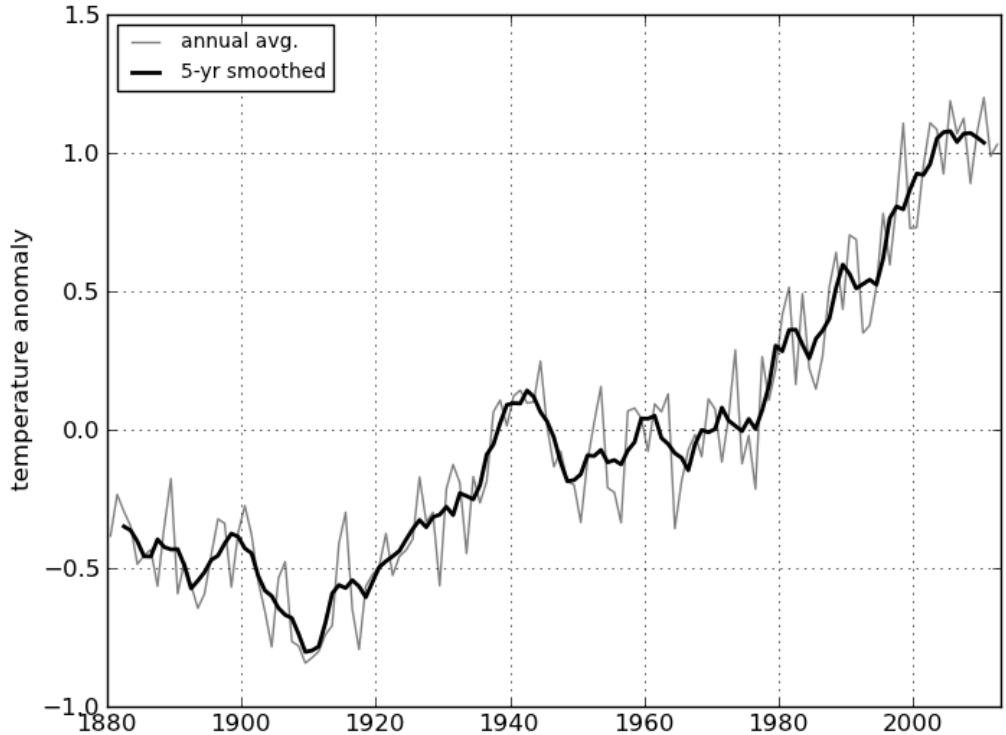


Fig. 1. Global annual average temperature anomaly in °F; the gray line is the annual average and the black line is a smoothed time series. Data are from the NASA GISS Surface Temperature Analysis [Hansen et al., 2010], downloaded from http://data.giss.nasa.gov/gistemp/. Other analyses show nearly identical results.

2. Most of the recent warming is extremely likely due to emissions of carbon dioxide and other greenhouse gases by human activities.

This conclusion is based on several lines of evidence:

a. Humans have increased the amount of carbon dioxide in the atmosphere from 280 parts per million in 1750 to 400 parts per million today. Methane levels have more than doubled over this period, and chlorofluorocarbons did not exist in our atmosphere before humans.

b. The physics of the greenhouse effect is well understood, and it predicts

that the increase in greenhouse gases will warm the climate.

Fig. 2. Ocean temperature anomaly in °F of the entire ocean. Anomalies are calculated relative to the 1970-2000 period (data are from Balmaseda et al. [2013]).

c. The actual amount of warming over the last century roughly matches what is predicted by the standard model[1] of climate. This is shown in Fig. 3.

d. Reconstructions of paleoclimate data over the last 60 million years show that changes in atmospheric carbon dioxide exert a strong control on the climate system.

e. There is no alternative explanation for the recent warming other than an enhanced greenhouse effect due to human activities.

[1] Following particle physics and cosmology, I'll refer to the mainstream theory of climate science as the *standard model*. A climate model is a single computational realization of the physics embodied in this standard model.

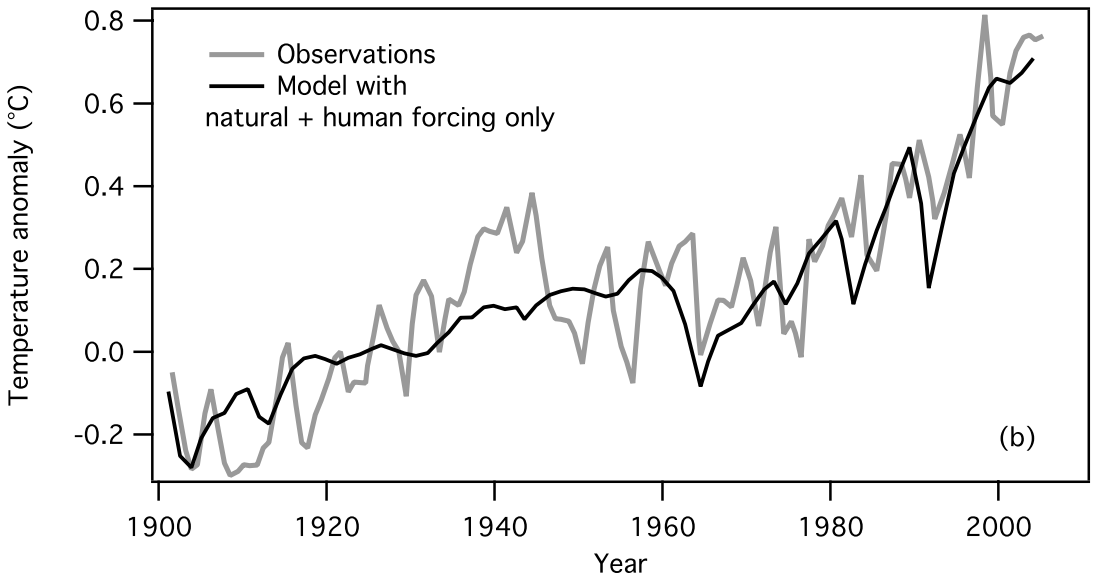


Figure 3. Global mean surface temperature anomalies from the surface thermometer record (gray line), compared with a coupled ocean-atmosphere climate model (black line). The model includes natural forcing and human greenhouse-gas emissions, aerosols, and ozone depletion. Anomalies are measured relative to the 1901-1950 mean. Source: Fig. 3.12 of Dessler and Parson [2010], which was an adaptation of Fig. TS.23, Solomon et al. [2007].

These points fit into a more general context about how science works. Making successful predictions is the gold standard of science. If a theory successfully predicts phenomena that are later observed, one can be confident that the theory captures something essential about the real world system. The standard model has done that. For example, climate scientists predicted in 1967 that the stratosphere would cool while the troposphere warmed as a result of increasing greenhouse gases. This was observed 20 years later. Climate models predicted in the 1970s that the Arctic would warm faster the Antarctic. This has also been subsequently confirmed[2].

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[2] Some of these examples are taken from the 2012 AGU Tyndall Lecture by R. Pierrehumbert, http://fallmeeting.agu.org/2012/events/tyndall-lecture-gc43i-successful-predictions-video-on-demand/

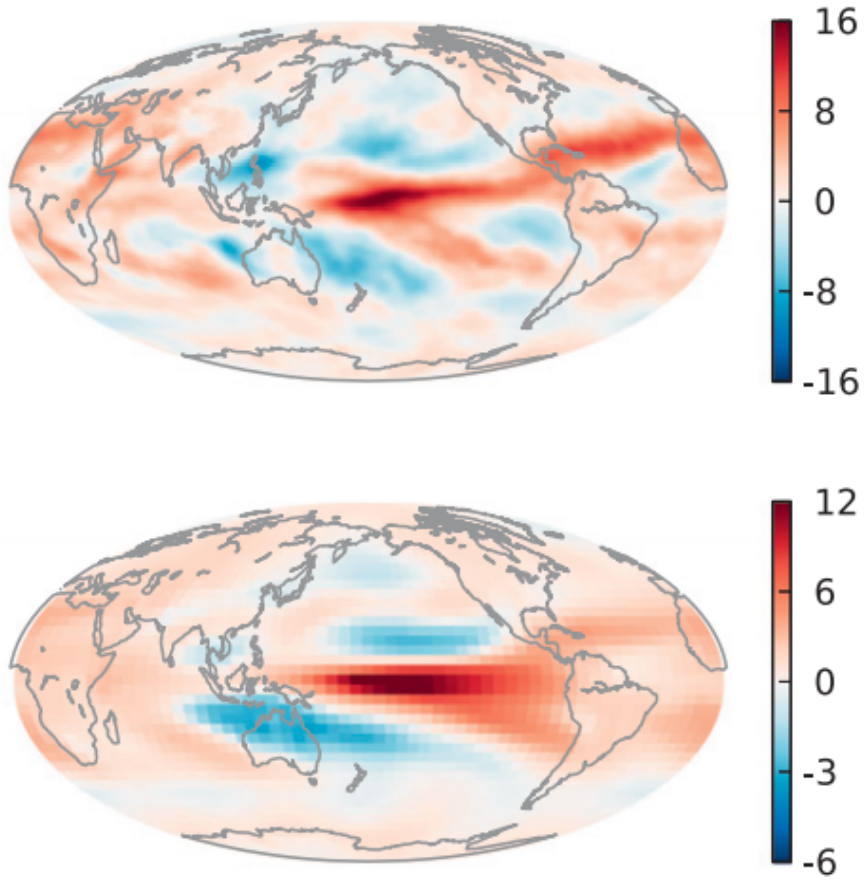

Figure 4. The spatial distribution of the water vapor feedback ($W/m^2/K$) in (top) observations between 2000 and 2010 and (bottom) control runs of CMIP3 models. Adapted from Fig. 2 of Dessler [2013].

Figure 4 shows the spatial distribution of the water vapor feedback in observations and in climate models. The model calculations are fundamentally a prediction because they were done before the observations were available. The agreement is excellent, and I take from this high confidence in the ability of the models to simulate this feedback. And given the importance of this process in driving climate change, I take this as a strong validation of the standard model generally.

And this is just the tip of the melting iceberg of successful predictions that the climate science community has made using the standard model. Other

successful predictions include an increase in energy stored in the ocean, amplification of heating over land during transient warming, etc. The list goes on and on — far too many to catalog here.

The standard model also explains the paleoclimate record. In the 1980s, my colleague Prof. Jerry North was trying to use energy balance models to simulate the ice ages and he just couldn't get the model to simulate those cold periods. Then, in the 1990s, ice core data showed that carbon dioxide was much lower during ice ages. When Prof. North included that reduction of carbon dioxide into the model, voila! — he could suddenly simulate the cold temperatures necessary to account for the ice ages.

In addition, there are many occasions where the observations and the standard model disagreed, and it turned out that the observations were wrong. For example, in the 1980s, paleoclimate reconstructions suggested that the Tropics did not cool much during the last Ice Age, while the standard model found that to be inconsistent with the land-based data. More recent syntheses, however, have shown that the Tropics actually cooled more than previously thought — in good agreement with the standard model.

Another example is the cooling observed in the MSU satellite temperature record in the 1990s. The standard model told us that cooling of the troposphere is inconsistent with surface temperature increases. But after corrections to the satellite data processing were made, they now both show warming. Disagreements between this data set and climate models still exist, but ongoing studies of the satellite record are uncovering more issues in it [e.g., Po-Chedley and Fu, 2012]. I suspect future revisions will bring it into ever-closer agreement with the models.

Thus, we have a standard model of climate science that is capable of explaining just about everything. Naturally, there are some things that aren’t necessarily

explained by the model, just as there're a few heavy smokers who don't get lung cancer. But none of these are fundamental challenges to the standard model.

An excellent example of a challenge to the standard model is the so-called "hiatus" [Trenberth and Fasullo, 2013]: a lack of warming in the surface temperature record over the last decade or so. This is frequently presented as an existential threat to the standard model, but as I describe below that greatly exaggerates its importance.

To begin, the lack of a decadal trend in surface temperatures does not mean that warming has stopped. Figure 2 shows the continued accumulation of heat in the bulk of the ocean, which is a clear marker of continued warming. And because heat can be stored in places other than at the surface, a lack of surface warming for a decade tells you almost nothing about the underlying long-term warming trends.

More quantitatively, Figure 5 shows surface temperature anomalies between 1970 and 2013. Over this period, the planet warmed rapidly, at a rate of 3°F/century. Also plotted on this figure are short-term trends based on endpoints that were selected to demonstrate short-term cooling trends. As you can see, it's possible to generate a nearly continuous set of short-term cooling trends, even as the climate is experiencing a long-term warming. This would allow someone to claim that global warming had stopped or even that the Earth had entered a cooling period — even though the climate is rapidly warming!

As Fig. 5 shows, the problem in very short temperature trends (like a decade) is that climate variability such as El Niño cycles completely confounds ones ability to see the underlying trend. However, this short-term variability can be removed, and, if one does that, then the hiatus essentially disappears [Foster and Rahmstorf, 2011; Kosaka and Xie, 2013]. Because of this, I judge that there is

virtually no merit to suggestions that the “hiatus” poses a serious challenge to the standard model.

