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CLIMATE CHANGE AND ENSURING THAT AMERICA LEADS THE CLEAN ENERGY TRANSFORMATION

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED ELEVENTH CONGRESS

FIRST SESSION

AUGUST 6, 2009

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ONE HUNDRED ELEVENTH CONGRESS
FIRST SESSION

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CLIMATE CHANGE AND ENSURING THAT AMERICA LEADS THE CLEAN ENERGY TRANSFORMATION

THURSDAY, AUGUST 6, 2009

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The full committee met, pursuant to notice, at 10 a.m. in room 406, Dirksen Senate Building, Hon. Barbara Boxer (chairman of the full committee) presiding.

Present: Senators Baucus, Inhofe, Lautenberg, Cardin, Whitehouse, Merkley, Voinovich, Barrasso, Bond, and Alexander.

OPENING STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator BOXER. The hearing will come to order. Very happy to see all of you here.

Today's hearing will focus on ensuring that America leads the clean energy transformation as we address the threat posed by climate change. I want to welcome our witnesses who will share their insights and expertise on this critical subject.

We are facing two historic challenges in America today, a deep economic recession and the threat of unchecked global warming. During this hearing, we will examine the ways in which Federal initiatives are already addressing both of these challenges and about additional steps we can take to provide incentives for clean energy development to transform the American economy.

This country can and should be a leader of the clean energy revolution. Clean energy and climate legislation provides the certainty that companies need and the signal businesses are looking for to mobilize capital and harness the greatest source of power we have in this great country, American ingenuity. Clean energy legislation is jobs legislation. By creating powerful incentives for clean energy, it will create millions of new jobs in America, building wind turbines, installing solar panels on homes, and producing a new fleet of electric and hybrid vehicles.

Every time we have one of these hearings, the Republicans and the Democrats put different studies into the record proving their point, so I want to again refer to the Pew Charitable Trust study that shows that the creation of jobs in the clean energy sector is the one bright spot in our economy, the major bright spot in our economy, and noting that a charitable organization, I believe, does come to the table without bias.

Legislation that provides powerful incentives for the development of clean energy technologies will put America to work and unleash U.S. investment to create innovative technologies and whole new industries right here in America, reduce our dependence on foreign oil, and protect our children from pollution.

So I do look forward to hearing all of our witnesses today about how we can work together to rise to the clean energy challenge and to transform our economy.

Senator Inhofe.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. Well, thank you, Madam Chairman, and thank you for holding this hearing.

I think it might be a good time, since we are going to go into August recess, to kind of assess what we have learned from these hearings. Madam Chairman, since I turned the gavel over to you, this committee has held over 30 hearings on global warming, with testimony from numerous experts and officials from all over the country, all over the world. These hearings explored various issues associated with cap-and-trade, and I am sure my colleagues learned a great deal from them.

But over the last 2 years it was not from these hearings, at times arcane and abstract policy discussions, that we got to the essence of cap-and-trade; it was the Democrats who cut right to the chase. It was the Democrats, over the last 2 years, who exposed what cap-and-trade really means for the American people.

We learned, for example, from President Obama that, under a cap-and-trade, electricity prices would necessarily skyrocket.

We learned from Democrat Representative John Dingell that cap-and-trade is a tax, and a great big one.

We learned from Democrat Representative Peter DeFazio that "a cap-and-trade system is prone to market manipulation and speculation without any guarantee of meaningful greenhouse gas emission reductions. A cap-and-trade has been operating in Europe for 3 years and is largely a failure."

We learned from Democrat Senator Dorgan that the cap-and-trade system, "the Wall Street crowd can't wait to sink their teeth into a new trillion dollar trading market in which hedge funds and investment banks would trade and speculate on carbon credits and securities. In no time they will create derivatives, swaps, and more for that new market. In fact, most of the investment bankers have already created carbon trading departments. They are ready to go. I am not." Now, I am quoting Senator Dorgan in the case.

We learned from Democrat Senator Maria Cantwell that cap-and-trade programs might allow Wall Street to distort a carbon market for its own profits.

We learned from the EPA Administrator, Lisa Jackson, that unilateral United States action—she was referring to the bill that is on the table now—to address climate change through cap-and-trade would be futile. She said, in response to a question from me, that U.S. action alone would not impact CO_2 levels.

We learned from Democrat Senator John Kerry there is no way the United States of America, acting alone, can solve this problem, so we have to have China, we have to have India.

We learned from Democrat Senator Claire McCaskill that "if we go too far with this, that is, cap-and-trade, then all we are going to do is chase more jobs to China and India, where they have been putting up coal-fired plants every 10 minutes."

In sum, we have a slew of hearings in three unsuccessful votes on the Senate floor—well, actually, I would say four, because we rejected the Kyoto Treaty in the beginning. The Democrats taught us that cap-and-trade is a great big tax and will raise electricity prices on consumers, I would have to say in a regressive way. In rich Wall Street, traders send jobs to China and India, all without any impact on global temperature.

So off we go into the August recess secure in the knowledge that cap-and-trade is riddled with flaws and that Democrats are seriously divided over one of President Obama's top domestic policy priorities. We also know that, according to a recent polling, the American public is increasingly unwilling to pay anything, as the polling has shown, to fight global warming. But all this does not mean cap-and-trade is dead and gone; it is very much alive, as Democratic leaders, as they did in the House, they are eager to distribute pork in unprecedented scales to secure the necessary votes to try to pass this thing.

So be assured of this, we will mark up legislation in this committee, pass it, and then it will be combined with other bills from other committees, and we will have a debate on the Senate floor. Throughout the debate on cap-and-trade, we will be there to say that, according to the American Farm Bureau, the vast majority of agriculture opposes it. According to GAO, it will send jobs to China and India. According to the National Black Chamber of Commerce, it will destroy over 2 million jobs. According to the EPA and the EIA, it will not reduce our dependency on foreign oil. According to EPA, it will do nothing to reduce global temperature.

And, when it is all said and done, the American people will reject it and we will defeat it.

Thank you, Madam Chairman. On that happy note, I will——

[Laughter.]

[The prepared statement of Senator Inhofe follows:]

STATEMENT OF HON. JAMES M. INHOFE,
U.S. SENATOR FROM THE STATE OF OKLAHOMA

Madam Chairman, thank you for holding this hearing today. This is the last hearing on climate change before the August recess, so I think it's appropriate to take stock of what we've learned.

Madam Chairman, since you assumed the gavel, this committee has held over 30 hearings on climate change. With testimony from numerous experts and officials from all over the country, these hearings explored various issues associated with cap-and-trade, and I'm sure my colleagues learned a great deal from them.

But over the last 2 years, it was not from these, at times, arcane and abstract policy discussions that we got to the essence of cap-and-trade. No, it was the Democrats who cut right to the chase; it was the Democrats over the last 2 years who exposed what cap-and-trade really means for the American public.

We learned, for example, from President Obama that under his cap-and-trade plan, "electricity prices would necessarily skyrocket."

We learned from Representative John Dingell (D–Mich.) that cap-and-trade is "a tax, and a great big one."

We learned from Representative Peter DeFazio (D–Ore.) that "a cap-and-trade system is prone to market manipulation and speculation without any guarantee of meaningful GHG emission reductions. A cap-and-trade has been operating in Europe for 3 years and is largely a failure."

We learned from Senator Dorgan (D–N.D.) that with cap-and-trade, "the Wall Street crowd can't wait to sink their teeth into a new trillion-dollar trading market in which hedge funds and investment banks would trade and speculate on carbon credits and securities. In no time they'll create derivatives, swaps and more in that new market. In fact, most of the investment banks have already created carbon trading departments. They are ready to go. I'm not."

We learned from Senator Cantwell (D–Wash.) that "a cap-and-trade program might allow Wall Street to distort a carbon market for its own profits."

We learned from EPA Administrator Lisa Jackson that unilateral U.S. action to address climate change through cap-and-trade would be futile. She said in response to a question from me that "U.S. action alone will not impact world CO_2 levels."

We learned from Senator Kerry (D–Mass.) that "there is no way the United States of America acting alone can solve this problem. So we have to have China; we have to have India."

We learned from Senator McCaskill (D–Mo.) that if "we go too far with this," that is, cap-and-trade, then "all we're going to do is chase more jobs to China and India, where they've been putting up coal-fired plants every 10 minutes."

In sum, after a slew of hearings and three unsuccessful votes on the Senate floor, the Democrats taught us that cap-and-trade is a great big tax that will raise electricity prices on consumers, enrich Wall Street traders, and send jobs to China and India—all without any impact on global temperature.

So off we go into the August recess, secure in the knowledge that cap-and-trade is riddled with flaws, and that Democrats are seriously divided over one of President Obama's top domestic policy priorities.

And we also know that, according to recent polling, the American public is increasingly unwilling to pay anything to fight global warming.

But all of this does not mean cap-and-trade is dead and gone. It is very much alive, as Democratic leaders, as they did in the House, are eager to distribute pork on unprecedented scales to secure the necessary votes to pass cap-and-trade into law.

So be assured of this: We will markup legislation in this committee, pass it, and then it will be combined with other bills from other committees. And we will have a debate on the Senate floor.

Throughout the debate on cap-and-trade, we will be there to say that:

According to the American Farm Bureau, the vast majority of agriculture groups oppose it;

According to GAO, it will send our jobs to China and India;

According to the National Black Chamber of Commerce, it will destroy over 2 million jobs;

According to EPA and EIA, it will not reduce our dependence on foreign oil;

According to EPA, it will do nothing to reduce global temperature;

And when all is said and done, the American people will reject it, and we will defeat it.

Thank you, Madam Chairman.

Senator BOXER. Thank you. You really started my day off. Such excitement.

Senator INHOFE. But that is not the first time.

Senator BOXER. No.

Senator INHOFE. That is what you do to my days.

Senator BOXER. I know. I am sorry. I apologize.

Senator Voinovich—Senator Bond was here first. I am sorry, Senator.

OPENING STATEMENT OF HON. CHRISTOPHER S. BOND, U.S. SENATOR FROM THE STATE OF MISSOURI

Senator BOND. Oh, thank you very much, Madam Chair. I want to continue to brighten your day as we talk about clean energy and climate change.

There have been a lot of charges that have been thrown around that Republicans are not willing to do anything. I want to point out that the Republicans are the party of yes when it comes to supporting clean energy, American energy, and affordable energy. We support harnessing the largest source of clean energy we have, nuclear power. The single greatest source of zero carbon, zero air pollution, base-load energy is nuclear power.