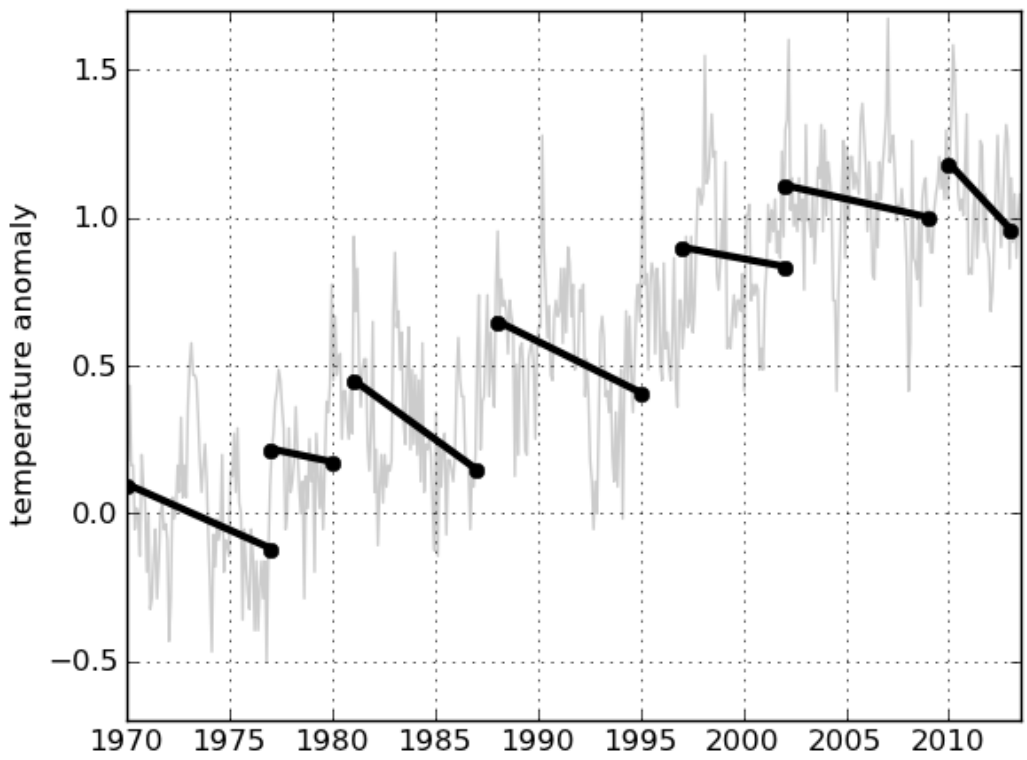

Fig. 5. A plot of monthly and global average surface temperature anomalies (°F) from the GISS Surface Temperature Analysis (gray line) along with selected negative short-term trend lines (black lines). This figure is inspired by SkepticalScience’s escalator plot (http://www.skepticalscience.com/graphics.php?g=47)

Nevertheless, it would be wrong for me to claim that the standard model includes a robust understanding of the interaction of ocean circulation, short-term climate variability, and long-term global warming. Viewed that way, the “hiatus” is an opportunity to refine and improve our understanding of these facets of the standard model. Papers are already coming out on this subject [e.g., Kaufmann et al., 2011; Kosaka and Xie, 2013; Solomon et al., 2010] and I suspect that, in a

few years, our understanding of this phenomenon will be greatly improved.

What about alternative theories? Any theory that wants to compete with the standard model has to explain all of the observations that the standard model can. Is there any model that can even come close to doing that?

No.

And making successful predictions would help convince scientists that the alternative theory should be taken seriously. How many successful predictions have alternative theories made?

Zero.

Based on everything I discussed above, and more, the Working Group I report recently released by the IPCC concludes that humans are extremely likely to be the cause of most of the warming over the last few decades. Note that this does not claim that humans are the ONLY cause, nor does it claim that we are 100% certain. But given the amount of work that's gone into studying this and the amount of evidence in support of it that has emerged, my view is that this statement is, if anything, conservative.

3. Future warming could be large

As a consequence of our understanding of the climate system, unchecked greenhouse-gas emissions would lead to warming over the 21st century of 4.7-8.6°F[3] (for the global average). Regionally, on land and in the Arctic, the warming is apt to be larger.

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[3] Based on an ensemble of RCP8.5 runs.

These warmings may not sound like much until you realize that the warming since the last ice age — a warming that completely reconfigured the planet — was 9°F-14°F (5-8°C). The upper limits of projected warming over the 21st century would therefore herald a literal remaking of the Earth's environment and our place within it.

4. The impacts of this are profound.

Before I begin talking about impacts, it is worth discussing the value of talking about what we know rather than what we don't know. Focusing on what is unknown can lead to an incorrect perception of uncertainty. For example, we don't know the exact mechanism by which smoking cigarettes causes cancer. Nor do we know how many cigarettes you have to smoke to get cancer. Nor can we explain why some heavy smokers don't get cancer, while some non-smokers do. Based on this, you might conclude that we don't know much about the health impacts of smoking. But that's wrong. Despite these unknowns, it is certain that smoking increases your risk of health problems.

In the climate debate, we can argue about what we know or what we don't know. Arguing about what we don't know can give the impression that we don't know much, even though some impacts are virtually certain.

The virtually certain impacts include:

- increasing temperatures
- more frequent extreme heat events
- changes in the distribution of rainfall
- rising seas
- the oceans becoming more acidic

In my judgment, those impacts and their magnitude are, by themselves, sufficient to compel us to act now to reduce emissions.

And there are a number of impacts that may occur, but are not certain. We may see changes in drought intensity and distribution, and increases in flood frequency. And we have an expectation that hurricanes will get stronger, although their numbers might decrease. And there's always the risk of a surprise, like the Antarctic ozone hole, where some high consequence impact that we never anticipated suddenly arises.

We can argue about these less certain impacts, and scientific research in these areas is very active, but they should not distract us from those that are virtually certain.

In conclusion, things are beginning to change rapidly. More and more frequently it seems we pass another climate milestone — hottest year of the modern temperature record, highest CO_2 in perhaps a million years, etc. Because of inertia in the climate system, every year we don't take action commits us to about 2% more eventual warming [Allen and Stocker, 2014]. In other words, if we start taking appropriate action today, we can limit global warming to 2°C. But, if we wait 10 years to begin to reduce emissions, then the same level of effort will lead to warming of 2.4°C. Time is not our friend in this problem. By the time everyone agrees we have a problem, it is too late to do much about it.

The scientific community has been working on understanding the climate system for nearly 200 years. In that time, a robust understanding of it has emerged. We know the climate is warming. We know that humans are now in the driver's seat of the climate system. We know that, over the next century, if nothing is done to rein in emissions, temperatures will likely increase enough to profoundly change the planet. I wish this weren't true, but it is what the science tells us.

References

Allen, M. R., and T. F. Stocker (2014), Impact of delay in reducing carbon dioxide emissions, Nature Clim. Change, 4, 23-26, 10.1038/nclimate2077.

Balmaseda, M. A., K. E. Trenberth, and E. Kaellen (2013), Distinctive climate signals in reanalysis of global ocean heat content, Geophys. Res. Lett., 40, 1754-1759, 10.1002/grl.50382.

Dessler, A. E. (2013), Observations of climate feedbacks over 2000-10 and comparisons to climate models, J. Climate, 26, 333-342, 10.1175/jcli-d-11-00640.1.

Dessler, A. E., and E. A. Parson (2010), The science and politics of climate change: A guide to the debate, Cambridge Univ. Press.

Foster, G., and S. Rahmstorf (2011), Global temperature evolution 1979-2010, Environmental Research Letters, 6, 10.1088/1748-9326/6/4/044022.

Hansen, J., R. Ruedy, M. Sato, and K. Lo (2010), Global surface temperature change, Rev. Geophys., 48, Rg4004, 10.1029/2010rg000345.

Kaufmann, R. K., H. Kauppi, M. L. Mann, and J. H. Stock (2011), Reconciling anthropogenic climate change with observed temperature 1998–2008, Proc. Natl. Acad. Sci., 108, 11790-11793, 10.1073/pnas.1102467108.

Kosaka, Y., and S.-P. Xie (2013), Recent global-warming hiatus tied to equatorial Pacific surface cooling, Nature, advance online publication, 10.1038/nature12534.

Po-Chedley, S., and Q. Fu (2012), A Bias in the Midtropospheric Channel Warm Target Factor on the NOAA-9 Microwave Sounding Unit, Journal of Atmospheric and Oceanic Technology, 29, 646-652, 10.1175/jtech-d-11-00147.1.

Solomon, S., K. H. Rosenlof, R. W. Portmann, J. S. Daniel, S. M. Davis, T. J. Sanford, and G. K. Plattner (2010), Contributions of stratospheric water vapor to decadal changes in the rate of global warming, Science, 327, 1219-1223, 10.1126/science.1182488.

Solomon, S., D. Qin, M. Manning, R.B. Alley, T. Berntsen, N.L. Bindoff, Z. Chen, A. Chidthaisong, J.M. Gregory, G.C. Hegerl, M. Heimann, B. Hewitson, B.J. Hoskins, F. Joos, J. Jouzel, V. Kattsov, U. Lohmann, T. Matsuno, M. Molina, N. Nicholls, J. Overpeck, G. Raga, V. Ramaswamy, J. Ren, M. Rusticucci, R. Somerville, T.F. Stocker, P. Whetton, R.A. Wood and D. Wratt (2007),

Technical Summary. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Trenberth, K. E., and J. T. Fasullo (2013), An apparent hiatus in global warming?, Earth's Future, 10.1002/2013EF000165.

TESTIMONY OF DANIEL A. LASHOF, Ph.D.

DIRECTOR, CLIMATE AND CLEAN AIR PROGRAM,

NATURAL RESOURCES DEFENSE COUNCIL

HEARING ON

"THE PRESIDENT'S CLIMATE ACTION PLAN"

BEFORE THE COMMITTEE ON ENVIRONMENT & PUBLIC WORKS

U.S. SENATE

JANUARY 16, 2014

Chairman Boxer and members of the Committee, thank you for inviting me to present NRDC's views on federal efforts to address climate change under the President's Climate Action Plan.

We have an obligation to protect our children and future generations from the effects of climate change by reducing emissions of carbon dioxide and other heat-trapping pollutants and by taking sensible steps to prepare for changes in climate that are no longer avoidable. Acting responsibly at home is also a prerequisite for the indispensable leadership that only the United States can provide internationally.

President Obama's historic Climate Action Plan will set us on the right track to cut dangerous pollution that threatens our health and well-being. It will help communities across the country prepare for more frequent and intense extreme weather, such as heat waves, heavy precipitation, drought, coastal flooding, and wildfires. And it will position the United States to provide the leadership the world needs.

The year 2012 was the hottest on record in the continental United States.[1] Severe drought destroyed livestock and livelihoods across the Southwest. Wildfires charred 9.3 million acres of forest.[2] Storm surges amplified by higher sea levels ravaged coastal communities in the East. Overall, extreme weather cost the U.S. economy $140 billion,[3] of which the federal government's share amounted to $96 billion. That's about $1,100 per taxpayer and more than it spent on education or transportation.[4] These staggering sums give us a sense of the cost of inaction. Indeed, they make it clear that inaction is not a responsible option.

The centerpiece of the Climate Action Plan is a set of actions under existing federal laws by the Environmental Protection Agency (EPA), the Department of Energy (DOE) and other agencies to curb heat-trapping pollution and cut energy waste in order to cut total economy-wide

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[1] National Oceanic and Atmospheric Administration (NOAA) and the National Climactic Data Center, *See* http://www.ncdc.noaa.gov/billions/events.

[2] United States Department of Agriculture: USDA Forest Service Update, March 2013, Wildfires of 2012

[3] National Oceanic and Atmospheric Administration (NOAA) and the National Climactic Data Center, *See* http://www.ncdc.noaa.gov/billions/events.

[4] Dan Lashof and Andy Stevenson. Who Pays for Climate Change? U.S. Taxpayers Outspend Private Insurers Three-to-One to Cover Climate Disruption Costs, published by NRDC, May 2013, available at: http://www.nrdc.org/globalwarming/files/taxpayer-climate-costs-IP.pdf.

U.S. greenhouse gas emissions 17% from 2005 levels by 2020.[5] President Obama committed to this benchmark during his first term in office, and reaffirmed it with the announcement of the Climate Action Plan. Other elements of the plan are to prepare for changes in climate that are no longer preventable by supporting community-based preparedness, resilience planning and investment, and developing bilateral and multilateral agreements to reduce climate change pollution worldwide. My testimony focuses primarily on the pollution reduction component of the Climate Action Plan.

To achieve the objectives of the Climate Action Plan the administration will need to take ambitious steps using all the tools at its disposal under current law to reduce carbon dioxide, methane and HFC pollution from major sources. The World Resources Institute (WRI) has identified a "go-getter" scenario in which the administration pursues reductions with the "highest ambition achievable without new congressional action."[6] WRI's analysis shows that meeting the 17% economy-wide emission reduction target will require significant cuts from the largest sources of heat-trapping pollution, particularly: carbon dioxide from power plants, methane from natural gas and oil extraction, and the use of hydrofluourocarbons (HFCs) in industrial and consumer applications. Further carbon dioxide emission reductions from the transportation sector, where the Obama Administration has already made important progress, will also play a role in reaching the 17% reduction goal.

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[5] The President's Climate Action Plan, June 2013, available at: http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.

[6] Nicholas Bianco, Franz Litz, Kristin Meek, and Rebecca Gasper. Can The U.S. Get There From Here?, published by the World Resources Institute, February 2013, available at: http://www.wri.org/publication/can-us-get-there-here.

Carbon Dioxide Emissions from Power Plants. Power plants in the United States release about 2.2 billion tons of carbon pollution each year.[7] This accounts for 40% of the nation's total carbon footprint, more than any other industry. Currently, power plants operate under federal limits on how much arsenic, mercury and soot they can release, but there are no national limits on dangerous carbon pollution. That's wrong and it needs to change.

The U.S. Supreme Court ruled in 2007[8] and again in 2011 that the Clean Air Act authorizes EPA to set sensible safeguards for carbon dioxide and other greenhouse gas pollutants to protect public health and welfare.[9] Following the law and the president's directive, EPA took an important step forward to carry out the Climate Action Plan when Administrator Gina McCarthy announced EPA's proposal under the Clean Air Act to set federal limits on carbon pollution from future power plants in September last year. That proposal is now open for public comment, following its publication in the Federal Register last week.

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[7] U.S. Energy Information Administration.

[8] *Massachusetts v. EPA*, 549 U.S. 497 (2007). *Massachusetts* directly concerned carbon pollution from motor vehicles. In a companion case stemming out of a 2006 EPA decision refusing to issue standards for CO2 from power plants, the U.S. Court of Appeals for the District of Columbia Circuit directed EPA to take action on power plants in light of the *Massachusetts* decision. *State of New York et al. v. EPA*, No. 06-1322 (Order, Sept. 24, 2007). In 2011 the parties reached a settlement agreement in the *New York* case with a schedule for EPA to act on CO2 standards for both new and existing power plants. www.epa.gov/airquality/cps/settlement.html.

[9] In 2011 the Supreme Court confirmed EPA's responsibility to address carbon pollution from power plants under Section 111 in another climate change case, *American Electric Power vs. Connecticut*, 131 S.Ct. 2527 (2011).

In setting carbon pollution standards, EPA is continuing to do the job of protecting public health and welfare for which it was created more than 40 years ago by a bipartisan Congress. EPA's proposal signals that the era of unlimited carbon pollution is drawing to a close. The proposed standards for new coal plants are based on carbon capture and storage (CCS) technology that is now available and ready for use. EPA has proposed a standard that a system of partial carbon capture can easily achieve. Contrary to claims by naysayers, EPA has a wealth of data showing that CCS has been adequately demonstrated by experience in a variety of applications, including the Boundary Dam plant in Canada, which is designed to outperform the standard. The Kemper plant under construction in Georgia would also meet EPA's proposed standard, providing corroboration of its feasibility.

Electricity from new coal plants—with or without CCS—is considerably more expensive than energy efficiency or electricity supplied by new wind or natural gas combined cycle (NGCC) power plants. As a result, other than completion of a few plants already under construction, neither government nor industry forecasts anticipate construction of any new coal plants in the United States, whether or not carbon pollution standards are established. Nevertheless, EPA notes that there may be a few instances where despite these basic economics companies choose to build something other than the lowest-cost options. In that case, EPA estimates that the cost of power from a coal plant equipped with partial CCS would range from $92 to $110 per Megawatt-hour (MWh), which is comparable to the range for other non-NGCC baseload options of $80 to $130 per MWh. Thus, EPA concluded that the costs of CCS are consistent with the costs of other low-carbon baseload options, and that requiring any new coal

plants to meet the standard would not result in significant increases in electricity prices for consumers.[10]

EPA has also announced a schedule for development of guidelines to control carbon pollution from existing power plants, in cooperation with state clean air officials. EPA is conducting an extensive outreach process to provide ample opportunity for all voices to make their views known, ensuring that EPA considers perspectives from the full range of stakeholders. There will be a further opportunity for everyone to comment on EPA's proposed guidelines after they are proposed this June.

NRDC has proposed one option for how such standards could be designed and NRDC's analysis of this approach, using the same power sector model employed by EPA and many power companies, demonstrates that it is feasible to achieve significant emission reductions in carbon dioxide pollution from power plants with benefits for Americans that would far outweigh the modest costs of compliance. In its updated analysis of this proposal, NRDC demonstrated that by implementing guidelines that would permit compliance using a range of power system resources, states could reduce power sector carbon pollution by 23 to 30 percent from 2012 levels in 2020, with net benefits of $30 to $55 billion.[11]

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[10] EPA, Regulatory Impact Analysis: Proposed Standards of Performance for GHG Emissions for New EGUs – Sept 20, 2013, available here: http://www2.epa.gov/sites/production/files/2013-09/documents/20130920proposalria.pdf.

[11] Dan Lashof, Even Bigger Reductions, Even Lower Costs, available at: http://switchboard.nrdc.org/blogs/dlashof/even_bigger_carbon_reductions.html, and NRDC preliminary results of updated analysis. *See* http://switchboard.nrdc.org/blogs/dlashof/NRDC%20Carbon%20Pollution%20Standards%20UPDATED%20ANALYSIS%20BPC%20Workshop%20Dec%202013%20Rev1.pdf.

It is critical that EPA carry out its responsibilities under the Clean Air Act and the Supreme Court's two climate change decisions. NRDC strongly opposes any efforts to repeal its Clean Air Act authority to set standards for carbon pollution, a view shared by two-thirds of registered voters nationwide according to a poll conducted by Hart Research and Chesapeake Beach Consulting in July, 2013.[12] Most recently, Chairman Whitfield and Senator Manchin have introduced a bill that would repeal EPA's authority to carry out carbon pollution standards for existing power plants and would allow the power sector to dictate the standards that could be adopted for new coal plants. This legislation would harm Americans by allowing unlimited excess carbon pollution from power plants for decades; pollution that would stay in the air for centuries, disrupting the climate we depend on to thrive as a modern civilization. Ironically, the legislation would not improve the lot of coal producers or communities in coal country. Rather, it would destroy the interest of U.S. power companies in seriously considering carbon capture and storage systems -- the one technology that could provide a pathway for more sustainable use of coal. The Senate should reject any legislation that would weaken the Clean Air Act or prevent EPA from carrying out the president's Climate Action Plan.

Another poorly-considered effort to block EPA from doing its job is the argument, set forth in a letter from four members of the House of Representatives, that the Energy Policy Act of 2005 prevents EPA from setting standards based on CCS because several CCS coal projects received government funding. This is an incorrect interpretation of the language, and EPA's proposal is in full compliance with the EPAct provision. The 2005 EPAct says that EPA cannot

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[12] Hart Research Associates and Chesapeake Beach Consulting, Key Findings From Survey on Carbon Pollution and Climate Change, July 15, 2013. Available at http://docs.nrdc.org/air/files/air_13071801a.pdf

determine that a technology is adequately demonstrated under the Clean Air Act "solely" because the technology was used at projects that have received some government funding. What that means is that if a government-funded project is the *only* evidence EPA has that a technology is viable, EPA cannot set a standard based just on those projects. EPA's conclusion that CCS is adequately demonstrated is based on a number of factors, including the following:

- Experience with large-scale industrial carbon capture going back to the 1930s and large-scale experience with transporting and injecting carbon going back to the 1970s;
- Studies by DOE and others demonstrating that the technologies are fully applicable to the power sector; and
- Several projects that are now moving forward that include the use of CCS.[13]

The fact that some projects have been supported by government funding does not undermine EPA's assessment that the industry has confidence this technology will work in real-world plants, and does nothing to weaken the grounds upon which EPA developed its proposed standard. As these projects go online, they will provide corroboration of the soundness of EPA's "adequately demonstrated" determination, which rests on other evidence.

Methane Emissions from the Oil and Natural Gas Industry. Emissions of methane take place today in the oil and gas sector when natural gas is accidentally leaked or intentionally vented into the air. The chief component of natural gas is methane, which is a highly potent heat-trapping pollutant, at least 34 times more potent than carbon dioxide, on a pound for pound

[13] EPA, Regulatory Impact Analysis: Proposed Standards of Performance for GHG Emissions for New EGUs – Sept 20, 2013, available at: http://www2.epa.gov/sites/production/files/2013-09/documents/20130920proposalria.pdf.

basis. Moreover, natural gas is composed of a number of other harmful pollutants which threaten public health, including volatile organic compounds (VOCs) that cause ground-level smog and hazardous air pollutants (HAPs).

Emissions control technologies and associated practices to significantly limit such pollution exist today, have been tried and tested, and are being used by some oil and gas producers in the field already[14]. These are cost-effective and often profitable, and can generate value for the broader economy by reducing the waste of a valuable resource.[15] But voluntary implementation of these profitable measures has not occurred comprehensively across the industry. Hence, it is important to establish emission control standards that will help to ensure environmental and community safety, while generating economic value. The recently-established EPA New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants for the oil and gas industry[16] are an important first step in the right direction. A recent study led by researchers from the University of Texas confirms that methane emissions from the oil and gas industry are significant, but that control measures such as those required in some cases by these standards can be very effective at reducing these emissions. However, the current

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[14] Susan Harvey, Vignesh Gowrishankar and Thomas Singer, Leaking Profits: The U.S. Oil and Gas Industry Can Reduce Pollution, Conserve Resources, and Make Money by Preventing Methane Waste, published by NRDC, April 2012, available at http://www.nrdc.org/energy/leaking-profits.asp.

[15] *Id.*

[16] EPA, 40 CFR Parts 60 and 63, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews: Final Rule, Federal Register, Vol. 77, No. 159, August 16, 2012, Page 49490-49600.

standards are limited to natural gas wells and don't address methane emissions directly. Much greater emission reductions can be achieved with more comprehensive and direct regulations.

Pursuant to the Climate Action Plan, the Administration will develop an interagency methane strategy that coordinates government action to analyze emissions data, and identify, improve and implement best practices to reduce methane emissions, in collaboration with other sectors of the economy. Specifically, NRDC urges EPA to use its authority under Section 111 of the Clean Air Act to establish standards that require reductions in methane pollution from new and existing sources in the oil and gas industry. This includes establishing standards that specifically regulate methane emissions and cover (i) existing equipment, in addition to new and modified ones; (ii) all types of wells from which natural gas can be produced; and (iii) sources of methane emissions across the entire natural gas supply chain. Such standards will help protect the air we breathe, reduce global warming pollution and prevent the waste of a valuable energy commodity.

The Use and Emission of HFCs. Another key initiative of the Climate Action Plan is phasing down the production and use of HFCs both domestically and internationally. Pound for pound, HFCs are hundreds to thousands of times more efficient at trapping heat than carbon dioxide. The U.S. has already joined Mexico and Canada to propose a global HFC phase-down under the Montreal Protocol and has been party to bilateral and multilateral discussions on proposals to manage HFCs. In a breakthrough in June and September, President Obama reached important agreements with Chinese President Xi committing both countries to phasing down HFCs under the Montreal Protocol. The leaders of the G-20 agreed to similar steps on HFCs in September, and more than 110 governments have endorsed negotiating an HFC agreement.

EPA's analysis of the global benefits of phasing down HFCs shows that the opportunity is considerable—more than 90 billion tons of CO2-equivalent emissions could be avoided by 2050, equaling more than two year's current worldwide emissions of all forms of heat-trapping pollution[17]. EPA has also concluded that less climate-destructive alternatives are available and that there are reasonable phase-down trajectories that could reduce HFC consumption in the U.S. in accordance with schedules proposed during international negotiations.

The President's climate plan directs EPA to cut HFCs in the U.S. using the Clean Air Act's "significant new alternatives program" (SNAP), by identifying and approving climate-friendly chemicals while prohibiting certain uses of the most harmful HFCs. NRDC has petitioned EPA to act quickly on some of the biggest opportunities to reduce HFC use. For example, it is time for EPA to end the use of HFC-134a in new car air conditioners. HFC-134a is 1300 times more powerful in trapping heat than carbon dioxide. It can be replaced with an EPA-approved coolant called HFO-1234yf, which does 1/325th as much climate damage (its potency is just 4 times that of carbon dioxide). Similar opportunities to move to climate-friendlier alternatives exist in commercial refrigeration and a range of other consumer goods. Leadership here at home, and bilaterally with China, will bring big dividends in the Montreal Protocol negotiations.

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[17] Benefits of Addressing HFCs Under the Montreal Protocol, EPA, June 2013, available at: http://www.epa.gov/ozone/downloads/Benefits_of_Addressing_HFCs_Under_the_Montreal_Protocol_6-21-2013.pdf.

Carbon Dioxide Emissions from Vehicles. The transportation sector accounts for roughly one-third of national carbon dioxide emissions, and is the second largest emitter behind power plants. In its first term, the Obama Administration finalized clean car and fuel-efficiency standards for light-duty vehicles and the first-ever fuel-efficiency standards for heavy-duty vehicles.[18] This standard built on the success of the Administration's previous standards for cars and light-duty trucks, and will reduce carbon pollution, address climate change and strengthen the economy. Combined, the Administration's standards will cut carbon emissions from new cars and light trucks in half by 2025, reducing carbon dioxide emissions by 6 billion metric tonnes over the life of the program—more than the total amount of carbon dioxide emitted in the U.S. in 2010. Still, to reach the goal specified in the Climate Action Plan, we must continue to clean up the transportation sector with a special focus in the near term on emissions from freight trucks.

To achieve the necessary long-term reductions in carbon pollution from the transportation sector, the Administration must expand on its successes and continue the progress set in motion in the first term. Freight trucks are the fastest growing source of carbon pollution in the transportation sector. Without tighter standards, the EIA projects that on-road freight trucks will increase carbon dioxide emissions at an average rate of 1.2 percent per year between 2011 and 2040.

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[18] *See* Environmental Protection Agency and National Highway Traffic Safety Administration, "2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards", 77 FR 62624, October 15, 2012, and Environmental Protection Agency and National Highway Traffic Safety Administration, "Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles", 76 FR 57106, September 15, 2011.