Nuclear power will create tens of thousands of productive jobs, and that is in contrast to the so-called green jobs of wind and energy, which can only be bought with up to $100,000 of taxpayer subsidy [unintelligible] to produce, intermittently, power that we, as taxpayers, get the privilege of subsidizing at the rate of about $20 a megawatt hour, when it blows, of course.

Unfortunately, President Obama seems more interested in Iran's right to peaceful nuclear energy than expanding American nuclear energy. Republicans support clean hybrid and electric plug-in vehicle technology. Just last week we celebrated a new electric truck assembly plant in Kansas City, Missouri. We had on the mall totally electric plug-in vans with the private sector partners, including AT&T, Coca Cola, Frito-Lay. Madam Chair, your Pacific Gas & Electric, and my Kansas City Power & Light are going to be running these totally electric power zero emission vans.

In Missouri, I am also working with our research in the universities and the Danforth Plant Science Center to develop economical ways of producing biomass to generate electricity with less emissions. We are using algae combined with carbon dioxide to produce transportation fuel, as we have discussed here.

But I also support, as my fellow Republicans do, harnessing the American oil and gas lying off our shores and under our lands. Environmentally friendly drilling technology allows for oil drilling in an ocean that was safe enough to withstand Hurricane Katrina. And we do it without the pollution that is produced in other countries, which are now producing the oil and gas that we need, and from the best information we have, are going to continue to need for at least the next 20 years.

Government estimates are that we have 144 billion barrels of oil waiting for us offshore if we only go ahead and tap it. In the American West, The Rand Corporation estimates America has over 1 trillion barrels of recoverable oil. That is more than 2,000 years of imports from Saudi Arabia. Government estimates, 200-year supply of American coal and a 95-year supply of natural gas.

Allowing ourselves to use America's abundant supplies of energy will promote another Republican core belief, and that is affordable energy. Abundant supplies of American energy will help keep prices down, will help families stretch their family budgets and keep good paying jobs. We will oppose proposals from the other side of new energy taxes which will cost us jobs and hurt America while helping our competitors in China and India.

We oppose intentionally hurting the American people with higher prices or putting a price on carbon, as environmentalists and some on the other side like to say. Instead, Democrats propose to impose pain on the American people, to force them to use less energy, which will not do anything for the climate. We support allowing America to harness its own abundant, clean, affordable energy.

Finally, the reports of cap-and-trade legislation that the Chair intends to introduce will omit key details vital to determining its impact on families and workers. That troubles me a great deal, Madam Chair. If families are going to have to pay higher utility bills, farmers pay higher production costs, drivers face more pain at the pump, and workers face greater job loss, depending on how the cap-and-trade legislation allocates its tradeable allowances, we ought to be considering that over the August recess. I think the American people deserve to know how legislation will affect their energy bills and jobs. We can't leave these allocation provisions blank, with placeholders, if we are going to give Americans a fair, honest, and open, transparent view of the legislation.

I would wonder how we can even hold legislative hearings on legislation without reviewing its key provision. And I would urge the Chair not to try to force the committee to do so.

I thank you very much, Madam Chair, for giving me this opportunity.

Senator BOXER. Senator Bond, I totally agree with you that, when we mark up, we will know exactly what the——

Senator BOND. Will we know before the recess?

Senator BOXER. Before? Today? No. We won't see that until after. We are going to have many, many more hearings before we mark up.

Senator BOND. OK. Will we know those provisions when they are developed?

Senator BOXER. Of course.

Senator BOND. OK. That is what we——

Senator BOXER. Absolutely.

Senator BOND. OK.

Senator BOXER. Senator Alexander.

OPENING STATEMENT OF HON. LAMAR ALEXANDER, U.S. SENATOR FROM THE STATE OF TENNESSEE

Senator ALEXANDER. Thanks, Madam Chairman. Thanks for the hearing, and I look forward to the witnesses. They know a lot about the subject matter we are discussing. And I like the title clean energy revolution.

Senator Bond has accurately described a Republican proposal that we believe is consistent with the views of a lot of Democratic Senators as well; 100 nuclear power plants in the next 20 years, clean plug-in vehicles. I believe we can electrify half our cars and trucks—I learned that from one of the witnesses here today—during the next 20 years. Offshore exploration for natural gas, that is low carbon. And then some mini Manhattan projects on the things that we need to figure out, like capturing carbon from existing coal plants. By my computations, if all that were fully implemented, we would reach the Kyoto goals by 2030 without a cap-and-trade, and do it in a low cost way.

My questions today are going to have to do with a separate part of the bill that is coming over toward us from the House of Representatives. There is a renewable electricity standard that requires States to create 20 percent of their electricity by 2020 from a narrowly defined group of renewable energies—wind, solar, geothermal, and new hydro. It is a continuation of what I would call

a national windmill policy that we have had since 1992, when we began to almost theologically subsidize the building of giant wind turbines as a way of powering our country.

So if the title of our hearing is clean energy revolution, my question, then, to the witnesses and to others is, Why don't we have a clean energy standard? Why do we leave out, for example, nuclear power, which produces 70 percent of our carbon-free electricity today?

I congratulate Mr. Sandalow for actually mentioning nuclear power in his testimony, which is rare for witnesses from this Administration. We had a very good meeting, several of us did, that Senator Carper had with Dr. Chu earlier this week about what he hopes to do about nuclear power, and he said what we believe, that it is safe, that we have ways to deal with the waste, and he wants to get it going.

So if this is so important that we need to encourage wind, why don't we encourage nuclear power? And, for the record, I would like to include this chart of comparisons, two different options to make another 20 percent of the United States carbon-free. The Administration has said that it wants—and it is mentioned in the testimony today—let's make 20 percent of our electricity from wind. OK. Well, why not, at the same time, try to make 20 percent of our electricity from nuclear? Both are pollution-free and carbon-free, and here are the comparisons.

To do it with nuclear, you would need 100 new reactors, about the number we have today. To do it with wind, you would need 180,000 1.5 megawatt turbines, covering an area the size of West Virginia. Nuclear produces 20 percent of our electricity today; wind 1.3 percent. Nuclear is a base-load power. Maybe what we need is a base-load clean energy standard and a renewable clean energy standard. Wind, of course, is intermittent; it is only available when the wind blows. Nuclear is available about 90 percent of the time, on the average, that is why we call it base-load; wind is available about a third of the time.

In our part of the country, Tennessee, it is only available about 19 percent of the time, and the only wind farm in the Southeast shows the net effect of the renewable electricity standard is to force us to pay more to buy wind from South Dakota, when we would rather be using it for nuclear or conservation or buying scrubbers for our coal plants.

The 100 nuclear reactors would be built mostly on existing sites; wind would require thousands of miles of new transmission lines. We would have to pay for that. The subsidy costs for nuclear to build 20 percent of our electricity from carbon-free would be about $17.5 billion over 10 years, including the nuclear production tax credit. For wind, it would be 10 times that, $170 billion over 10 years, which is the production tax credit.

The Chairman mentioned green jobs. There would be more under building 100 nuclear power plants, a lot more, than there would be under building even 180,000 wind turbines, according to the Department of Energy statistics. Nuclear plants last 80 years; wind turbines 20. We have 47,000 abandoned mines in California. What if we add 180,000 abandoned wind turbines in the United States?

The cost of building both is about the same, according to the National Academies, and the visual impact is 100 square miles for nuclear, 25,000 square miles for wind.

So my question will be why not have a clean energy standard or a base-load standard that includes nuclear?

Madam Chairman, I would like to ask permission to include this chart, following my remarks.

Senator BOXER. It will be done, sir, yes.

Senator ALEXANDER. Thank you very much.

[The referenced document follows:]

Two Options to Make Another 20% of U.S. Carbon-Free Electricity

	Nuclear	Wind
New Plant Needs	100 new reactors	180,000 1.5-megawatt turbines
Current Percentage of U.S. Electricity [1]	20%	1.3%
Type of Power	Baseload	Intermittent - can't be more than 20% of total generation
Actual Operating Availability (Capacity Factor)	90%	33%
Additional Infrastructure	Little - Mostly built on existing sites	Thousands of miles of new transmission lines
Subsidy Cost [2]	Up to $17.5 billion (over 10 years) including nuclear production tax credit	$170 billion (over 10 years)
Direct Jobs [1]	250,000 construction	73,000 construction
	70,000 permanent	77,000 permanent
Plant Lifetime	80 years	20 years
Levelized Cost per KWh [3]	$0.06-0.13 - includes financing and spent fuel disposal	$0.04-0.10 - does not include transmission or backup power
Visual Impact	100 square miles	25,000 square miles - covers an area the size of West Virginia

[1] Department of Energy

[2] Nuclear Subsidy: $100 billion loan guarantees scored at 10%, and nuclear production tax credit. Wind Subsidy: renewable production tax credit extended to 20% U.S. electricity production.

[3] The National Academies: America's Energy Future, July 2009.

Senator BOXER. Senator Lautenberg.

OPENING STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator LAUTENBERG. Thanks very much, Madam Chair. We are never quite where the Chair is, chairman or chairwoman, but this is a Chair of all abilities and talents.

We are glad to see the witnesses.

Today's hearing is our sixth in the past month on the need to fight global warming by building the economy of the future. During these hearings, we have heard from business and industry leaders that the U.S. needs to act fast to catch up to other countries that are leading the way on clean energy. Right now, for example, China is investing 10 times more of its gross domestic product on clean energy than the United States.

We have also heard from military leaders that global warming is a serious threat to our national security. As many as 800 million people are going to face water or crop land scarcity in the next 15 years, setting the stage for conflict and breeding the conditions for terrorism, according to the CIA's National Intelligence Council.

During today's hearing, we are going to hear more about science-based options. We have to reduce emissions, create jobs, and to grow our economy.

Last month, the House passed the landmark bill that would fundamentally shift how America uses energy and confronts the challenges that we have. All eyes are now on this committee to see if we are going to do our part. We have got to reward innovative companies and workers that are building the clean energy economy and make polluters pay for the damage that they are doing to our planet.

We must reduce greenhouse gas emissions by 20 percent by 2020 to get on the track that we need to ultimately have by 2050. That is a science-based achievable goal. And, in fact, the major new report by McKinsey & Co. found that the United States can reduce energy use by 23 percent by 2020 simply by becoming more energy efficient.

We also need to invest in research and development to create jobs in the short-term and give our country the tools to compete in the long term. Right now, the House bill only devotes 1.5 percent of the allowances to research and development, but a Fortune 500 company like J&J, Johnson & Johnson, spends about 12 percent of its revenues on R&D. We need to improve the House bill to make sure that we provide the investments necessary to match our technology with our goals.

If we accomplish these objectives, factories that are now dark and empty can find new life building wind turbines, geothermal heat pumps, solar panels, or any of the thousands of components that generate renewable energy.