Action under the President's Climate Action Plan will put heavy-duty vehicles, including freight trucks, on a cleaner road into the future, with lower fuel consumption that will save drivers money while cutting carbon pollution. The Administration is preparing to release the second phase of the heavy-duty truck fuel efficiency standards as an integral component of the Climate Action Plan. Based on analysis by the National Academies of Science,[19] known cost-effective technologies can achieve fuel consumption and carbon pollution reductions of 5 percent per year, a rate similar to that being achieved with cars and light trucks. A recent NAS report stated,

> "The fuel-saving technologies that are already available on the market generally result in increased vehicle cost, and purchasers must weigh the additional cost against the fuel savings that will accrue. In most cases, market penetration is low at this time. Most fuel saving technologies that are under development will also result in increased vehicle cost, and in some cases, the cost increases will be substantial. As a result, many technologies may struggle to achieve market acceptance, despite the sometimes substantial fuel savings, unless driven by regulation or by higher fuel prices."[20]

Under strong standards, new trucks in 2025 could consume roughly 40 percent less fuel than the average 2010 truck. With these improvements, oil consumption from the on-road U.S. trucking

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[19]National Research Council. Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles . Washington, DC: The National Academies Press, 2010.

[20] *Id.*

fleet would be cut by 1 million barrels per day in 2030, reducing CO2 emissions by about 200 million tons per year, relative to what would occur if truck technology did not improve.[21]

Conclusion. U.S. emissions of carbon dioxide and other heat-trapping pollutants have decreased significantly during the last five years as our use of energy has become more efficient and as we have shifted our energy mix toward cleaner fuels. As a result, the United States' commitment to reduce our annual contribution to global warming pollution by 17 percent by 2020 is within reach. Provided that Congress does not prevent EPA and other agencies from doing their jobs, and provided that those agencies are ambitious in implementing the President's Climate Action Plan, we can build on the progress to date and achieve this goal through cost effective standards to reduce carbon dioxide emissions from power plants and vehicles, methane emissions from oil and gas operations, and HFC emissions from the chemical and consumer products industries. Doing so will create new markets for technological ingenuity and will put the United States on track to the much deeper emission reductions needed to forestall out-of-control climate disruption and protect our health and the future our children inherit.

Thank you.

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[21] American Council for Energy-Efficient Economy (ACEEE), "Further Fuel Efficiency Gains for Heavy-Duty Vehicles", September 25, 2013. Available at http://aceee.org/fact-sheet/heavy-duty-fuel-efficiency.

STATEMENT TO THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
OF THE UNITED STATES SENATE

Hearing on
"Review of the President's Climate Action Plan"

16 January 2014

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I am Chair of the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology. I have devoted 30 years to conducting research on topics including climate of the Arctic, the role of clouds and aerosols in the climate system, and the climate dynamics of extreme weather events. As President of Climate Forecast Applications Network (CFAN) LLC, I have worked with decision makers on climate impact assessments, assessing and developing meteorological hazard and climate adaptation strategies, and developing subseasonal climate forecasting strategies to support adaptive management.

I am increasingly concerned that both the climate change problem and its solution have been vastly oversimplified.[1] My research on understanding the dynamics of uncertainty at the climate science-policy interface has led me to question whether these dynamics are operating in a manner that is healthy for either the science or the policy process.[2] I see a growing gap between what science is currently providing in terms of information about climate variability and change, and the information needed to understand and manage associated risks.

My testimony focuses on the following issues of central relevance to the President's Climate Change Program:

- Evidence reported by the IPCC AR5 weakens the case for human factors dominating climate change in the 20th and early 21st centuries.
- Climate change in the U.S. and the importance of natural variability on understanding the causes of extreme events
- Sound science to manage climate impacts requires improved understanding of natural climate variability and its impact on extreme weather events

The IPCC AR5 WGI Report – a weaker case for anthropogenic global warming

Last September, the Intergovernmental Panel on Climate Change (IPCC) released the 5th Assessment Report (AR5) from Working Group I (WGI) – The Physical Science Basis. Over the past two decades, the IPCC's reports have expressed increasingly confident consensus views of the importance of anthropogenic influence on the global climate, as reflected by these statements from the Summary for Policy Makers (SPM):

[1] Curry, JA and Webster PJ 2011: Climate science and the uncertainty monster. *Bull Amer Meteorol. Soc.,* 92, 1667-1682. http://journals.ametsoc.org/doi/pdf/10.1175/2011BAMS3139.1

[2] Judith Curry, Statement to the Subcommittee on Environment of the U.S. House of Representatives Hearing on Policy Relevant Climate Science in Context, 25 April 2013.

- AR4 (2007): "*Most of the observed increase in global average temperatures since the mid-20th century is* ***very likely*** (*>90% confidence*) *due to the observed increase in anthropogenic greenhouse gases.*" (SPM AR4)

- AR5 (2013): "*It* ***is extremely likely*** (*>95% confidence*) *that human influence has been the dominant cause of the observed warming since the mid-20th century.*" (SPM AR5)

The AR5 statement of 'extremely likely' implies that the overall arguments have strengthened. However, several key elements of the AR5 WGI report point to a weakening of the case for attributing most of the warming to human influences, relative to the previous assessment AR4 (2007):

- Lack of warming since 1998 and the growing discrepancies between observations and climate model projections
- Evidence of decreased climate sensitivity to increases in atmospheric CO_2 concentrations
- Evidence that sea level rise during 1920-1950 is of the same magnitude as in 1993-2012
- Increasing Antarctic sea ice extent

The following summarizes the key points, using the figures and text from the IPCC AR5 WG1 Report and comparing them with the AR4.

Recent hiatus in surface warming and discrepancies with climate models

The IPCC AR5 notes the lack of surface warming since 1998:

> *"[T]he rate of warming over the past 15 years (1998–2012) [is] 0.05 [–0.05 to +0.15] °C per decade which is smaller than the rate calculated since 1951 (1951–2012) [of] 0.12 [0.08 to 0.14] °C per decade."* (AR5 SPM)

The significance of this hiatus in warming since 1998 arises from comparison with climate model projections. The IPCC AR4 stated:

> *"For the next two decades, a warming of about 0.2°C per decade is projected for a range of SRES emission scenarios."* (AR4 SPM)

The fifth phase of the Coupled Model Intercomparison Project (CMIP5)[3] has produced a multi-model dataset that includes long-term simulations of twentieth-century climate and projections for the twenty-first century and beyond. CMIP5 provides the climate model simulations used in the AR5. Figure 1 summarizes the near-term projections from CMIP5 of global mean surface temperature anomalies. The observed global temperature record, particularly since 2005, are on the low end of the model envelope that contains 90% of the climate model simulations, and observations in 2011-2012 are below the 5-95% envelope of the CMIP5 simulations. Overall, the trend in the model simulations is substantially larger than the observed trend over the past 15 years.[4]

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[3] Taylor, Karl E., Ronald J. Stouffer, Gerald A. Meehl, 2012: An Overview of CMIP5 and the Experiment Design. *Bull. Amer. Meteor. Soc.*, **93**, 485–498. http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-11-00094.1

[4] A revised version of Figure 11.25 from the AR5 WG1 Report is given by Ed Hawkins http://www.climate-lab-book.ac.uk/2013/updates-to-comparison-of-cmip5-models-observations/, which also includes the new surface temperature climatology by Cowtan and Way (2013) *Roy. Meteorol. Soc.* http://onlinelibrary.wiley.com/doi/10.1002/qj.2297/abstract. It is seen that this new climatology is slightly warmer, but does not significantly change the climate model discrepancies with observations

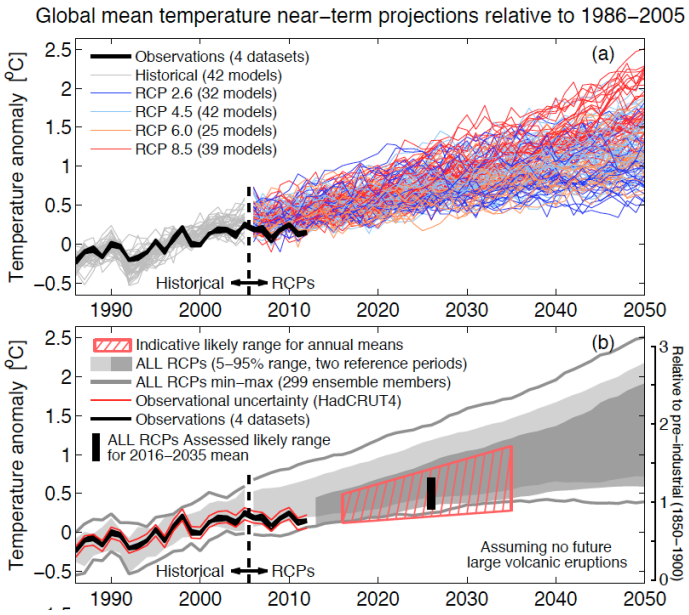

Figure 1. Comparison the global average surface temperatures from the surface temperature data sets with the CMIP5 simulations. The red-hatched region shows the likely range for annual mean global surface teperature during the period 2016–2035 based on expert judgment. From Figure 11.25 (IPCC AR5 WG1).

Regarding projections for the period 2012-2035, the CMIP5 5-95% trend range is 0.11°C–0.41°C per decade. The IPCC then cites 'expert judgment' as the rationale for lowering the projections (indicated by the red hatching):

> *"However, the implied rates of warming over the period from 1986–2005 to 2016–2035 are lower as a result of the hiatus: 0.10°C–0.23°C per decade, suggesting the AR4 assessment was near the upper end of current expectations for this specific time interval."* (AR5 Chapter 11)

This lowering of the projections (and decreasing the trend) relative to the results from the raw CMIP5 model simulations was done based on expert judgment that some models are too sensitive to anthropogenic forcing.

While the near term projections were lowered relative to the CMIP5 simulations, the AR5 states with regards to extended-range warming:

> *"Increase of global mean surface temperatures for 2081–2100 relative to 1986–2005 is projected to likely be in the ranges derived from the concentration driven CMIP5 model simulations."* (AR5 Chapter 12)

In Table SPM.2, which provides a summary of the CMIP5 simulations for the different emission scenarios for the periods 2046-2065 and 2081-2100, a note in the caption states:

> *"The likely ranges for 2046−2065 do not take into account the possible influence of factors that lead to the assessed range for near-term (2016−2035) global mean surface temperature change that is lower than the 5−95% model range, because the influence of these factors on longer term projections has not been quantified due to insufficient scientific understanding."* (AR5 SPM)

This statement acknowledges that there is an uncertainty and possible bias leading to high values that has not been taken into account due to lack of understanding. Although this statement is made explicitly only for the period 2046-2065, the issue is also not accounted for in the later period. This kind of *insufficient scientific understanding* is not a good basis for high confidence in the climate model simulations and projections.

Regarding the current hiatus, the IPCC concludes that:

> *". . . the hiatus is attributable, in roughly equal measure, to a decline in the rate of increase in effective radiative forcing (ERF) and a cooling contribution from internal variability (expert judgment, medium confidence). The decline in the rate of increase in ERF is primarily attributed to natural (solar and volcanic) forcing but there is low confidence in quantifying the role of forcing trend in causing the hiatus, because of uncertainty in the magnitude of the volcanic forcing trend and low confidence in the aerosol forcing trend."* (AR5 Chapter 11)

In summary:

- After expecting a global mean surface temperature increase of 0.2^{o}C per decade in the early decades of the 21st century based on climate model simulations and statements in the AR4, the warming over the past 15 years is only ~0.05^{o}C.
- The IPCC AR5 bases its surface temperature projection of 0.10 to 0.23^{o}C per decade for the period 2016-2036 on expert judgment, which is lowered relative to the climate model results that predict substantially greater warming
- The IPCC does not have a convincing or confident explanation for the current hiatus in warming.

Sensitivity of climate to doubled CO2 concentrations

The equilibrium climate sensitivity (ECS) is defined as the change in global mean surface temperature at equilibrium that is caused by a doubling of the atmospheric CO_2 concentration. The IPCC AR4 conclusion on climate sensitivity is stated as:

> *"The equilibrium climate sensitivity. . . is likely to be in the range 2°C to 4.5^{o}C with a best estimate of about 3°C and is very unlikely to be less than 1.5^{o}C. Values higher than 4.5^{o}C cannot be excluded."* (AR4 SPM)

The IPCC AR5 conclusion on climate sensitivity is stated as:

> *Equilibrium climate sensitivity is likely in the range 1.5°C to 4.5°C (high confidence), extremely unlikely less than 1°C (high confidence), and very unlikely greater than 6°C (medium confidence)* (AR5 SPM)

The bottom of the 'likely' range has been lowered from 2 to 1.5^{o}C in the AR5, whereas the AR4 stated that ECS is very unlikely to be less than 1.5^{o}C. It is also significant that the AR5 does not cite a best estimate, whereas the AR4 cites a best estimate of 3°C. Further the AR5 finds values of ECS exceeding 6°C to be very unlikely, whereas the AR4 did not have sufficient confidence to identify an upper bound at this confidence level. The stated reason for not citing a best estimate in the AR5 is the substantial discrepancy between observation-based estimates of ECS (lower), versus estimates from climate models (higher). Figure 1 of Box 12.2 in the AR5 WG1 report shows that 11 out of 19 observational-based studies of ECS have values below 1.5^{o}C in the range of their ECS probability distribution.

Hence the AR5 reflects greater uncertainty and a tendency towards lower values of the ECS than the AR4. The discrepancy between observational and climate model-based estimates of climate sensitivity is substantial and of significant importance to policymakers -- sensitivity, and the level of uncertainty in its value, is a key input into the economic models that drive cost-benefit analyses and estimates of the social cost of carbon.