I hear our colleague from Tennessee, Senator Alexander, continue to ask why not more nuclear, and I think the question is a fair one. I remember when nuclear was a dirty word around here, and now we have seen applications come in from people who want to make the investment, and I think certainly we have to look at that more seriously.

Just look at what has happened in my State of New Jersey. More than 2,000 clean energy companies now call New Jersey home. They employ more than 25,000 people.

So, Madam Chairman, when we return to Washington in September, we need to take what we have learned from these hearings, get to work building our clean energy future, and I hope that we will have had sufficient debate and volume of air pass so that we can take that air into renewable energy. Thank you very much.

Senator BOXER. Thank you very much, Senator.

Senator Barrasso.

OPENING STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM THE STATE OF WYOMING

Senator BARRASSO. Thank you, Madam Chairman.

Madam Chairman, unemployment has now hit 9.5 percent in America. The Administration admitted again this week that unemployment will continue to rise. It will continue to rise despite promises that the President's $787 billion stimulus bill would prevent unemployment from reaching even 8 percent and would create or save 3.5 million jobs.

Vice President Biden has said the Administration misread the economy. He is correct. Misreading the economy is a serious mistake, given the billions we borrowed from China to pay for that stimulus bill. The people depending on this Administration to restore the job market paid the price.

Now some in the majority in Congress want to move at breakneck speed to pass a 1500-page cap-and-trade scheme. With the failure of an economic stimulus package to create the promised jobs, should America believe that the 1500-page cap-and-tax bill will work? Supporters are putting a lot on the line by advocating the largest energy tax in the history of America. The burden of the bill will fall on the backs of working Americans in a time of high unemployment. And they are not being deliberative about this, they are rushing to do it.

In an article in Investors Business Daily, Drew Thornley asks why the urgency. Why not more time for thorough cost-benefit analysis? Why hurriedly push a bad bill just to get something passed? Why no acknowledgment that the countries that take the best care of their environment are the richest? Thornley also asks why not tap more of our Nation's abundant natural fuels in ways that are as, or more, environmentally friendly than other nations?

Cap-and-tax advocates have tried to sell the American people on the idea that we can be energy secure by having less energy, but making it more expensive. They claim this approach will create jobs all across America, leaving no worker behind. They also claim that this cap-and-trade strategy will wean America off foreign sources of energy. They claim it is critical for our national security, and they claim it will make us competitive in the world.

In response, I would simply ask the question, Why are Saudi Arabia and our Middle Eastern countries so vital to the world's energy mix? The answer, they have vast deposits of the world's oil. If America had the same amount of oil as Saudi Arabia and coal reserves that surpass any country in the world, would we be in a

better position to win the energy race with China and India? The answer is yes.

Well, we have that in America. We have oil reserves contained in oil shale throughout the West that rivals Saudi Arabia's deposits. We also have oil in Alaska, Louisiana, Montana, North Dakota, California, and Wyoming. Do the authors of cap-and-trade want to tap into that? No.

We have coal reserves in the West, Midwest, and the South that have been referred to as the Saudi Arabia of coal. These are in the States like Kentucky, Ohio, Illinois, West Virginia, Montana, and my home State of Wyoming. Do the authors of cap-and-trade want to truly tap into that? No.

America has that and more. We also have the uranium, the wind, the solar, the geothermal, the biomass, the hydro power. We have it all, and we can develop it in a responsible way.

What puts us in a better position to win the energy race with India and China? Well, the answer is American energy. The authors of cap-and-trade don't want to develop all-American energy resources; they want to start the energy race with China and India two laps behind, as opposed to three laps ahead.

The more energy America can produce, the stronger the American economy will be. Energy development creates jobs; not just green jobs, but real red, white, and blue jobs. We need to keep all the American jobs we can, we need them all, and the solution rests on our shores.

Thank you, Madam Chairman.

Senator BOXER. Thank you, Senator Barrasso.

Senator Merkley.

OPENING STATEMENT OF HON. JEFF MERKLEY, U.S. SENATOR FROM THE STATE OF OREGON

Senator MERKLEY. Thank you very much, Madam Chair.

It is a delight to have you all here today. As I was looking over your testimony, it is clear there is a central message: that we have here in the United States, right now, the technology, the resources, the know-how to build a clean energy economy; that economy will create jobs; it will cut our dependence on foreign oil; and it will reduce pollution. This sounds like a triple win. I look forward to hearing the details from all of you.

Thank you.

Senator BOXER. Thank you, Senator.

Senator Voinovich.

OPENING STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Senator VOINOVICH. First of all, I would like to say thank you for this hearing and echo the words of my friend from Tennessee, that if you look at where we get our energy in this country, we are only getting about eight-tenths of 1 percent from solar, about 1.4 percent from wind. And what we need to look at is nuclear; we need to look at coal.

It seems to me if we really wanted to reduce our emissions in this country, we would move very quickly on the nuclear and move very quickly to find technology that would capture and sequester

carbon so that we could continue using coal. We know that those people overseas are going to use it. And I think the Senator from Missouri made a good point when he said that in terms of oil, we need to find more and use less.

The public interest and private sector communities agree that the crucial factor that will determine whether we have an effective climate policy is the extent to which the policy will encourage the development and deployment of needed technology. Yet, regulation without sufficient available technology will result in high costs for American consumers while offering little hope that developing nations will answer the call to reduce their emissions.

Tackling the climate change problem is not something we can do alone. I agree that the U.S. should be a leader. But while carbon caps or taxes are difficult to sell to the developing world, access to new technology is not. That is why, Madam Chairman, I have introduced a bill to create a new committee in the Asia-Pacific partnership designed to enhance and focus international cooperation on clean energy technology development and commercialization. The bill is designed to help speed the widespread adoption of these technologies and provide an additional foreign to engage rapidly growing economies on the production and use of clean and efficient energy technologies.

That technology development is needed in the areas of carbon capture and sequestration, energy efficiency, and alternative sources of generation, such as nuclear, renewables, and alternative motor fuels and hybrids. That is without dispute.

But the Waxman proposal does not address these technological needs in a manner that is consistent with the bill's mandates. Recognizing the disconnect between what technology can delivery and the bill's objectives, the authors include numerous provisions to mask the strain this compliance burden will have on the economy, that, if all these provisions don't work out as planned—and Government programs rarely work out as planned—the costs could be enormous.

EIA's recent analysis offers a devastating critique of a proposal whose efficacy hinges upon a string of assumptions that defy political, practical, and technological realities. The analysis shows a range of impacts that may accompany the bill's implementation under a variety of technology and offset available assumptions. Notably, even in scenarios where low carbon technologies are deployed at paces that energy experts agree are implausible, there are significant economic costs.

But if offsets and the growth of new technology are more limited, the legislation could devastate the economy through increases in electricity prices of up to 77 percent, gasoline prices up to 33 percent, and natural gas up 75 percent, resulting in a cumulative hit to the GDP of $3.6 trillion by 2030, non-discounted.

Senator Baucus recently said let's face it, the bill we now consider is "a tax bill." I agree. It is not possible to look at putting a price on carbon in any other way. The Government is imposing a mandate with the intention of increasing prices to achieve a certain outcome. Accordingly, the costs associated with the bill should be considered with the seriousness that any tax measure is given.

Against this backdrop, I would say that I do support efforts to reduce greenhouse gas emissions. But our policy approach must be reasonable, and by that I mean it must ensure economic stability by not causing fuels switching, rapid rate increases, or economic dislocation. And this is contingent upon achievable requirements, that is, requirements that are consistent with the development and deployment of sources of low carbon energy. During a time when the national unemployment rate is at 9.5 and the national debt is $11 trillion, our first responsibility, folks, is to do no harm to the economy.

My goals are to keep this Nation's economy and that of Ohio on a sure footing while decreasing emissions. Climate change requires a long-term solution whose strategy is fully capable of accommodating the time necessary to reduce emissions in a manner that is consistent with low carbon technology development and deployment. We can greatly move the process forward if our policy approach embraces realistic goals, while providing the necessary resources and incentives to develop and deploy clean energy technologies.

[The prepared statement of Senator Voinovich follows:]

STATEMENT OF HON. GEORGE V. VOINOVICH,
U.S. SENATOR FROM THE STATE OF OHIO

Madam Chairman, the public interest and private sector communities agree that the crucial factor that will determine whether we have an effective climate policy is the extent to which that policy will encourage the development and deployment of needed technology. Yet regulation without sufficiently available technology will result in high costs for American consumers while offering little hope that developing nations will answer the call to reduce their emissions.

Tackling the climate change problem is not something we can do alone. I agree that the U.S. should be a leader. But while carbon caps or taxes are difficult to sell to the developing world, access to new technology is not. This is why I introduced a bill to create a new committee in the Asia Pacific Partnership designed to enhance and focus international co-operation on clean energy technology development and commercialization. The bill is designed to help speed the widespread adoption of these technologies and provide an additional forum to engage rapidly growing economies on the production and use of clean and efficient energy technologies.

That technological development is needed in the areas of carbon capture and sequestration; energy efficiency; and alternative sources of generation, such as nuclear, renewables, and alternative motor fuels and hybrids is without dispute. But the Waxman proposal does not address these technological needs in a manner that is consistent with the bill's mandates. Indeed, the requirements and mandates in the Waxman proposal are completely severed from what technology is able to deliver and will harm our competitive position in the global marketplace. Indeed, what we now consider is the most environmentally stringent climate change legislation proposed to date.

Recognizing the disconnect between what technology can deliver and the bill's objectives, the authors include numerous provisions to mask the strain this compliance burden will have on the economy. Yet, if all these provisions don't work out as planned (and government programs rarely work out as planned), the costs could be enormous.

EIA's recent analysis offers a devastating critique of a proposal whose efficacy hinges upon a string of assumptions that defy political, practical and technological realities. The analysis shows a range of impacts that may accompany the bill's implementation under a variety of technology and offset availability assumptions. Notably, even in scenarios where low carbon technologies are deployed at paces that energy experts agree are implausible, there are significant economic costs. But if offsets and growth in new technologies are more limited, the legislation would devastate the economy through increases in electricity prices of up to 77 percent, gasoline prices of up to 33 percent, and natural gas prices of up to 75 percent, resulting in a cumulative hit to GDP of $3.6 trillion by 2030 (non-discounted).

Reducing greenhouse gas emissions will require a technological revolution centered on the way we produce and use energy. That cannot be done without costs. But instead of accepting the economic impacts of reducing greenhouse gases and moving forward in a responsible manner, the authors and proponents of this legislation prefer to hold a basic economic principle—that there are no free lunches—in suspense. You can't get something for nothing; our economy is reeling right now because this principle has been ignored, and it is something we can no longer afford to do.

And while the impacts might not be as high as outlined above, it is disingenuous to claim that this bill's mandates can be met for the cost of a postage stamp a day. Senator Baucus, Chairman of the Senate Finance Committee, recently stated in an interview that the bill we now consider is "a tax bill." I agree. It's not possible to look at putting a "price on carbon" in any other way—the Government is imposing a mandate with the intention of increasing prices to achieve a certain outcome. Accordingly, the costs associated with this bill should be considered with the seriousness that any tax measure is given.

Against this backdrop I'll say that I do support efforts to reduce greenhouse gas emissions. But our policy approach must be reasonable, and by that I mean it must ensure economic stability by not causing fuel switching, rapid rate increases or economic dislocation. This is contingent upon achievable requirements, that is, requirements that are consistent with the development and deployment of sources of low carbon energy. During a time when the national unemployment rate is at 9.5 percent and the national debt is over $11.5 trillion, our first responsibility is to do no harm to the economy.

My goals are to keep Nation's economy, and that of Ohio, on a sure footing while decreasing emissions. Climate change requires a long-term solution whose strategy is fully capable of accommodating the time necessary to reduce emissions in a manner that is consistent with low carbon technology development and deployment. We can greatly move the process forward if our policy approach embraces realistic goals while providing the necessary resources and incentives to develop and deploy clean energy technologies.

Senator BOXER. Thank you.

Senator Cardin.

OPENING STATEMENT OF HON. BENJAMIN L. CARDIN, U.S. SENATOR FROM THE STATE OF MARYLAND

Senator CARDIN. Thank you, Madam Chair.

Let me thank our witnesses today.

I would ask unanimous consent that my entire statement can be placed in the record.

Let me just summarize by saying clean energy is important for this country for many reasons. We know it is important for national security as we become energy self-sufficient here in America. It is important for our environment. We know the impacts of global climate change and carbon emissions.

But it is also important for our economy. This is where the growth in jobs will be in America. GE understands that, Honeywell understands that, Motorola understands that, DuPont understands that, and they are prepared to move forward with new technologies in energy creating jobs here in America and saving jobs here.

The difficulty is we have to have a level playing field, and we don't have a level playing field today because for dirty energy we don't calculate the true costs. We don't put into the cost equations the health dangers that are created by the pollution. We don't put into the equations the environmental damage that is being done, the clean up that will be required in cleaning up our air and cleaning up our water. And we don't put in that the fact that there are built-in subsidies today for dirty energy that new technologies clean energy does not enjoy.

That came home to me, Madam Chairman, when BP Solar, a company located in Frederick, Maryland, doing very well in solar energy, was planning an expansion in Frederick. But because of the economic incentives, they took that expansion to Spain rather than America, and we lost those jobs because we were not as aggressive as we should have been in moving forward, as other countries are doing today. We don't want to be left behind.

Let me just point out I come from a proud manufacturing State. Maryland, and particularly Baltimore, has a rich history as a manufacturing hub, and we want to have a future in manufacturing in our community. And when I take a look at the turbine propellers, the motors, the towers, the transmission lines that are going to need to be developed, it is an opportunity for us to save and expand manufacturing jobs in America by expanding clean energy technologies. So I am bullish on clean technology for clean energy. I think that is where we are going to be having the job growth in America.

I was proud to be a supporter of President Obama's American Recovery and Reinvestment Act. This committee worked very hard on that Act. Madam Chairman, you were critically responsible for many of the provisions that were included in that Act that dealt with moving forward with our infrastructure, including our infrastructure to improve technology for clean energy.

Now, if I might, just yesterday, the Department of Energy announced $2.4 billion of grants from the recovery fund supporting the development and manufacturing and the next generation of batteries in electric vehicles. Now, part of those funds are going to go to a General Motors in White Marsh, Maryland. Now, here is a facility that has a future, but now has a much brighter future in keeping jobs in Maryland. We have lost manufacturing jobs in my State. That recovery bill is going to create jobs in my State and a good future for the people of Maryland.

And, by the way, we are going to develop the type of battery power and electric power so that we can have the next generation of vehicles in America that can compete anywhere in the world and help us with an energy policy that makes sense for our country. It is good for our environment, and it is also, by the way, good for our economy.

Thank you, Madam Chairman.

[The prepared statement of Senator Cardin follows:]

STATEMENT OF HON. BENJAMIN L. CARDIN,
U.S. SENATOR FROM THE STATE OF MARYLAND

Competition and innovation have always been a driving force behind the American economy. Our market based economy, coupled with sound and thoughtful business regulation, has fostered invention and created a profitable domestic market for entrepreneurs, across business sectors, to work within.

However, somewhere along the line we let the opportunity to play an early leadership role in clean energy technology development and production pass us by.

This is largely due to a national energy policy that has not fostered competition and innovation the way American business policy does for other sectors of the economy.

Our Nation's energy policy has subsidized the fossil fuel industry for years creating an unfair advantage in the marketplace for dirty fuels over clean energy alternatives. Some would argue that this has helped keep energy costs low. However, the market price for so-called "cheap" fuels, like coal and gasoline, does not take into

consideration the full cost of these fuels, be it to the environment, to the public's health or the taxpayer.

The full cost of dirty fuels is realized by consumers indirectly in the form of higher healthcare cost because of increased incidence of respiratory and pulmonary diseases associated with breathing dirty air, which in turn raises insurance premiums. We pay for it in our water bills because of coal and oil extraction's impacts on water quality that ultimately needs to be treated. We also pay for subsidies, cheap land leases, and environmental remediation through our taxes. If the energy production playing field were leveled, differences in cost would hardly be a factor in this debate.

While Congress continues to debate the merits of creating thousands of jobs in a new, clean energy economy, American companies like General Electric, Honeywell, Motorola and DuPont stand at the ready to produce clean technologies once the U.S. market becomes a viable place to market their clean technologies.

I am not impressed by big oil funded studies claiming incentives for clean energy development will cost America jobs. I can tell you that Maryland is losing jobs because we have NOT made clean energy a national priority.

In May 2007 BP Solar's headquarters, located in Frederick, Maryland, employed 2,000 workers in my State. A year after breaking ground on the second expansion of their Frederick headquarters, BP Solar altered its plans. The company decided to scale back its Maryland operations and move its manufacturing facility to Spain where government programs create greater incentives for renewable energy companies to do business.

While Europe, China, Japan, the Middle East and other parts of the world increase their investment in clean energy technologies it seems abundantly clear that the next frontier of technological innovations is going to be in clean energy development, and we can either help our country lead the way or watch the world pass us by.

For many regions of the country, particularly in the rust belt and the manufacturing plants of the Midwest, the economic downturn has been going on a lot longer than just the last few years. Manufacturing of clean energy components ranging from wind turbine propellers, motors and towers to solar photovoltaics, glass, frames, mounts, conduit and transmission lines are just some of the products that will need to be mass produced as we move toward a clean energy economy.

Fortunately, there are positive signs that legislation passed early this year is helping move us toward a clean energy economy now. Yesterday, the Department of Energy announced that $2.4 billion in Recovery Act funds aimed at supporting the development and manufacturing of the next generation of batteries and electric vehicles was sent out. This is welcome news to Baltimore County, Maryland, where workers at General Motors' White Marsh facility, which has had its share of struggles in recent years, will employ workers to produce critical clean transportation technologies.

Existing facilities in Michigan, Pennsylvania, Ohio, Indiana and in Maryland (Baltimore in particular) that are relics of a bygone manufacturing era can be retrofit to build clean energy products and bring life back to old manufacturing communities. That is why the United Steelworkers, with whom I met in my office a few weeks ago, support clean energy legislation that creates and protects new manufacturing opportunities for the United States. They also see the opportunity to build clean energy products not just for the U.S. market but for the world.

Addressing the challenge of global climate change is a Herculean task. So is righting the American economy. The urgency to do both, however, can provide the spark needed to transform the Nation to a clean energy economy.

Thank you, Madam Chairman, for holding this hearing, and I look forward to the testimony of our witnesses.

Senator BOXER. Thank you, Senator.

Senator Whitehouse.

OPENING STATEMENT OF HON. SHELDON WHITEHOUSE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator WHITEHOUSE. Thank you, Madam Chair. You have assembled a very distinguished panel of witnesses, and I think I may be the last person between us and them, so I don't want to go on. But I do want to emphasize very briefly some of the points that the distinguished Senator from Maryland made.

The first is how very important it is that we reset our economy toward a clean energy future. The consequences of failing to do that are manifold. There are national security consequences, economic consequences, jobs consequences, quality of life consequences, environmental consequences, and they are all going to become very real for our children and grandchildren if we fail to act.

But the second and related point that I want to leave us with is that I don't believe that our present status quo is some ideal state of nature from which any variation is an anomaly or an interference. The status quo right now is riddled with Government hand on the levers of our economy. It just happens to put those hands in places that benefit dirty, polluting industries. And to move Government's hand in a way that supports a better clean energy future is not a disturbance in the state of nature that some of my colleagues appear to presume the status quo represents; it is actually just making better decisions with the same Government power we use right now.

Right now, Government's hand provides incentives to pollute. Right now, Government's hand creates a failure in this country to meet the international market that exists for clean energy incentives and investment. Right now, Government's hand lays subsidies all over dirty fuel. So, really, all we are doing is resetting something that we have just set in the wrong place, rather than taking an ideal market and adding Government interference, and I just think that is a kind of basic fact we need to acknowledge in this debate.

I appreciate the hearing and will be delighted to get to the witnesses.

Senator BOXER. Thank you, Senator, very much.

So now we turn to our panel. The title of today's hearing, in case we forgot, is Climate Change and Ensuring That America Leads the Clean Energy Transformation.

We will hear first from Hon. Jon Wellinghoff, Chairman, Federal Energy Regulatory Commission, otherwise known as FERC.

STATEMENT OF HON. JON WELLINGHOFF, CHAIRMAN, FEDERAL ENERGY REGULATION COMMISSION

Mr. WELLINGHOFF. Thank you, Chairman Boxer. If I could have my full written remarks placed in the record, I will summarize from them.

Senator BOXER. Yes.

Mr. WELLINGHOFF. Chairman Boxer, Ranking Member Inhofe, and members of the committee, thank you for the opportunity to speak here today.

The Federal Energy Regulatory Commission and many States are using their existing authorities to remove barriers to the development of low carbon renewable resources to encourage greater efficiency in the electric system. These efforts are helping to reduce the emissions produced by the generation of electricity.