Sea level rise

In the AR5 SPM, the following statements are made regarding sea level rise:

> *"It is very likely that the mean rate of global averaged sea level rise was 1.7 [1.5 to 1.9] mm yr^{-1} between 1901 and 2010, 2.0 [1.7 to 2.3] mm yr^{-1} between 1971 and 2010 and 3.2 [2.8 to 3.6] mm yr^{-1} between 1993 and 2010.* ***It is likely that similarly high rates occurred between 1920 and 1950."*** (AR5 SPM)

> *"It is* ***very likely*** *that there is a substantial contribution from anthropogenic forcings to the global mean sea level rise since the 1970s."* (AR5 SPM)

The rate of global mean sea level as portrayed in AR5 is shown in Figure 2 below.

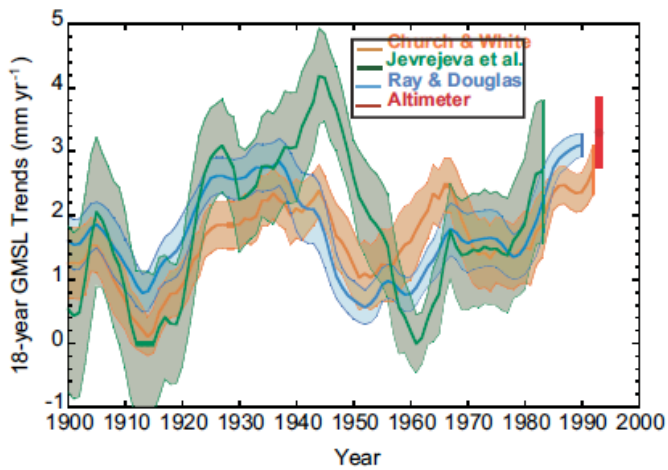

Figure 2. 18-year trends of global mean sea level rise estimated at 1-year intervals. The time is the start date of the 18-year period, and the shading represents the 90% confidence. The estimate from satellite altimetry is also given, with the 90% confidence given as an error bar. [AR5 WGI Figure 3.14]

In AR5 SPM there are significant changes relative to the AR4 WG1 SPM concerning the estimated contributions to sea level rise from different sources:

Table 1: Contributions to sea level rise from different sources (mm per year)

	AR4 (1993-2003)	AR5 (1993-2010)
Thermal expansion	1.6	1.1
Glaciers and ice caps	0.77	0.76
Greenland ice sheet	0.21	0.33
Antarctic ice sheet	0.21	0.27
Land water storage	---	0.38
Sum	0.28	0.28
Observed sea level rise	3.1	3.2

Thermal expansion is one third smaller in AR5 and land water storage with a substantial amount is completely new in AR5, while the sum of these sources remained constant. With regards to land water storage, a recent paper[5] estimated that the human impacts, particularly unsustainable ground water use, have contributed a sea-level rise of about 0.77 mm yr^{-1} between 1961 and 2003, which is twice as large as the estimate used in the AR5.

Global sea level has been rising for the past several thousand years. The key issue is whether the rate of sea level rise is accelerating owing to anthropogenic global warming. It is seen that the rate of rise during 1930-1950 was comparable to, if not larger than, the value in recent years. Hence the data does not seem to support the IPCC's conclusion of a substantial contribution from anthropogenic forcings to the global mean sea level rise since the 1970s. Further, the growing realization of the importance of land water storage to sea level rise is diminishing the percentage of sea level rise that is associated with warming. Better understanding of natural versus anthropogenic components of sea level rise and the impacts of land use (especially groundwater depletion) on sea level rise is needed to effectively evaluate policy responses to sea level rise.

Sea ice

The IPCC AR5 reports the following trends in sea ice:

> *"Continuing the trends reported in AR4, the annual Arctic sea ice extent* ***decreased*** *over the period 1979–2012: the rate of this decrease was very likely between 3.5 and 4.1% per decade* (AR5 SPM)
>
> *"It is very likely that the annual Antarctic sea ice extent* ***increased*** *at a rate of between 1.2 and 1.8% per decade between 1979 and 2012.* (AR5 SPM)

AR5 Chapter 10 states:

> *"Anthropogenic forcings are very likely to have contributed to Arctic sea ice loss since 1979. There is low confidence in the scientific understanding of the observed increase in Antarctic sea ice extent since 1979, due to the incomplete and competing scientific explanations for the causes of change and low confidence in estimates of internal variability."* (AR5 Chapter 10)
>
> *"Arctic temperature anomalies in the 1930s were apparently as large as those in the 1990s and 2000s. There is still considerable discussion of the ultimate causes of the warm temperature anomalies that occurred in the Arctic in the 1920s and 1930s."* (AR5 Chapter 10)

The increase in Antarctic sea ice is not understood and is not simulated correctly by climate models. Further, Arctic surface temperature anomalies in the 1930's were as large as the recent temperature anomalies. Notwithstanding the simulations by climate models that reproduce the decline in Arctic sea ice, more convincing arguments regarding causes of sea ice variations requires understanding and ability to simulate sea ice variations in *both* hemispheres.

A key issue in understanding the recent decline in Arctic sea ice extent is to understand to what extent the decline is caused by anthropogenic warming versus natural climate variability.

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[5] Pokhrel et al. 2013: Model estimates of sea-level change due to anthropogenic impacts on terrestrial water storage. *Nature Geoscience.* http://www.nature.com/ngeo/journal/v5/n6/full/ngeo1476.html

Analysis[6] of the CMIP3 and CMIP5 simulations found that about 41% of the recent sea ice decline could be attributed to anthropogenic warming from the CMIP3 models, and about 60% from the CMIP5 models. A recent paper seeks to interpret the multi-decadal natural variability component of the Arctic sea ice in context of a 'stadium wave'.[7] This paper suggests that a transition to recovery of the natural variability component of the sea ice extent has begun in the Eurasian Arctic sector, and that the recovery will reach its maximum extent circa 2040.

Summary

Multiple lines of evidence presented in the IPCC AR5 WG1 report suggest that the case for anthropogenic warming is weaker than the previous assessment AR4 in 2007. Anthropogenic global warming is a proposed theory whose basic mechanism is well understood, but whose magnitude is highly uncertain. The growing evidence that climate models are too sensitive to CO_2 has implications for the attribution of late 20th century warming and projections of 21st century climate.

If the recent warming hiatus is caused by natural variability, then this raises the question as to what extent the warming between 1975 and 2000 can also be explained by natural climate variability.

The stadium wave hypothesis[8] predicts that the warming hiatus could extend to the 2030's. Based upon climate model projections, the probability of the hiatus extending beyond 20 years is vanishing small. If the hiatus does extend beyond 20 years, then a very substantial reconsideration will be needed of the 20th century attribution and the 21st century projections of climate change.

Climate change in the U.S.

The prospect of increased frequency and severity of extreme weather in a warmer climate is proposed as potentially the most serious near term impact of climate change. Metaphors such as climate change 'loading the dice' for severe weather or causing 'weather on steroids' are frequently used to communicate an elevated probability of extreme weather events as a result of human-caused climate change. Because of their large socioeconomic impacts, weather catastrophes act as focusing events for the public in the politics surrounding the climate change debate. The perception that humans are causing an increase in extreme weather events is a primary motivation for the President's Climate Change Plan:

> *". . . climate change is no longer a distant threat – we are already feeling its impacts across the country and the world. Last year was the warmest year ever in the contiguous United States and about one-third of all Americans experienced 10 days or more of 100-degree heat. The 12 hottest years on record have all come in the last 15 years. . . And increasing floods, heat waves, and droughts have put farmers out of business, which is already raising food prices dramatically."*

In 2012, the IPCC published a *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (SREX)[8]. The following draws from the SREX, the IPCC AR5 WG1 report, and climatic data for the U.S. provided by NOAA and the Berkeley Earth Surface Temperature project.

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[6] Stroeve, J. et al. 2012: Trends in Arctic sea ice extent from CMIP3, CMIP5 and observations. Geophys. Res. Lett., 39, L16502

[7] Wyatt, MG and JA Curry, 2013: Role for Eurasian Arctic shelf sea ice in a secularly varying hemispheric climate signal during the 20th century. Climate Dynamics, http://curryja.files.wordpress.com/2013/10/stadium-wave1.pdf

[8] https://ipcc-wg2.gov/SREX/

U.S. surface temperatures

Figure 3 shows the latest analysis of annual surface temperature anomalies for the continental U.S. since 1850, from Berkeley Earth Surface Temperature Project. The year 2012 was the warmest year on record for the U.S., followed by 2006, 1998, and 1934. Globally, 2012 ranked as the 8th or 9th warmest year, with Argentina also recording its warmest year. It is seen that the annual average temperature for 2013 was relatively cool, and ranked only as the 42nd warmest year for the continental U.S.

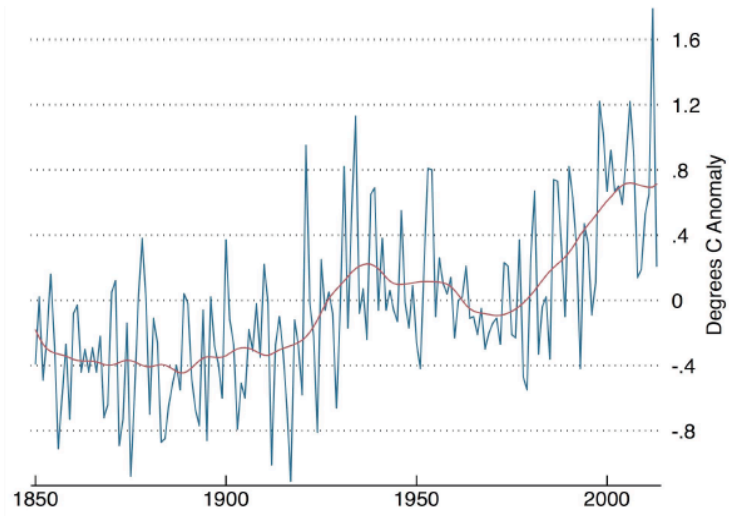

Figure 3. Annual average surface temperature anomalies for the continental U.S. since 1850. Data and plot from the Berkeley Earth Surface Temperature Project.

Summer heat extremes

Figure 4 shows the number of daily record high summertime daily maximum temperatures (T_{max}) and minimum temperatures (T_{min}) for the continental U.S. since 1895. The number of daily record T_{max} shows no trend, with a strong maximum during the 1930's. The number of daily record T_{min} also shows a maximum in the 1930's, but also shows an overall increasing trend since the 1970's.

The EPA also cites evidence that summertime heat waves were frequent and widespread in the 1930s, and these remain the most severe heat waves in the U.S. historical record.[9] Overall, any evidence of an anthropogenic effect (greenhouse gases, aerosols, land use) on summertime record high temperatures is more likely to be seen in T_{min} than in T_{max}.

[9] http://www.epa.gov/climatechange/images/indicator_figures/high-low-temp-figure1-2013.gif

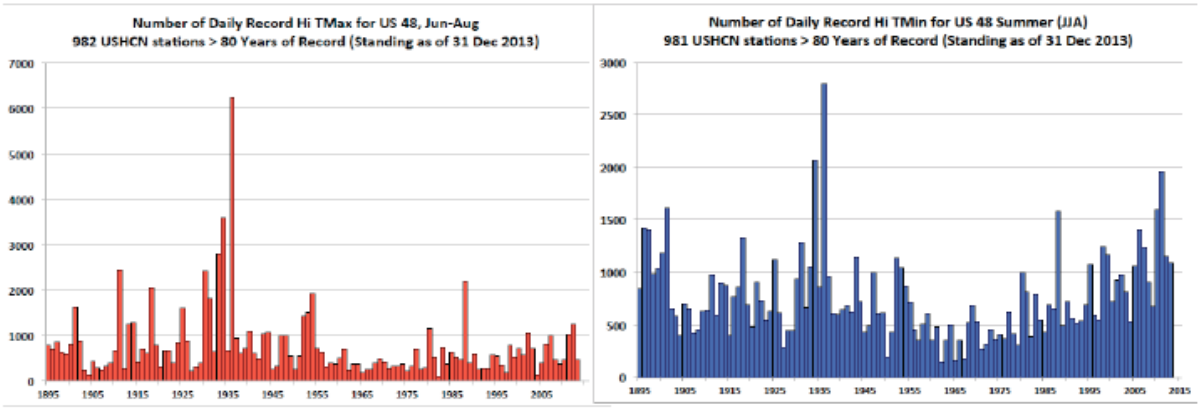

Figure 4. Number of daily record high T_{max} (red; left) and T_{min} (blue; right) for the summer season (Jun-Aug) for the continental U.S. Data obtained from 981 USHCN stations with surface temperature records exceeding 80 years and standing as of 12/31/13. Figure courtesy of John Christy, University of Alabama Huntsville.

Winter cold extremes

Figure 5 shows the number of daily record wintertime maximum (T_{max}) and minimum (T_{min}) temperatures for the continental U.S. since 1895. A declining trend in wintertime T_{min} records is seen, with very few records for the period 1997-2013. The wintertime T_{max} records do not show any particular trend, with a cluster of records during the 1930's and the 1980's standing out years with the largest number of wintertime T_{max} records.

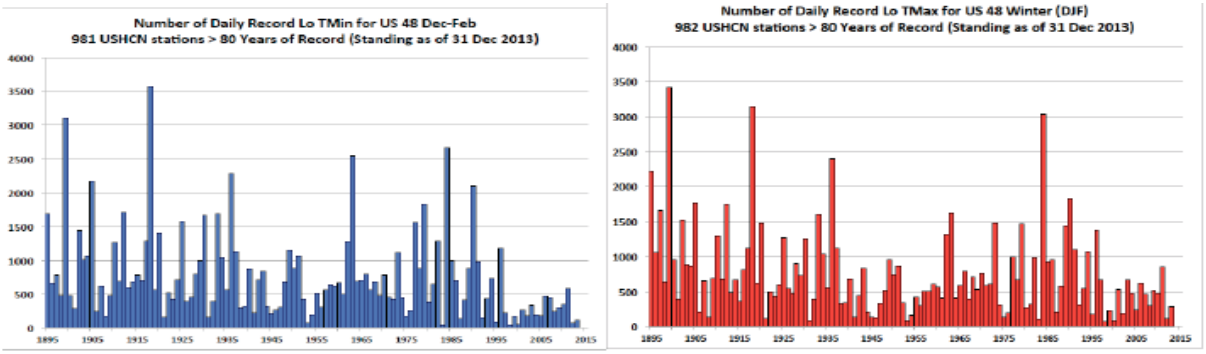

Figure 5. Number of daily record low T_{min} (top) and T_{max} (bottom) for the winter season (Dec-Feb) for the continental U.S. Data obtained from 981 USHCN stations with surface temperature records exceeding 80 years, and standing as of 12/31/13. Figure courtesy of John Christy, University of Alabama Huntsville.

Last week, the central and eastern U.S. was in the midst of a major cold wave, with large regions dropping below 0°F and wind chills reaching below -30°F. On one hand, some have stated that such cold is clear evidence that global warming is nonsense. On the other, some have argued that the cold wave is another example of extreme weather forced by increased greenhouse gases. Neither statement is supported by the evidence. There is nothing in Figure 5 to suggest that extreme cold air outbreaks (as reflected in record temperatures) are becoming more frequent in the U.S. With regards to the polar vortex, such circulation patterns are not uncommon. Analogues for a similar pattern and associated major wintertime cold air outbreak occurred in 1977, 1978, 1985, 1993 and 1994.[10]

[10] personal communication, Joe Bastardi of WeatherBell

Precipitation

Extremes in precipitation (drought and heavy rainfall events) are shown in Figure 6. These data reflect NOAA's Climate Extreme Index, which is calculated as the percentage of the U.S. being falling in the upper or lower tenth percentile of the local period of record. Drought is represented by the Palmer Drought Severity Index (PDSI) and heavy rainfall events are characterized from extremes in 1-day precipitation.

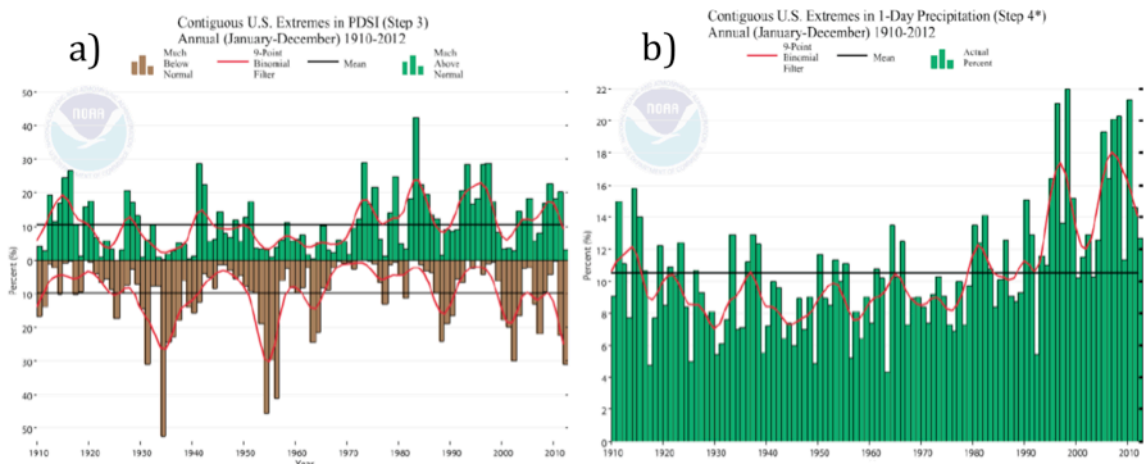

Figure 6. Annual frequency (%) of extremes in a) the Palmer Drought Severity Index; and b) extremes in 1-day precipitation. Figures obtained from the NOAA NCDC Climate Extremes Index
a) http://www.ncdc.noaa.gov/extremes/cei/graph/3/01-12 b) http://www.ncdc.noaa.gov/extremes/cei/graph/4/01-12

Figure 6a shows that the most extreme droughts were observed in the 1930's and 1950's. The largest positive extremes (wet) are seen since the 1980's. Figure 6b shows the historical distribution of extremes in 1-day rainfall rates. The highest values are clustered in the period since the 1990. It is unclear whether an increase in flooding can be attributed to the increase in extreme rainfall rates owing to the confounding factors of land use change and urbanization. Combined, Figures 6a and 6b present a picture of increasing precipitation and decreasing frequency of extreme drought.

Sea level rise

As cited above, the IPCC AR5 finds a mean global sea level rise of 3.2 [2.8 to 3.6] mm yr^{-1} between 1993 and 2010, and states that there is very likely a substantial contribution from anthropogenic forcings since the 1970s. In many locations, local factors dominate the sea level variations: rising or subsidence from geologic processes, coastal engineering projects, and human impacts on terrestrial water storage including reservoir operation, ground water use and irrigation.

Figure 7 shows local trends in sea level for the U.S. coast. The predominant arrow color is green (0-3 mm/yr), which is nominally below mean global sea level rise. In Florida, sea level is rising at a rate of only 0.75 to 2.4 mm/yr. By contrast, Louisiana sea level rise exceeds 9 mm/yr. The Mid Atlantic coast has sea level rises ranging from 2.5 to 6 mm/yr. Along the coast of the Gulf of Alaska, sea level is *decreasing* at rates exceeding -10 mm/yr.

Many locations have a rate of sea level rise that differs significantly from the global average value. This occurs owing to the dominance of local factors (geologic and/or land use) on sea level rise. Projected rates of sea level rise for the period 2081-2100 depend on emission scenarios, and range

from 3 to 15 mm/yr, with most scenarios projecting a substantial acceleration over the current rate. Sea level rise projections using climate models may be too high owing to biases in sensitivity to greenhouse gases, and projections based on semi-empirical models may be too high owing to insufficient consideration given to land water storage. Assessing vulnerability of individual locations to anthropogenically-induced sea level rise also needs to account for local factors (e.g. geologic and land use) driving sea level rise as well as natural variability in sea level rise.

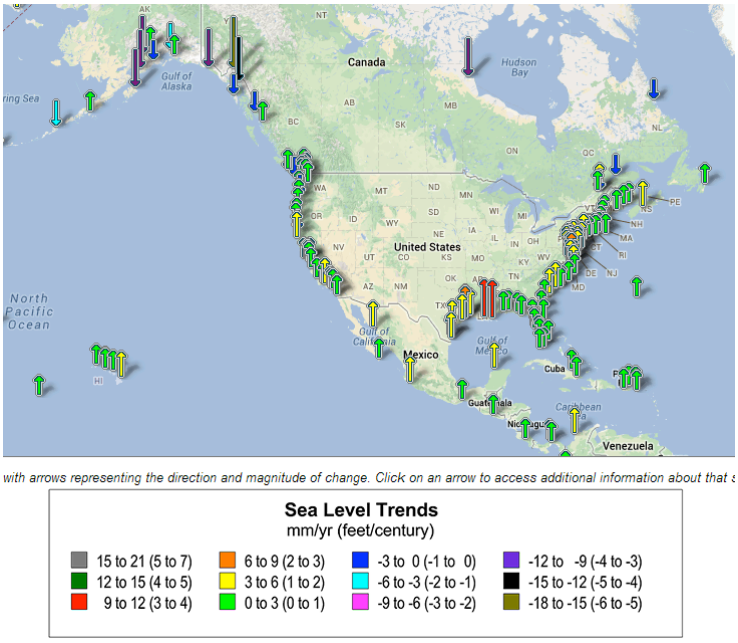

Figure 7. Local trends in sea level determined from tide stations, with arrows representing the direction and magnitude of the change. http://tidesandcurrents.noaa.gov/sltrends/

Summary

With regards to the impacts of climate change on the continental U.S., the following trends are seen over the past century are seen:

- declining frequency of wintertime cold extremes
- declining frequency of drought
- increasing frequency of heavy rain events
- increasing sea level rise that is dominated by local factors in many locations

There is a large component of natural variability seen in the 100+ year data record particularly for drought and heat waves, each of which had maximum extremes during the 1930's. Sea level rise also shows a maxima during the 1930's to 1940's.

There is a widespread perception that extreme weather events are worsening, as reflected by this statement from President Obama's State of the Union address:

"Heat waves, droughts, wildfires, and floods – all are now more frequent and intense. We can choose to believe that Superstorm Sandy, and the most severe drought in decades, and the worst wildfires some states have ever seen were all just a freak coincidence. Or we can choose to believe in the overwhelming judgment of science – and act before it's too late."[11]

In the U.S., most types of weather extremes were worse in the 1930's and even in the 1950's than in the current climate, while the weather was overall more benign in the 1970's. This sense that extreme weather events are now more frequent and intense is symptomatic of 'weather amnesia' prior to 1970. The extremes of the 1930's and 1950's are not attributable to greenhouse warming and are associated with natural climate variability (and in the case of the dustbowl drought and heat waves, also to land use practices).

There is no *a priori* scientific reason to prefer the climate of the 1930's, the 1970's, the current climate, or a climate that is 1-2°C warmer than present. Which climate is preferable from a socioeconomic perspective:

- the current warmer climate with fewer extreme cold air outbreaks versus the climate of the 1970's with fewer heat waves?
- the current climate with fewer severe droughts and more frequent heavier rainfall, versus prior periods with overall less rainfall?
- the present climate, or a future climate that is 1-2°C warmer with overall more rainfall and less frequent drought, fewer extreme cold events but more frequent heat waves?

The preference undoubtedly varies regionally. The key issues are the adaptive capacity of societies, and the unresolved moral dilemma of how to balance obligations towards future generations against obligations to the current generation, which underlies economic debates around the discount rate.

Sound science in support of good judgment

The premise of President Obama's Climate Action Plan is that there is an overwhelming judgment of science that anthropogenic global warming is already producing devastating impacts, which is summarized by this statement from the President's Second Inaugural Address:

Some may still deny the overwhelming judgment of science, but none can avoid the devastating impact of raging fires and crippling drought and more powerful storms.

This premise is not strongly supported by the scientific evidence:

- the science of climate change is not settled, and evidence reported by the IPCC AR5 weakens the case for human factors dominating climate change in the 20th and early 21st centuries
- with the 15+ year hiatus in global warming, there is growing appreciation for the importance of natural climate variability
- the IPCC AR5 and SREX find little evidence that supports an increase in most extreme weather events that can be attributed to humans, and weather extremes in the U.S. were generally worse in the 1930's and 1950's than in recent decades.

Not only is more research needed to clarify the sensitivity of climate to carbon dioxide and understand the limitations of climate models, but more research is needed on solar variability, sun-climate connections, natural internal climate variability and the climate dynamics of extreme weather events. Improved understanding of these aspects of climate variability and change is needed to help

[11] http://www.whitehouse.gov/state-of-the-union-2013

government officials, communities, and businesses better understand and manage the risks associated with climate change.

Nevertheless, the premise of dangerous anthropogenic climate change is the foundation for a far-reaching plan to reduce greenhouse gas emissions and reduce vulnerability to extreme weather events. Elements of this Plan may be argued as important for associated energy policy reasons, economics, and/or public health and safety. However, claiming an overwhelming scientific justification for the Plan based upon anthropogenic global warming does a disservice both to climate science and to the policy process.

Motivated by the precautionary principle to avoid dangerous anthropogenic climate change, attempts to modify the climate through reducing CO_2 emissions may turn out to be futile. The stagnation in greenhouse warming observed over the past 15+ years demonstrates that CO_2 is not a control knob on climate variability on decadal time scales. Even if CO_2 mitigation strategies are successful and climate model projections are correct, an impact on the climate would not be expected for a number of decades owing to the long lifetime of CO_2 in the atmosphere and thermal inertia driven by the ocean (AR5 WG1 FAQ 12.3); solar variability, volcanic eruptions and natural internal climate variability will continue to be sources of unpredictable climate surprises.

Specifically with regards to most extreme weather events, their frequency and intensity is heavily influenced by natural internal variability. Whether or not anthropogenic climate change is exacerbating extreme weather events, vulnerability to extreme weather events will continue owing to increasing population and wealth in vulnerable regions. Climate change (regardless of whether the primary cause is natural or anthropogenic) may be less important in driving vulnerability in most regions than increasing population, land use practices, and ecosystem degradation. Regions that find solutions to current problems of climate variability and extreme weather events and address challenges associated with an increasing population are likely to be well prepared to cope with any additional stresses from climate change.

Short Biography

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Dr. Judith Curry is Professor and Chair of the School of Earth and Atmospheric Sciences at the Georgia Institute of Technology and President of Climate Forecast Applications Network (CFAN). Dr. Curry received a Ph.D. in atmospheric science from the University of Chicago in 1982. Prior to joining the faculty at Georgia Tech, she held faculty positions at the University of Colorado, Penn State University and Purdue University. Dr. Curry's research interests span a variety of topics in climate; current interests include air/sea interactions, climate feedback processes associated with clouds and sea ice, and the climate dynamics of hurricanes. She has published over 190 journal articles and is author of the books *Thermodynamics of Atmospheres and Oceans* and *Thermodynamics*, *Kinetics and Microphysics of Clouds.* She is also Editor of the *Encyclopedia of Atmospheric Sciences*. She is a prominent public spokesperson on issues associated with the integrity of climate research, and is proprietor of the weblog Climate Etc. judithcurry.com. Dr. Curry currently serves on the DOE Biological and Environmental Research Advisory Committee, and has recently served on the NASA Advisory Council Earth Science Subcommittee, National Academies Climate Research Committee and the Space Studies Board and the NOAA Climate Working Group. Dr. Curry is a Fellow of the American Meteorological Society, the American Association for the Advancement of Science, and the American Geophysical Union.