Our Nation, however, has a much greater ability to reduce emissions from the usage of electricity. Studies indicate we could add hundreds of gigawatts of renewable energy resources by 2030. In addition, a study issued last week by McKinsey & Company indi-

cated that on an economy-wide basis, energy efficiency alone could reduce our overall energy usage by nearly 25 percent.

A major reason why low carbon renewable resources and energy efficiency are not used more extensively is that greenhouse gas emissions are, in economic terms, an externality. For example, energy marketplace takes little or no account of the fact that certain types of coal production currently cause significant emissions of greenhouse gases, while resources such as wind turbines and energy efficiency do not.

Climate change legislation can change this. This legislation is a way to recognize in the energy marketplace the effect of greenhouse gases. Doing so will encourage more energy efficiency and the use of low carbon renewable resources, allowing us to reduce our greenhouse gas emissions while maintaining our quality of life.

Let me describe some of the Commission's efforts to reduce barriers to renewable energy development.

The Commission has limited the charges imposed on wind generators and other variable resources for deviating from the amount of energy they schedule to delivery to the grid, because these resources often have limited ability to control their output. While we have also approved rates to fund the development of transmission facilities needed to deliver resources such as hydroelectric power from Canada and wind power from the upper Midwest and from Montana and Wyoming. However, I would note it is highly unlikely that all of the transmission facilities needed to deliver the output of renewable resources will be constructed without additional Federal planning, siting, and cost allocation authority.

The Commission also is supporting the development of emerging hydrokinetic energy technologies, which use the power of ocean waves, tides, river currents to generate electricity. In April 2009, the Commission and the Department of Interior signed an agreement clarifying each agency's jurisdictional responsibilities for leasing and licensing renewable energy projects on the U.S. Outer Continental Shelf. This agreement will facilitate the development of offshore hydrokinetic projects, as well as wind and solar projects. Similarly, we have signed agreements with the State of Washington and the State of Oregon to coordinate the review of hydrokinetic projects in the waters off those States.

In addition, the incorporation of consumer energy use management, also called demand response, into the operation of the electric grid will reduce both consumer costs and carbon footprint of our electric supply. The Commission has required the country's regional transmission organizations and independent system operators to make filings that will ultimately reduce barriers to demand response. The Commission also recently issued a national assessment of demand response potential after the year 2019.

That assessment found the potential for peak electricity demand reductions across the country is as much as 188 gigawatts, up to 20 percent of our national peak demand. These savings, if realized, can reduce carbon emissions by over a billion tons annually.

Finally, Congress recently tasked the Commission to adopt smart grid standards. Last month, the Commission identified several priorities for the development of standards for smart grid technologies. The Department of Energy and the National Institute of

Standards and Technology also have major roles in the development of smart grid and we are working closely with those agencies and with States in collaboratively fostering our deployment of smart grid technology.

In conclusion, the Commission is using its statutory authorities aggressively to eliminate barriers to renewable resources and consumer energy use management, and to encourage greater efficiency in the electric energy system. But those efforts and the efforts of other Federal and State agencies, while helpful, are not enough to prevent the growing accumulation of greenhouse gases in our atmosphere. Climate change legislation is the key to altering this trend. This legislation will also set an example for the leadership of other countries and help our Nation change from an importer of energy to an exporter of energy technology. Congress should enact this legislation now.

Thank you again for the opportunity to testify today. I would be happy to answer any questions you may have.

[The prepared statement of Mr. Wellinghoff follows:]

Testimony of Jon Wellinghoff
Chairman, Federal Energy Regulatory Commission
Before the Committee on Environment and Public Works
United States Senate
August 6, 2009

Introduction

Chairman Boxer, Ranking Member Inhofe, and members of the Committee, thank you for the opportunity to speak here today. My name is Jon Wellinghoff, and I am the Chairman of the Federal Energy Regulatory Commission (FERC or Commission). My testimony addresses climate change legislation in the context of the energy industries. The Commission has regulatory authority over various aspects of these industries. The Commission seeks to assist energy consumers in obtaining reliable, efficient, and sustainable energy services at a reasonable cost through appropriate regulatory and market means.

One of the Commission's most important authorities is to regulate the rates, terms and conditions of transmission and sales for resale of electric energy by public utilities in interstate commerce. The Commission has used this authority to remove barriers to the use of "low carbon" renewable resources and to encourage greater efficiency in the electricity system. These efforts, as described below, and the similar efforts of many States are helping to reduce the emissions produced by the generation of electricity.

Our Nation, however, has much greater ability to reduce the emissions from its usage of electricity. For example, studies indicate that we could add hundreds of gigawatts of renewable energy resources by 2030. Similarly, a study issued last week by

McKinsey and Co. indicated that, on an economy-wide basis, energy efficiency alone could reduce our overall energy usage by nearly 25 percent. Moreover, this study did not consider the substantial additional potential for improved efficiency in the interstate electric system on the utility side of the meter. Only efficiency on the consumer load side of the meter was analyzed. Thus, the total potential for efficiency savings in this country is even greater than estimated by McKinsey.

A major reason why "low carbon" renewable resources and energy efficiency are not used more extensively is that the cost of greenhouse gas emissions is, in economic terms, an "externality." In other words, the effect of these emissions is not reflected in the energy marketplace. The market-based cost of producing electricity from coal as compared to, for example, producing electricity from wind turbines or reducing energy use through efficiency, takes little or no account of the fact that certain types of coal production currently cause significant emissions of greenhouse gases and wind turbines and efficiency do not.

Climate change legislation can change this. This legislation is a way to recognize, in the energy marketplace, the effect of greenhouse gases. Doing so will encourage more energy efficiency and use of "low carbon" renewable resources, allowing us to reduce our greenhouse gas emissions while maintaining our quality of life. We have extensive amounts of untapped renewable resources and large potential to use energy more efficiently. Climate change legislation will remove a major impediment to using those tools.

Renewable Resources

Renewable energy resources can not only help reduce greenhouse gas emissions, but also diversify the fuels used to generate electricity and reduce our dependence on foreign sources of energy. For example, solar photovoltaic systems installed on homes and businesses produce emission-free energy, especially during peak hours of energy usage. Other examples of emission-free energy sources include wind power and geothermal power.

Renewable energy already plays an important role in U.S. energy supply. Energy from renewable resources, excluding conventional hydroelectric generation, accounted for over three percent of U.S. generation in the most recent 12-month period (ending in April 2009) reported by the Energy Information Administration (EIA). Including conventional hydroelectric generation, renewable energy provides almost ten percent of total electric energy supplied, with wind energy production increasing significantly in recent years. In fact, since 2006, wind energy production has more than doubled, and its contribution to U.S. generation has more than doubled. New energy technologies such as wave, tidal, and advanced photovoltaics—coupled with new battery technologies—promise to make renewable resources an even more important contributor to our electricity supply.

FERC has taken a range of actions to reduce barriers to renewable energy development and deployment. For example, in FERC's Order No. 890, the Commission reformed transmission rates to exempt wind generators and other intermittent resources from the highest tier of "energy and generator imbalance penalties." (These are charges

for deviations between the amount of energy scheduled for delivery to the grid and the amount actually taken by a transmission customer or delivered by a generator, respectively.) This reform was important because intermittent resources have a limited ability to control their output, and must therefore be assured that imbalance charges are no more than is required to provide appropriate incentives for prudent behavior.

As another example, FERC recognized that its policy on allocating transmission interconnection costs can present a barrier to entry by location-constrained resources like renewable energy. To address this problem, FERC approved a variation from that policy proposed by the California Independent System Operator that should make it easier for California, and other regions that implement a similar approach, to meet state-level renewable energy requirements.

FERC also has approved rates to fund the development of transmission facilities needed for renewable resources. In May of this year, for example, FERC approved the funding arrangement for a major transmission project to deliver hydroelectric power from Quebec to New England, an effort expected to reduce greenhouse gas emissions by up to six million tons of carbon dioxide annually by displacing natural gas-fired generation. In April 2009, FERC approved rate incentives for proposed transmission facilities to deliver wind power from the upper Midwest to consumers in and around Chicago, Minneapolis, and other cities. In February 2009, FERC approved rates for two transmission projects to deliver wind power from Montana and Wyoming to consumers in Nevada and other Southwestern states.

Last year, the Commission addressed the delays of Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs) in processing the requests of planned generation projects to interconnect with the electric grid. Many of these projects are wind projects. The Commission required the RTOs and ISOs to file reports on their backlogs and their efforts to expedite interconnections. The RTOs and ISOs have since taken, or are planning, significant steps to reduce their interconnection backlogs.

A significant expansion of renewable resources in our electricity supply portfolio will impose other stresses on the electric grid, requiring additional high-voltage transmission facilities, network upgrades, and feeder lines. It is highly unlikely that the transmission facilities necessary to deliver the output of these renewable resources will be constructed without additional federal planning, siting, and cost allocation authority.

Hydrokinetic Energy

The Commission also is supporting the development of emerging hydrokinetic energy technologies, which use the power of ocean waves, tides, and river currents to generate electricity. The Commission has determined that new hydrokinetic technology can be tested in certain circumstances without the need for Commission authorization, has issued a policy statement regarding preliminary permits focusing on hydrokinetic projects, and has developed a "pilot license" process allowing for the expedited licensing in appropriate instances of hydrokinetic projects. FERC also has issued two licenses for such projects (including, in December 2008, the first installation of a hydrokinetic device

at an existing FERC-licensed hydroelectric project), and over 140 preliminary permits with the potential for approximately 8,400 megawatts of generating capacity.

In April 2009, FERC and the Department of the Interior signed an agreement clarifying the agencies' jurisdictional responsibilities for leasing and licensing in relation to renewable energy projects on the U.S. Outer Continental Shelf. This agreement will facilitate the development of offshore hydrokinetic projects as well as wind and solar projects. Similarly, the Commission has signed agreements with the State of Washington (in June of this year) and the State of Oregon (March 2008) to coordinate the review of hydrokinetic projects in the waters of those States. The agreements recognize that FERC and the States will undertake their regulatory efforts in an environmentally-sensitive manner that recognizes economic and cultural factors.

Consumer Energy Use Management

Consumer energy use management, also called "demand response", refers to consumers reducing their usage at certain times that will result in improved grid efficiency. Consumer energy use management increases efficiency by reducing transmission congestion, enhances the amount of variable renewable energy such as wind that can be integrated into the grid, and reduces the need to run inefficient and costly generators. Thus, the incorporation of consumer energy use management into the operation of the electric grid will reduce consumer costs, and will reduce the carbon footprint of our electricity supply.