Financial declaration

Funding sources for Curry's research have included NSF, NASA, NOAA, DOD and DOE. Recent contracts for CFAN include a DOE contract to develop extended range regional wind power forecasts and a DOD contract to predict extreme events associated with climate variability/change having implications for regional stability. CFAN contracts with private sector and other non-governmental organizations include energy and power companies, reinsurance companies, other weather service providers, NGOs and development banks. Specifically with regards to the energy and power companies, these contracts are for medium-range (days to weeks) forecasts of hurricane activity and landfall impacts. CFAN has one contract with an energy company that also includes medium-range forecasts of energy demand (temperature), hydropower generation, and wind power generation. CFAN has not received any funds from energy companies related to climate change or any topic related to this testimony.

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For more information:

http://curry.eas.gatech.edu/
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http://judithcurry.com

Review of the President's Climate Action Plan

Testimony
Before the

Committee on Environment and Public Works
U.S. Senate

Washington, D.C.
January 16, 2014

By

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Armstrong Center for Energy and the Environment
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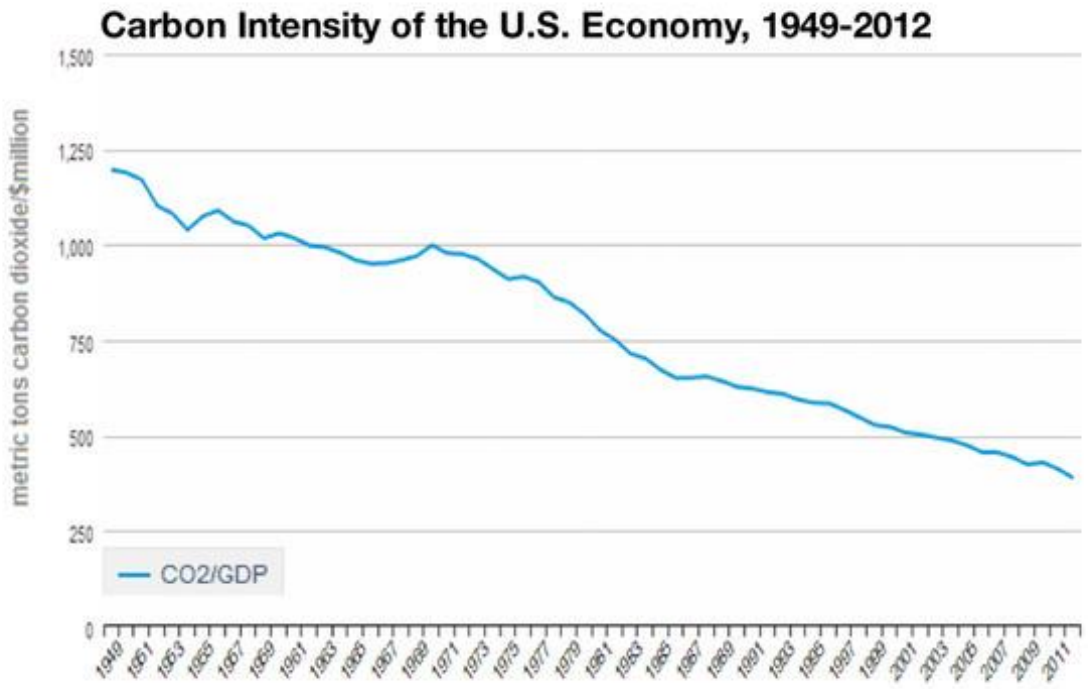
Chairman, Texas Commission on Environmental Quality
(2001-2007)

Introduction

Thank you, Chairman Boxer, Ranking Member Vitter, and fellow members of this committee for the privilege of testifying before the U.S. Senate's Environment and Public Works Committee. I am particularly grateful to offer my perspective as the former head of the state agency known as the Texas Commission of Environmental Quality (TCEQ), the second largest environmental agency in the world after the U.S. EPA.

The overwhelming majority of TCEQ's work is the actual implementation and enforcement of federal environmental regulation. Implementation of federal regulation in a state agency allows close observation of the actual -not estimated- impacts and relative effectiveness of federal policies in the towns, businesses, families and individual lives across Texas.



Source: EIA.

Powerfully Positive Trends

Before addressing specific components of the President's Climate Action Plan (CAP), I note the remarkably positive trends in U.S. emissions of anthropogenic carbon dioxide (CO2). In October 2013, the Energy Information Administration (EIA) announced that energy-related emissions of CO2 decreased 3.7 percent in 2012, the lowest emission level of CO2 since 1994.[1] And as a measure of the amount of

CO2 generated per dollar of economic output, the carbon intensity of the U.S. economy has steadily fallen since 1949. According to EIA, this carbon intensity declined 6.5 percent in 2012.[2]

Indeed, CO2 emissions in the U.S. are falling faster than in countries operating under mandates such as the European Union's Emissions Trading System or in countries like Germany which have most aggressively pursued renewable energy. Even before implementation of EPA's greenhouse gas regulations, U.S. CO2 emissions in 2012 fell 3.7 percent while Europe's declined by only 1.8 percent.[3] Although our weak economy and increased use of natural gas may have contributed to declining CO2 emissions, the long term trend is more the result of the private market's innate drive for efficiency.

The President's Climate Action Plan: Overview

The President's Climate Action Plan (CAP) is a mixture of at least fifty federal programs or initiatives that are mostly redundant at best. A few of the Plan's components, however, could be extremely damaging to the economy, low income families and even to U.S. national sovereignty. The Plan strikes me more as a legislative wish-list than an executive directive. Given the broad scope, cost, questionable need and lack of clear legislative foundation, such an expansion of federal purview is more properly the prerogative of Congress rather than the Executive branch.

The Plan's goal to reduce emissions of CO2 by 17 percent in 2030 appears arbitrary and without legislative foundation or technical justification. And the Plan seems out of sinc with significant developments in climate science as well as with NOAA's, NASA's , the UK's Meteorological Office, and even the IPCC's recent Fifth Assessment Report conclusions that recent extreme weather is neither historically unprecedented nor a result of man-made emissions of CO2.

EPA's New Source Performance Standards for CO2 from Electric Generating Units

The most aggressive provision in the Climate Action Plan directs the EPA to develop national regulatory standards for CO2 emission from power plants. EPA is already well underway on this initiative. The Agency recently re-proposed New Source Performance Standards (NSPS) for CO2 from new power plants and is developing a proposed NSPS for all existing plants. Based on carbon capture, control and storage technology, the CO2 limits dictated in EPA's proposed CO2 NSPS for new plants (or discussed for existing plants) are infeasible for coal.

In requiring the impossible, EPA breeches the limits of its regulatory authority under the Clean Air Act (CAA). Section 111(a)(1) of the CAA limits EPA's authority to technological-based limits achievable through "the best system of [emission] reduction" which has been commercially demonstrated. The only control measures now commercially available to reduce CO2 from coal fired generation are likely site-specific energy efficiency measures to improve heat rate. Energy efficiency is the indirect means of CO2 reduction that EPA utilized in its first greenhouse gas regulation for stationary sources- the so-called Tailoring rule applicable to large industrial sources.

EPA, however, now concludes that CCS technology does meet the CAA's required "best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."[4] Carbon capture and storage technologies, however, have not yet been commercially demonstrated in a single successfully operating power plant. Several heavily subsidized

pilot projects have failed and the few remaining, such as Southern Company's Kemper County project, remain incomplete with staggering cost overruns. Southern Company's – still under construction- project sees costs rising to$ 4.2 billion from an originally estimated $2.4 billion.[5]

Significant technical, financial, and regulatory barriers must be resolved before CCS can become a practicable option for significantly reducing CO2 emissions from coal-fired generation at a commercial scale. Parasitic load remains a key obstacle. When capturing carbon alone requires one-third to one-half of the electric power generated in the plant, the commercial enterprise is not viable.

Yet, EPA has remarkably declared that CCS is a feasible control option at a reasonable cost for coal generation. EPA, evidently, decided to conflate technical feasibility with adequate commercial demonstration. And analogizing CCS to the successful emission control technologies for conventional pollutants, such as flue gas-desulfurization (FGD) to reduce sulfur dioxide, does not apply. Compared with CCS, evidence for the commercial availability of FGD was substantial when EPA first required that control method in 1971.

The volume of CO2 that must be captured and stored is vastly larger than the volumes involved with the conventional pollutants regulated under the CAA. CO2 is measured in tons while the criteria pollutants are measured in parts per million. In volume and chemical properties, CO2 is wholly unlike conventional pollutants. The separating technologies long used for processing natural gas and chemicals pose none of the technical barriers of pre or post-combustion "capture" of CO2.

The net effect of EPA's NSPS for CO2 emissions from power plants is to force fuel-switching from coal to natural gas or from any fossil fuel generation to non-emitting generation (e.g. wind or solar). EPA concludes that few, if any, coal-fired power plants will be built in the next decade and so claims the NSPS for CO2 merely reinforces the market's trend toward natural gas and renewables. From this perspective EPA contends the proposed NSPS for new plants will not yield meaningful benefits or costs.

In a five-hundred page regulatory impact analysis, the Agency finds "under a wide range of future electricity market conditions, the proposed EGU GHG NSPA is not expected to change GHG emissions from newly constructed EGUs and is anticipated to impose negligible costs, economic impacts or energy impacts on the EGU sector or society."[6] Does EPA mean banning new coal-fired power plants will not reduce CO2 emissions in the future or increase costs because EPA's rule eliminates any uncertainty about the role of coal in future electric generation? Yet, EPA's mission, as stipulated in the CAA, does not extend to exercising federal power to force fuel switching or to "reinforce" trends that environmental regulators observe in the energy market.

EPA is no longer acting within its statutory authority to protect human health and the environment when the Agency arrogates the right to dictate the nation's energy infrastructure. This is a major expansion of the EPA's authority and violates a core tenet of the CAA. Under the statute, EPA cannot engineer the nation's energy infrastructure. Nothing in the Act empowered the EPA to engage in centralized energy planning and to command the specific means of energy production.

Regulatory decisions carrying the force of law with this magnitude of national consequence are unquestionably the purview of the U.S. Congress and not the Executive branch. Enacted and largely upheld over forty years the CAA enshrines an assumption of economic freedom in this democracy. The

CAA allows private actors- not the EPA- to choose energy source, process and product. EPA's authority is limited to requiring the best pollution control technology that has been commercially demonstrated for the industrial process in question. Mandating a technology achievable for natural gas and infeasible for coal puts EPA in the driver's seat of this nation's energy economy. An alarming precedent, EPA's proposed standards for CO2 turns the generation of electricity from an enterprise focused on productivity, efficiency and innovation into an industry that first and last must serve the government's purpose regardless cost or productivity.

The proposed CO2 New Source Performance Standards for power plants are EPA's first direct regulation of CO2 under a national numeric limit. EPA's initial CO2 regulations promulgated in 2010, such as the Tailoring Rule for the large stationary industrial sources, require CO2 reduction indirectly by means of Best Available Control Technology (BACT) derived energy efficiency measures. In great contrast, EPA's NSPS for CO2 requires an amount of CO2 reduction that is practicably infeasible. In so acting, EPA exceeds a fundamental limit to its authority imposed by the terms of the CAA.

EPA's increasing stack of mandates to reduce CO2 demonstrate why the federal Clean Air is wholly unsuited to regulate this most ubiquitous by-product of human activity and natural process. Whether labeled a "dirty pollutant" or not, this chemical compound remains "the gas of life" on this planet and thus is quite unlike the conventional pollutants Congress directed EPA to control in the CAA. CO2 is what results after combustion of a fuel and cannot be readily scrubbed, stripped, filtered or chemically changed but must be captured.

Also in contrast to genuine pollutants listed in the Clean Air Act, CO2 levels in our ambient atmosphere have no direct adverse health effects. EPA's Endangerment Finding that CO2 (and other greenhouse gases) endanger human health relies upon prediction of harm as a result of warmer temperatures in the future. OSHA sets a health effects level for CO2 at 5000 parts per million; current atmospheric levels of CO2 are approximately 400 parts per million.[7] In public communications, EPA increasingly regards CO2 as a pollutant no different from the six criteria pollutants listed in the Clean Air Act. This misinforms the public about the chemical and physical dynamics of human, animal and plant life on this planet.

The economic damage from EPA's multiple efforts to supplant coal already are felt across this country. More than two hundred power plants and rising number of coal mines have shuttered or plan closure as a result of the many new EPA rules for traditional pollutants or in anticipation of these NSPS for CO2. Unemployment in towns around these plants and mines rises. These closures also come on the heels of the coal industry's approximately $100 billion in investment in state of the art emission control technologies. Many coal plants already have reduced criteria pollutants and key toxins by 60-80 percent.[8]

Supplanting coal-fired generation is not toying with the margins of the electric power supply in this country. Coal remains the largest source and an essential mainstay of base load electric power operating at a steady state twenty-four hours a day. Historically less subject to volatile swings in price, coal is still critical to assuring reliable, affordable power. Energy infrastructure such as transmission lines and transfer stations developed over a century cannot be rapidly replaced without enormous loss in investment, supply, reliability, and affordability.

U.S. policy makers might consider the human pain created by the most aggressive regulatory initiatives in the history of EPA - energy poverty increasing in European countries and emerging in the U.S. The

EPA's rules already have hurt middle and low income families in our country. In the last ten years, the cost of energy as percentage of pre-tax income has nearly doubled for the poorest household and can absorb 40 percent of income.[9]

Generic "green energy" policies are now imbedded across the entire federal edifice, most of which without underlying legislation. And the impacts of those policies disproportionately hurt the poor. Even our Native Americans communities are denied the opportunity to develop their significant energy resources on tribal lands. Last October, the Wall Street Journal reported how federal energy policies obstruct tribal plans to use their energy assets to alleviate poverty and unemployment. Recall that the average incomes of Native American are about one-third that of U.S. citizens and their unemployment rates are four times the national average.[10] Is there not a more pressing moral obligation to allow Native Americans the fruits of employment and economic growth than to deny that opportunity in vague hope of averting a slightly warmer climate?

The Crow Indian reservation in Montana occupies one of the largest reserves of coal in this country. The tribe does generate considerable revenue from coal but federal agencies prevent fully taking advantage of their substantial coal assets. Tribal chairman Darrin Old Coyote put it simply. "The war on coal is a war on our families and our children."[11]

A Rush to Renewables: A Note of Caution

The federal government already has spent hundreds of billions of taxpayer's money towards aggressive deployment of renewable energy. Perhaps now is the moment to cease the lavish subsidies for more and more wind and solar installations- as envisioned in the Climate Action Plan - to allow time to integrate the new renewable capacity into the electric grids without sacrificing reliability and affordability.

At an installed capacity of 12,214 MW, Texas has more wind generation capacity than most countries. And Texas has just completed over 2000 miles of transmission lines to utilize the wind generated in the far westerns regions of the state - hundreds of miles from the population centers surrounding Interstate 35 running through the central Texas region. The $7 billion cost of those transmission lines – called the Competitive Renewable Enterprise Zones (CREZ)- will be paid by retail electric customers.[12]

How Texas will best utilize all this wind capacity remains to be seen. Because of intermittency and seasonal variability, the Texas grid (Electric Reliability Council of Texas) rates wind generation only at 8.7 percent of wind's installed capacity.[13] Increasing use of wind generation can increase reliability risks as the wind abruptly stalls or rapidly increases beyond wind speeds appropriate for generation. If wind generation receives dispatch priority, our state's highly competitive real-time nodal market will lose its competitive dynamic.

The soaring electric prices in European countries with ambitious renewable programs should give pause. Germany's rush to renewables has led to the highest electric prices in any developed country. Coupled with energy surcharges, taxes and fees, household energy costs have doubled since 2000. Germany has adopted the most audacious renewable initiative with a goal of 35 percent of electric generation from renewables by 2020 and 85 percent by 2050.[14]

Britain, Denmark, and Spain also rushed to renewables - and their energy consumers have suffered for it - but Germany tops the list for energy cost and human loss. Major media in Germany report increasing energy poverty – where heat energy is viewed as a "luxury good" in competition with food.[15] This was the human condition for the majority of the population 250 years ago before the Industrial Revolution when England first tapped the vast store of energy in coal.[16] For the first time since the Industrial Revolution, energy regression- as a policy choice in the most developed and affluent nations of the world, rears its head.

Germany began its "Energy Revolution" (Energiewende) in 2000 and dramatically accelerated renewable installations in 2011 after the Fukushima nuclear disaster in Japan. Since 2000, Germany's electric prices have increased 50 percent and are now three times higher than average U.S. prices. By 2020, German officials now conservatively estimate electric prices at 40 percent more than current prices.[17]

Der Spiegel reports that over 600-700,000 German households are cut off from electricity because residents could not pay their continually increasing energy bills. The Catholic charity, Caritas, takes energy saving light bulbs on their home visits and notes families must decide between using a light bulb or having a hot meal.[18] Has Germany's ambitious deployment of renewables reduced CO2 emissions? No, quite the contrary. Germany's CO2 emissions associated with electric generation have increased as more coal has been used to back up inherently intermittent and thus unreliable wind or solar electric generation – a problem that increases in frequency the larger the load renewables are called upon to play.[19]

As anecdotal evidence about energy regression, consider that trees in the U.S. are now felled and turned into wood pellets to be exported to Germany and Britain for home heating, cooking fuel and (not-so-low-carbon) electric generation. While in principle renewable, wood when burned emits abundant CO2 and particulate matter (otherwise known as harmful pollution). Let's hope U.S. energy policies do not lead to headlines reporting that "Rising Energy Costs Drive Up Forest Thievery," as more and more people revert to burning wood for heat.[20]

Likewise, Britain- the cradle of the Industrial Revolution that released entire populations from abject poverty- recently announced that one in four households now live in energy poverty. The Daily Mail warns of the risks of 24,000 deaths of the elderly this winter who cannot afford to heat their homes.[21]

That such a regression from modern living standards could occur so rapidly in these highly developed economies is a stunning turn of events that U.S. policy makers would be wise to absorb. Haphazard wishful- thinking policies that dismiss energy physics and transfer the cost to consumers are regressive and morally objectionable.

The Enigma: Fossil Fuel Is the Energy of Choice

Energy dense, abundant, imperishable, versatile, reliable, portable and affordable, fossil fuels provide 85 percent of the world's energy because they are superior to current alternatives. This nation's prosperity – literally "powered" aided by the productivity made possible by concentrated energy- catalyzed multiple emission control technologies that have dramatically reduced the CAA's criteria pollutants and key toxins – genuine pollutants that can harm human health.[22] Fossil fuels have also reduced the human footprint on natural ecosystems. Fertilizer derived from natural gas has dramatically increased agricultural

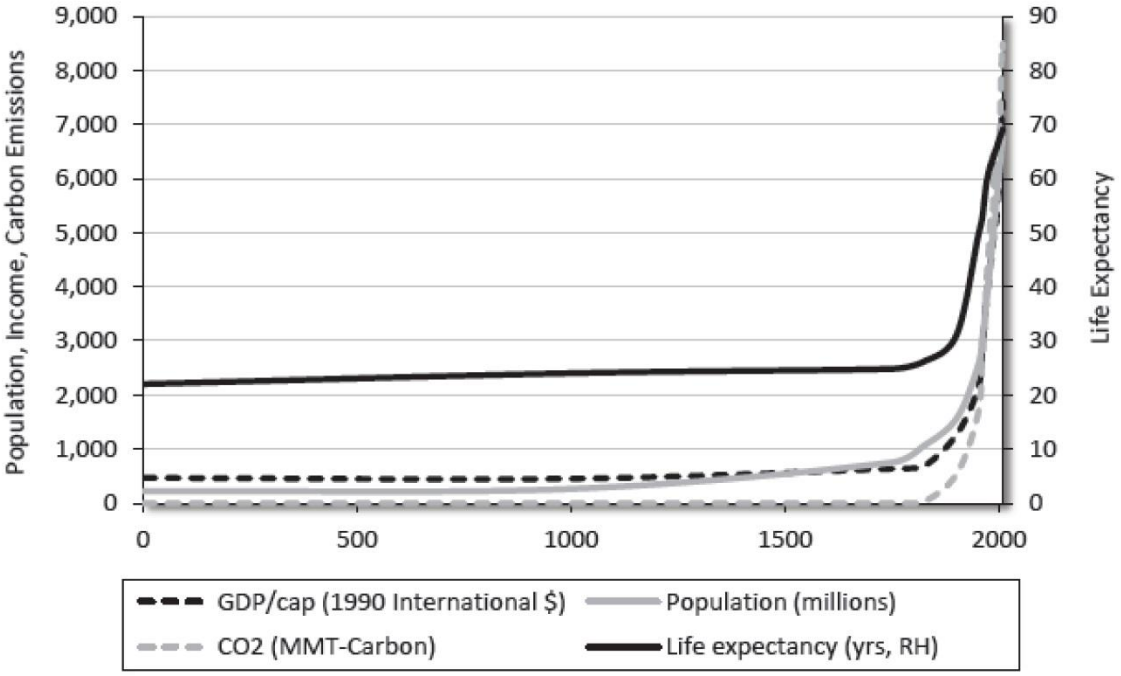
productivity as had the slightly increasing levels of atmospheric CO2.[23] Although wind, solar and biofuels have increased their share of the U.S. energy supply, they remain an inferior sliver of total supply. The EIA's Energy Outlook 2014 projects that fossil fuels will supply at least 80 percent of this nation's energy in 2040.[24]

Not so long ago, man methodically harnessed the dense energy in fossil fuels and so unleashed economic productivity on a scale never imagined in human history. When innovative minds like James Watt developed a steam engine which could convert heat energy into mechanical energy, the energy/economic limits under which all human societies had previously existed were blown apart. The greatest change was for the average worker. A life of back-breaking drudgery was no longer the common lot of the overwhelming majority of mankind.[25]

Population, life expectancy, and income per capita had changed little for all human history until the Industrial Revolution around 1800. Since then life expectancy has tripled and average global income per capita has increased 11-fold. Not coincidentally, man-made emissions of CO2 also have risen over the same period. See graph.[26]

Until energy sources comparable or superior to fossil fuels are fully available, grand plans to reduce CO2 emissions should proceed with caution, lest they prematurely jettison the wellsprings of mankind's greatest advance. The historic energy boom in the U.S., if allowed to flourish, offers the opportunity to lift millions out of poverty in this country and around the world. This country's energy riches can now be developed subject to elaborate environmental controls and without extending the human energy footprint on large swaths of still majestic natural ecosystems.

Figure 1
Global Progress, 1 A.D.–2009 A.D. (as indicated by trends in world population, gross domestic product per capita, life expectancy, and carbon dioxide [CO_2] emissions from fossil fuels)



Source: Indur M. Goklany, "Humanity Unbound: How Fossil Fuels Saved Humanity from Nature and Nature from Humanity," Cato, December 20, 2012; based on Angus Maddison, Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD, University of Groningen, 2010, http://www.ggdc.net/MADDISON/Historical_Statistics/vertical-file_02_2010.xls; World Bank, World Development Indicators 2011, http://databank.worldbank.org/; T.A. Boden, G. Marland, and R.J. Andres, Global Regional, and National Fossil-Fuel CO2 Emissions, http://cdiac.ornl.gov/trends/emis/overview_2008.html.

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[1] "Global Carbon emissions set to reach record 36 billion tonnes in 2013," Phys.org, November 18, 2013.
[2] Tom Randal, "America is Winning a Race That It Never Signed Up For," Bloomberg, November 4, 2013.
[3] *See supra*, note 1.
[4] Clean Air Act § 111(a)(1), 42 USCA § 7411(a)(1) (2006).
[5] "Southern Co replaces executives in wake of Kemper cost overrun," Reuters, May 20, 2013.
[6] Regulatory Impact Analysis for the Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, Environmental Protection Agency, September, 2013.
[7] "Chemical Sampling Information: Carbon Dioxide," United States Department of Labor, available at https:www.osha.gov/dts/chemicalsampling/data/CH_225400.html.

[8] Tom Hewson & Benjamin Stravinsky, "Coal Fired Power Invested in Air Pollution Controls," Energy Ventures Analysis, May 3, 2009; "The Facts About Air Quality and Coal-Fired Power Plants," Institute for Energy Research, June 3, 2009.
[9] Energy Cost Impacts on American Families, 2001-12, American Coalition for Clean Coal Electricity, April 2012.
[10] Terry L. Anderson & Shawn Regan, "The War on Coal is Punishing Indian Country," Wall Street Journal, October 11, 2013.
[11] Ibid.
[12] Laylan Copelin, "Little fanfare for state's $7 billion clean-energy project," Austin American Statesman, November 2, 2013.
[13] Emily Pickrell, "Role of Texas Wind Power Debates After Winter Emergency," Fuel Fix, January 8, 2014.
[14] "Germany's New Energy Policy," Federal Ministry of Economics and Technology, April 2012; David J. Unger, "German voters follow Merkel down bumpy path to clean energy," Christian Science Monitor, September 23, 2013.
[15] "How Electricity Became a Luxury Good," Der Spiegel, September 4, 2013.
[16]Indur M. Goklany, "Humanity Unbound: How Fossil Fuels Saved Humanity from Nature and Nature from Humanity," Cato, December 20, 2012; see also Indur M. Goklany, "The Improving State of the World," Cato (2007); Matt Ridley, "The Rational Optimist," Harper Collins (2010); Edward Wrigley, "Energy and the Industrial Revolution," Cambridge University Press (2010); Julian Simon, "The Ultimate Resource 2," Princeton University Press (1996); George Gilder, "Knowledge and Power," Regnery (2013).
[17] Der Spiegel, supra, note 15.
[18] Ibid.
[19] Unger, supra, note 14.
[20] Renuka Rayasam, "Rising Energy Costs Drive Up Forest Thievery," Der Spiegel, January 17, 2013.
[21] Jenny Hope, "Fuel poverty in Britain: 24,000 will die from cold this winter and 6m fear they cannot heat their home," Daily Mail, October 27, 2013; see also Enza Ferreri, "Green Britain: Energy Blackouts Imminent," FrontPage Magazine, October 14, 2013.
[22] Kathleen Harnett White, "EPA's Approaching Regulatory Avalanche," Texas Public Policy Foundation, February 2012.
[23] Goklany, supra, note 16.
[24] "Annual Energy Outlook 2014 Early Release," Energy Information Administration, December 2013.
[25] Gregory Clark, "A Farewell to Alms: A Brief Economic History of the World," Princeton University Press (2009).
[26] Goklany, supra, note 16.