In June, the Commission issued a national assessment of demand response potential, estimating the potential for consumer energy use management both nationally

and for each state, through 2019. The assessment found the potential for peak electricity demand reductions across the country is 188 gigawatts, up to 20 percent of national peak demand. These savings, if realized, can reduce significantly the number of power plants needed to meet peak demand and thereby reduce carbon emissions by as much as 1.2 billion tons of carbon annually.

Last month, the Commission (in its Order No. 719-A) reaffirmed that removing barriers to demand response in the RTO and ISO electricity markets is consistent with FERC's responsibilities under the Federal Power Act. FERC required filings by RTOs and ISOs addressing barriers to demand response in their markets. These filings ultimately will help facilitate even more use of demand response in the markets.

Smart Grid

Our nation's electric grid generally uses decades-old technology and has not incorporated new digital technologies extensively. Digital technologies have transformed other industries such as telecommunications. A similar change has not yet happened for the electric grid. Smart grid advancements will improve the efficiency of the bulk-power system and realize the efficiency improvements that are possible on the utility side of the meter. And they will help promote wider use of consumer energy use management and other activities that give consumers the tools they need to reduce electricity costs.

Last month, after considering comments from over 70 interested groups, the Commission adopted a policy statement on the smart grid. The Commission identified several priorities for the development of standards for smart grid technologies, including standards needed for the integration into the power system of demand response resources,

electricity storage facilities and electric transportation systems. The Commission also adopted an "Interim Rate Policy," specifying the criteria "early adopter" utilities must meet to recover their smart grid costs. The Department of Energy and the National Institute of Standards and Technology also have major roles in the development of the smart grid, and FERC is working closely with those agencies and with States in collaboratively fostering deployment of smart grid technology.

Conclusion

FERC is using its statutory authorities aggressively to eliminate barriers to renewable resources and consumer energy use management, and to encourage greater efficiency in the electricity system. But those efforts and the efforts of other Federal and State agencies, while helpful, are not enough to prevent the growing accumulation of greenhouse gases in our atmosphere. Climate change legislation is the key to altering this trend. This legislation will also set an example of leadership for other countries, and help our Nation change from an importer of energy to an exporter of "green energy technology." Congress should enact this legislation now.

Thank you again for the opportunity to testify today. I would be happy to answer any questions you may have.

August 6, 2009
Follow-Up Questions for Written Submission
Questions for Wellinghoff

Questions from:
Senator Benjamin L. Cardin

1. The fastest and possibly easiest ways to achieve carbon emissions reductions is by using less energy. As you point out, energy efficiency provides significant emission reductions but it is not captured in the economic analysis reductions [and] is not measurable in the marketplace. I find it particularly frustrating that the CBO does not score energy efficiency as a net saving to consumers.

- **As a regulator how would you recommend measuring the cost reductions of energy efficiency?**

I share your frustration that the substantial net savings to consumers associated with energy efficiency are not recognized more consistently. As stated in my testimony of August 6, there is great potential to increase efficiency on both the consumer side of the meter and the utility side of the meter. The former involves more efficient use of electricity by the consumer, which is generally referred to as energy efficiency. The latter involves more efficient production and delivery of electricity by suppliers, which can be referred to as supply-side efficiency.

It is possible to value energy efficiency by estimating the costs avoided both in the short-term and in the long-term. On a day-to-day basis, consumers who invest in energy efficiency will use less electricity, and, therefore, utilities will incur less cost to produce electricity. In the long-term, this slowed growth in demand for electricity means that utilities will need to invest less in new generating capacity and associated resources to maintain resource adequacy. A recent study by McKinsey & Company estimated cost savings of $1.2 trillion associated with $520 billion in investment in energy efficiency.[1]

Cost savings related to increased supply-side efficiency also can be estimated by identifying avoided costs. There are many ways to increase supply-side efficiency, such as steps to optimize the operation of generation and transmission facilities. In the short term, increased consumer energy use

[1] McKinsey & Company, *Unlocking Energy Efficiency in the U.S. Economy*, July 2009.

management (also called demand response) promotes that goal by, for example, diminishing the need to dispatch less efficient generating facilities. Moreover, running generating units more efficiently will over time allow utilities to invest less in new generating capacity, achieving the same type of long-term cost savings described above. Similarly, increasing the capacity and efficiency of transmission lines could allow utilities to reduce real-time production costs, as transmission line losses decrease and more cost-effective generation resources gain access to electric markets. Because the above-noted McKinsey study did not address these considerations, the total potential for savings associated with increased efficiency is even greater than the estimate presented in that study.

2. The 2007 Energy Independence and Security Act included a number of provisions to boost energy efficiency. These included new energy efficiency standards for lighting and appliances.

- **Were these new energy efficiency requirements something that manufacturers have been able to incorporate into products quickly?**

- **While I know it may be difficult to parse out the energy saving resulting from these efficiency specifications, are we able to gleam notable energy savings resulting from increased energy efficiency requirements?**

The Commission has not attempted to identify the extent to which manufacturers have implemented the energy efficiency requirements of the Energy Independence and Security Act of 2007 (EISA). However, the Electric Power Research Institute (EPRI) has estimated the energy savings from efficiency efforts, including the savings attributable to the requirements of EISA. By 2030, EPRI estimates that current energy efficiency measures will lead to 162 TWh of energy savings, which represent 3.4 percent of the total projected 2030 consumption.[2]

In addition, several studies have estimated further potential consumption savings that could be achieved through increased energy efficiency. For example, the above-noted EPRI study presents a "moderate" case that involves 398 TWh of achievable potential reduction in electricity consumed by 2030, or an 8 percent reduction. As I noted in my testimony, the McKinsey study referred to above indicated that, on an economy-wide basis, energy efficiency alone could reduce our overall energy usage by nearly 25 percent.

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[2] Electric Power Research Institute, *Assessment of Achievable Potential for Energy Efficiency and Demand Response Programs in the U.S.*, January 2009.

Senator Amy Klobuchar

1. Could you please expand briefly on the innovation needed to build and link a new energy transmission system across the country? How quickly can a smart grid realistically be deployed? Are there limitations that restrict the speed at which this technology can be adopted? What technological improvements are needed to include every American home in a smart grid system?

A robust electric transmission grid is essential to achieving many of our Nation's goals, such as promoting fuel diversity, reducing greenhouse gas emissions, strengthening our national security, revitalizing our economy, and ensuring reliability in the delivery of electricity. The Commission has taken a number of important steps in recent years to promote the development of such a transmission system. At present, however, there are gaps in the Commission's statutory authority, and the resulting absence of an adequate regulatory framework is a significant obstacle to developing a transmission system that can support these goals. To overcome that obstacle, I have encouraged Congress to consider three closely related issues: planning, siting, and cost allocation.

With respect to planning, the scope of existing regional initiatives needs to be expanded. To achieve greater benefits and efficiencies in transmission planning, we must create a structure that includes coordination on an inter-regional basis. With respect to siting, states should continue to have the opportunity to site transmission facilities, but transmission developers should have recourse to the Commission as a federal siting authority under appropriate circumstances. Federal siting authority would be helpful even if limited to transmission facilities needed to reliably meet renewable energy goals. Lastly, if Congress determines that there are broad public interest benefits in developing the transmission system necessary to meet the goals discussed above, then Congress should consider clarifying the Commission's authority to allocate the costs of such infrastructure to the load-serving entities within an interconnection or part of an interconnection where it is appropriate to do so. Of course, the Commission would need to ensure, as we do today, that those costs are allocated fairly to the appropriate entities and that due deference is accorded in regions that work together to develop cost allocation mechanisms that garner broad support.

To achieve its full potential, however, our electric transmission grid must be not only robust and reliable, but also smart. The development of a smart grid represents a fundamental shift in the operation of our Nation's electric system that will help us to meet new challenges, such as the need to integrate unprecedented amounts of variable renewable generation.

It is important to recognize that putting a smart grid in place will not require the wholesale replacement of our existing transmission infrastructure. Indeed, we will still need the same basic building blocks to serve electricity consumers: generation resources, transmission lines, distribution lines, and devices located at the individual end user. The smart grid will simply use additional technology, including technological improvements in American homes, to allow those building blocks to be used in new ways. For example, advanced sensors deployed on transmission lines can enable more efficient use of those lines without compromising safety and reliability, while appropriate technology at individual residences can enable consumers to better manage their electricity needs and to provide demand response services useful to the grid. Given the sheer size of our electric system, this incorporation of new technologies will be a significant undertaking. However, utilities and developers have already begun to take the first steps toward achieving that goal.

The development of a smart grid presents a number of challenges. As Congress recognized in the Energy Independence and Security Act of 2007 (EISA), the adoption and implementation of interoperability standards is one important step toward developing a robust smart grid. As I stated in my testimony of August 6, the Commission recently adopted a Smart Grid Policy Statement in which we identified several priorities for the development of standards for smart grid technologies.[3] The Department of Energy and the National Institute of Standards and Technology, as well as stakeholders involved in the standards process, also have major roles in the development of the smart grid. The Commission is working closely with those agencies, States, and other stakeholders in collaboratively fostering deployment of smart grid technology.

Second, because of the integral role that two-way data communication plays in the development of a smart grid, appropriate cybersecurity must be addressed in any smart grid technology deployment. The Commission's recent Smart Grid Policy Statement includes steps to ensure that cybersecurity is adequately addressed.

A third challenge involves how to deal with legacy systems currently in use on the electric grid, such as control room energy management systems. In many cases, those systems will remain useful for years to come. It may be possible to design smart grid interoperability standards in such a way as to incorporate some of these legacy systems into the ultimate smart grid architecture. In other cases, it may not be possible to accommodate certain legacy systems in the movement to

[3] *Smart Grid Policy*, 128 FERC ¶ 61,060 (2009).

the smart grid architecture. Whether or not the benefits of new smart grid capabilities outweigh the costs of prematurely replacing certain legacy systems will need to be decided on a case-by-case basis by individual utilities and their regulators, as implementation of equipment and technologies is considered. Although the Commission also addressed this issue in its Smart Grid Policy Statement with regard to facilities within its jurisdiction, a significant portion of the investment in question is subject to regulation by state and local authorities.

2. Last Month, Google announced it may have found a way to produce electricity using large scale geothermal energy at a cheaper price than coal. Given that companies like Google are making major strides in developing clean energy technologies, and that countries like China are outpacing our investments in clean energy technology, what will it take for us to go far enough in supporting R&D for clean energy technologies?

I agree that it is essential for our Nation to invest in clean energy technology research and development. A greater emphasis on demonstration and deployment of clean energy technologies also goes hand in hand with continuing research efforts, identifying areas in which research is likely to be particularly beneficial as we secure benefits from technologies that are already available.

As I stated in my testimony, a major reason why "low carbon" renewable energy resources and energy efficiency are not used more extensively is that the cost of greenhouse gas emissions is currently an externality. I believe that recognizing, in the energy marketplace, the effect of greenhouse gases will encourage both greater deployment of such resources and further research and development. In recent years, FERC has also taken a number of actions to remove regulatory barriers to participation by clean energy resources in wholesale electricity markets. I remain committed to identifying additional actions that could be taken to remove regulatory barriers that inhibit investment in clean energy technologies, and I look forward to working with my fellow Commissioners in exploring this issue.

Senator BOXER. Thank you so much.

Our next speaker will be Hon. David Sandalow, Assistant Secretary for Policy and International Affairs at the U.S. Department of Energy. Welcome.

STATEMENT OF HON. DAVID B. SANDALOW, ASSISTANT SECRETARY FOR POLICY AND INTERNATIONAL AFFAIRS, U.S. DEPARTMENT OF ENERGY

Mr. SANDALOW. Thank you, Chairman Boxer, Ranking Member Inhofe, and members of the committee. Thank you for the chance to testify today.

I have traveled to China twice in the past 2 months. During those trips, I have seen the impressive investments that country is making in clean energy. Chinese companies are investing in advanced clean coal technologies. They are developing huge wind farms. They are building ultra-high voltage long distance transmission lines, and they are launching electric vehicle programs in 13 major cities.

In Europe, sustained investments in clean energy have helped create widespread economic opportunities. Denmark, with a land area less than West Virginia and a population smaller than Chicago's, is the world's leading producer of wind turbines. The Danish wind turbine manufacturing industry employs more than 20,000 people and earns more than $4 billion each year.

Germany and Spain are the world's top installers of solar photovoltaic panels, accounting for nearly three-quarters of the global market, worth $37 billion last year.

In Brazil, more than half of the gasoline supply has been replaced with ethanol made from sugar cane, and more than 80 percent of the cars sold in Brazil last year were flex fuel.

Madam Chairman, the world is on the cusp of a clean energy revolution. Whether the United States is a leader or laggard in that revolution depends on decisions we as a Nation make in the months and years ahead.

The Obama administration has started to lay a strong foundation. The American Recovery and Reinvestment Act provides more than $80 billion of clean energy investments, expected to create hundreds of thousands of new jobs. This includes $11 billion to make our electric grid more efficient, $5 billion to weatherize low income homes, and $3.4 billion to accelerate deployment of carbon capture and storage technologies.

In May, President Obama announced the largest improvement ever in the fuel efficiency of the vehicle fleet, and just yesterday, as Senator Cardin has described, President Obama announced $2.4 billion of investments in American battery and electric vehicle industry, which will result in thousands of jobs while reducing our dependence on oil.

But these steps will not be enough. Transforming our energy economy will require comprehensive energy legislation to drive sustained American investment over a period of decades. As my boss, Energy Secretary Steven Chu, has said, we must get in the game and play to win.

We should start with energy efficiency. Today, American families and businesses are burdened with energy waste. A McKinsey

study, cosponsored by DOE and released last week, identifies potential efficiency opportunities available that could reduce fossil fuel emissions by the year 2020 by more than 10 percent, while saving the economy $700 billion. Let me repeat that. While saving the economy $700 billion.

As we work to improve this efficiency, we should also work to enhance our renewable resources. A recent DOE report concluded that with major national commitment to clean energy, wind could provide 20 percent of electricity by 2030. Our solar resources are also extraordinary.

The challenge we face is to harness these resources and grow our economy in the 21st century. Renewable energy presents a once in a generation business opportunity.

Now, as we accelerate this new industrial revolution, coal will remain an important part of our energy mix. We should also make full use of this domestic asset, but do so in ways that allow us to meet our energy needs, minimize environmental impacts, contribute to national security, and compete in global markets. Carbon capture and storage technologies offer an important path to achieving those multiple goals.

Today, nuclear power provides 20 percent of our electricity and 70 percent of our carbon-free electricity. The Obama administration is committed to restarting the domestic nuclear power industry. It is working on $18.5 billion in loan guarantees for nuclear power plants. A cap-and-trade mechanism as part of comprehensive legislation provides important advantages for nuclear power in the competition against other energy sources that emit greenhouse gases.

Natural gas is another fuel with great potential to aid the transition to a clean energy economy. In the past several years, due to technological advances, our recoverable reserves of natural gas have more than doubled in this country.

Now, last month the House passed historic comprehensive clean energy legislation. The Obama administration strongly supported House passage of the bill, which would help position the United States as a global leader in clean energy. Your chamber now holds the pen, and the Administration looks forward to working with you to swiftly enact strong legislation that will reward efficiency and clean energy innovation. Working together, we can enact legislation that ensures economic recovery, creating millions of good new jobs, while laying the foundation for a clean energy future.

I ask that my entire statement be put in the record and thank you, Madam Chairman, for the opportunity to participate in this hearing.

[The prepared statement of Mr. Sandalow follows:]

Statement of
David Sandalow
Assistant Secretary of Energy for Policy and International Affairs
Before the
Committee on Environment and Public Works
United States Senate

"Climate Change and Ensuring that America Leads the Clean Energy Transformation"

Washington, D.C.
August 6, 2009

Chairman Boxer, Ranking Member Inhofe, and Members of the Committee, thank you for the opportunity to testify today.

I have traveled to China twice in the past two months. During those trips I have seen the impressive investments that country is making in clean energy. Chinese companies are investing in advanced clean coal technologies. They are deploying huge wind farms. They are building ultra-high-voltage long-distance transmission lines with low line loss. They are launching programs to deploy electric vehicles in 13 major cities.

In Europe, sustained investments in clean energy driven by supportive policies have helped create economic opportunity. Denmark – with a land area less than West Virginia and a population smaller than the Chicago metropolitan area – is the world's leading producer of wind turbines. The Danish wind turbine manufacturing industry employs more than 20,000 people and earns more than $4 billion each year. Germany and Spain are the world's top installers of solar photovoltaic panels, accounting for nearly three-quarters of a global market worth $37 billion last year.

In Brazil, more than half the gasoline supply has been replaced with ethanol made from sugarcane. More than 80 percent of the cars sold in Brazil last year were flex-fuel.

The world is on the cusp of a clean energy revolution. Whether the United States is a leader or laggard in that revolution depends on decisions we as a nation make in the months and years ahead.

The Obama Administration has started to lay a strong foundation. The American Recovery and Reinvestment Act provides more than $80 billion of clean energy investments, expected to create hundreds of thousands of jobs. This includes $11 billion to make our electrical grid more efficient and connect it to sources of renewable power, $5 billion to weatherize low-income homes, and $3.4 billion to accelerate the deployment of carbon capture and storage (CCS) technologies.

In May, President Obama announced the largest improvement ever in the fuel efficiency of the U.S. vehicle fleet. President Obama's announcement yesterday of $2.4 billion of investments in the American battery and electric vehicle industry will result in the creation of thousands of jobs while reducing our dependence on oil.

But these steps will not be enough. Transforming our energy economy will require comprehensive energy legislation to drive sustained American investment over a period of decades. As my boss Energy Secretary Steven Chu has said, we must "get in the game and play to win."

We should start with energy efficiency. Today, American families and businesses are burdened with energy waste. A DOE co-sponsored McKinsey study released last week identifies potential efficiency opportunities available today that could reduce fossil-fuel CO_2 emissions in the year 2020 by more than 10 percent below 2005 levels – while yielding up to $700 billion in net lifecycle savings to the economy. Indeed, such savings could continue to underpin U.S. emissions reduction efforts well beyond 2020. The National Academy of Sciences' *America's Energy Future* report, also released last week, estimates that energy efficiency has the technical potential to more than offset projected business-as-usual increases in energy consumption through 2030.

As we work to become more energy-efficient, we must also make increasing use of the abundant renewable energy resources right here in the United States. Today, less than 2 percent of U.S. electricity comes from wind, yet a DOE report concluded that with a major national commitment to clean energy, wind could potentially provide 20 percent of our electricity by 2030 while creating 500,000 jobs in the wind sector and reducing emissions by 825 million tons of CO_2 per year. Our solar resources are also impressive. DOE's Sandia National Laboratory has estimated that solar power plants covering an area in the U.S. Southwest 100 miles on a side – 0.3 percent of total U.S. land area – could hypothetically meet the entire country's electricity needs.

The challenge we face is to harness American ingenuity and use these resources to grow our economy in the twenty-first century. Renewable energy presents an enormous, once-in-a-generation business opportunity, and we must recognize that if we don't seize it, others will. As noted by venture capitalist John Doerr in his testimony before this committee on July 16, the United States is now home to only one of the ten largest solar PV producers in the world, only one of the top ten wind turbine producers and only two of the top ten advanced battery manufacturers.

As we accelerate this new industrial revolution, coal will remain a key part of our energy mix, so we must ensure that it's burned cleanly. Coal generates around half of our electricity – and based on current rates of consumption, we have at least a 100-year supply. We should make full use of this domestic asset, but should do so in way that allows us to meet our energy needs, minimize environmental impacts, contribute to national security and compete in global markets.

Carbon capture and storage (CCS) technology offers us a path to achieving those multiple goals. The National Academy of Sciences' report concludes that it is technically feasible, through retrofitting and new construction, to ensure that the entire U.S. coal fleet employs CCS by 2035,

potentially eliminating over 2 billion tons of CO_2 per year – that's around a third of projected fossil-fuel CO_2 emissions.

Today, nuclear power provides 20 percent of our electricity and 70 percent of our carbon-free electricity. The Obama Administration is committed to restarting the domestic nuclear power industry and is working on $18.5 billion in loan guarantees for nuclear power plants. A cap-and-trade mechanism as part of comprehensive energy legislation provides important advantages for nuclear power in the competition against other energy sources that emit greenhouse gases.

Natural gas is another fuel with great potential to aid the transition to a clean-energy economy. Greenhouse-gas emissions from natural gas-fired plants are less than half those from conventional coal-fired power plants. In just the last several years, innovations in technology have almost doubled recoverable reserves of natural gas in the United States by allowing recovery from previously inaccessible reservoirs. Natural gas is especially well-suited to balancing fluctuations in load in intermittent renewable energy production.

The win-win opportunities here cannot be overstated. Investment in efficiency and clean energy enhances security, protects the environment, improves health, stimulates technological innovation, and drives economic growth.

Last month the House passed historic comprehensive clean energy legislation billed as the American Clean Energy and Security (ACES) Act. The Obama Administration strongly supported House passage of the ACES Act, which would help position the United States as a global leader in this area. The Senate now holds the pen, and the Administration looks forward to working with you to swiftly enact strong legislation that will reward efficiency and clean energy innovation. Working together, we can enact legislation that ensures economic recovery by creating millions of good new jobs while laying the foundation for a clean energy future.

Thank you for the opportunity to participate in this hearing. I'm pleased to take your questions.

QUESTION FROM SENATOR CARDIN

Q1. This committee has heard from a number of witnesses about how both developed and developing countries around the world are making greater investments clean energy for the future. I am happy to hear that the Department of Energy is paying close attention to what the world is doing not just to remind us that we need to catch up but to also identity potential markets for US companies to export products. The United States has always been the land of innovation and I am certain that we can turn out the best renewable energy technologies for the world.

- What is your sense of foreign interest in purchasing American clean technologies?

A1. Foreign interest in purchasing American clean energy technologies is high. Examples here include Westinghouse's AP1000 third-generation nuclear reactor and GE's steam turbine design, both licensed for use in China. Additionally, according to the EIA, U.S. export shipments of photovoltaic cells and modules have more than quadrupled from 1999 to 2007. I am confident that with comprehensive energy legislation and the impressive investments in the Recovery Act, we can harness American ingenuity to keep our clean energy businesses competitive and sustain U.S. leadership in these critical technologies.

QUESTION FROM SENATOR CARDIN

Q2. It is good to know that Vestas and other foreign clean technology companies are investing in the US market and opening facilities in the US. But, Maryland has in fact lost jobs to other countries that are taking a more proactive approach to developing clean energy.

- What needs to happen to spur more US companies to invest in clean energy in the US?

A2. Long-term, stable deployment policies are important to spur increased investment in clean energy and to attract manufacturers to the United States. Historically, the unpredictable nature of Federal incentives (such as production and investment tax credits) has made it difficult for the private sector to expand domestic manufacturing. The Recovery Act's incentives provide increased certainty at the Federal level and have enabled the private sector to maintain or increase investments in energy efficiency and renewable energy. The Recovery Act scale and the duration of some its provisions are keys to building domestic jobs.

Some specific initiatives which relate to increasing clean energy production and energy efficient manufacturing in the United States include:

- Grants in lieu of production tax credits that are incentives for the installation of wind, solar and geothermal energy. The opportunity to apply for grants is open now and will be available through 2010.
- $2.3 billion in IRS tax credits fostering the manufacture and use of renewable energy and energy efficiency equipment.
- Financing for manufacturing of advanced technology vehicles and components in the United States. Applications are still being accepted for the Department's direct loan program.

Additional long-term policies could help mitigate concern over a stable clean energy market, as could further expansion of State-level policies. In recent years, State and local governments have exhibited leadership in offering targeted incentives.

QUESTION FROM SENATOR KLOBUCHAR

Q1. Could you please expand briefly on the innovation needed to build and link a new energy transmission system across the country. How quickly can a smart grid realistically be deployed? Are there limitations that restrict the speed at which this technology can be adopted? What technological improvements are needed to include every American home in a smart grid system?

A1. Innovation is needed in the regulatory, policy, business, and technological realms for a new energy transmission system. The regulatory innovation involves appropriately factoring in long-term, future benefits and added future costs into the regulatory utility model in making current investment decisions, as well as devising and implementing market economics to drive electricity consumption. The policy innovation involves building regional, sub-regional, and interconnection-wide planning and coordination efforts, including standards conformance for interoperability and cyber security. The business innovation involves properly structuring performance-based incentives to encourage adoption of cutting-edge technologies and decoupling revenues from electricity sales in the utility business model. The technological innovation involves developing and integrating cost-effective solutions into the existing grid infrastructure while transforming it to meet next-generation system needs.

The Department has developed a national vision and technology roadmap for Grid 2030—a transformed, modernized electric grid in 2030 to meet the needs for electricity's second 100 years. This timeline, developed in 2003 with action items updated with latest developments, continues to align with the latest industry estimate as reported in the Electricity Advisory Committee December 2008

report, which states that "over the next 20 years, the utility industry must spend an estimated $500 billion on infrastructure just to meet the projected demand for electricity in the U.S."

On top of the innovations above, the current financial crisis has exerted significant limitations on what utilities and consumers can afford to invest in adopting smart grid technologies. Countering that are the direct investments, loan guarantees, and tax incentives from the American Recovery and Reinvestment Act on smart grid deployments. Most significantly, the Department is providing nearly $4 billion in Recovery Act funding to support deployment of smart grid technologies and smart grid demonstration projects. This investment is expected to significantly accelerate deployment of smart grid technologies such as smart meters that can enable customers to control their energy use and digital sensors that provide real time system data to improve reliability and help better manage peak demand.

With respect to technological improvements needed for American homes, the Department focuses on integrating communication/information/electricity infrastructure to: enable broad participation in demand response, through smart meters/in-home energy management systems/demand-responsive appliances; enable charging and billing practices for plug-in electric vehicle operations; readily integrate distributed resources at customer premises for enhanced

valuation; and improve power quality and reliability of electricity delivery, through enhanced outage management and restoration practices.

QUESTION FROM SENATOR KLOBUCHAR

Q2. Last Month, Google announced it may have found a way to produce electricity using large scale geothermal energy at a cheaper price than coal. Given that companies like Google are making major strides in developing clean energy technologies, and that countries like China are outpacing our investments in clean energy technology, what will it take for us to go far enough in supporting R&D for clean energy technologies?

A2. The Administration is committed to making the United States a leader in clean energy technology. The combination of increased annual appropriations to the DOE Office of Energy Efficiency and Renewable Energy (EERE), Recovery Act funding ($16.8 billion for EERE), a commitment to a faster implementation of U.S. energy and environmental regulations as well as new energy legislation with unmatched technological resources will make the United States the leader in clean energy development over the coming decade.

Long-term, stable deployment policies are essential spurring increased investment in clean energy in and luring manufacturers to the United States. The unpredictable nature of Federal incentives (production and incentive tax credits) has, historically, made it less attractive for the private sector to expand manufacturing in the United States. The Recovery Act's longer term tax incentives and grants in lieu of tax credits provide some certainty at the Federal level and have enabled the private sector to maintain or increase investments in energy efficiency and renewable energy. Additional long-term policies could help mitigate concern over a stable clean energy market, as could further expansion of State-level policies.

QUESTION FROM SENATOR WHITEHOUSE

Q1. The future role of nuclear energy has played a central role in the debate over setting energy policy for the United States. This debate has included determining the viability, both financially and technologically, of developing new advanced nuclear energy projects. One such advanced nuclear technology being discussed is the "traveling-wave" reactor. What is your analysis of "traveling-wave" reactor technology in terms of its viability as a future energy source in the United States? Has the Department of Energy tested the "traveling-wave" reactor model? If so, how was the testing done and what were the results? In your analysis of the viability of the "traveling-wave" reactor from a scientific and technological perspective, please also include in your response your analysis of the financial, environmental, and national security considerations related to developing this technology.

A1. The traveling-wave reactor has not been analyzed or tested by the Department, and so we have no views at this time on its viability.

Senator BOXER. Thank you so very much.

Next we will hear from Hon. Thomas Strickland, Assistant Secretary for Fish, Wildlife, and Parks, U.S. Department of Interior, speaking on behalf of Interior Secretary Ken Salazar.

STATEMENT OF HON. TOM STRICKLAND, ASSISTANT SECRETARY FOR FISH, WILDLIFE, AND PARKS, U.S. DEPARTMENT OF THE INTERIOR

Mr. STRICKLAND. Thank you, Chairman Boxer, Ranking Member Inhofe, and members of the committee. On behalf of Secretary Salazar, I am pleased to be here to speak about the work underway at the Department of Interior to transform our energy economy to one based on clean and renewable natural resources. I thank you, and the Secretary does, for your leadership on this important issue.

We are entering a new day for energy production and use in the United States, a time of increased renewable energy from domestic sources and more efficient use of energy from all sources. Together, these are the foundation of a clean energy era that will improve the environment and create jobs. As President Obama has said, there is a choice before us: we can remain the world's leading importer of oil or we can become the world's leading exporter of clean energy.

The Department of Interior has the responsibility of managing approximately 20 percent of America. These lands not only contain some of our most treasured landscapes and historic sites, but also some of our most productive energy areas.

Up until recently, the focus of this energy production has been on conventional energy resources, including oil, gas, and coal. To be sure, the continued development of these resources is essential to our energy security. But we also have enormous potential for renewable energy development on our public lands. And under the leadership of President Obama and Secretary Salazar, we are aggressively pursuing these opportunities.

We have prioritized the development of renewable energy on our public lands and the OCS. Bureau of Land Management has identified over 20 million acres of public land with wind energy potential in 11 western States and over 29 million acres with solar energy potential in 6 southwestern States. There are also over 140 million acres of public land in western States and Alaska which yield thermal resource potential as well as significant biomass potential on Federal lands.

These public lands have the potential to produce a total of 2.9 million megawatts of solar, enough to power eight times the total number of U.S. households, 206,000 megawatts of wind, enough to power 62 million homes; and 39,000 megawatts of geothermal energy. There is also significant wind and wave potential on our offshore waters. The National Renewable Energy Lab, a Department of Energy national laboratory, has identified more than 1,000 gigawatts of wind potential off the Atlantic coast and more than 900 gigawatts of wind potential off the Pacific coast.

The American business community is responding, as Mr. Sandalow indicated. On June 23, 2009, Department of Interior announced five limited leases to construct meteorological towers in support of offshore wind energy development off the coasts of New

Jersey and Delaware, the first of their kind ever offered by the Federal Government. Companies are also investing in solar facilities in the Southwest and wind and geothermal energy projects throughout the West.

At the same time we are concentrating on the development of our renewable energies, we are also maintaining our production of oil and gas. Currently, the Outer Continental Shelf acreage produces 15 percent of America's domestic natural gas and 27 percent of our oil.

In sum, we have abundant clean renewable energy resources on public lands and off our coasts, which taken together will provide a substantial portion of our energy portfolio by 2020 and beyond.

Renewables are not the only way to reduce our carbon emissions. We can store carbon both in the ground and in plants, and the Department is actively pursuing the work necessary to make that technology a reality through geologic carbon sequestration and biological carbon sequestration. Under congressional leadership in the 2007 Energy Policy Act, the Department is developing the methodologies and standards to accompany these efforts on a commercial scale.

The BLM is working with the Department of Energy on regional partnerships that promote carbon sequestration demonstration projects and promoting these efforts on public lands. The BLM is currently active in two demonstration projects, a deep saline sequestration project in Farmington, Utah, and an enhanced coal bed methane project in New Mexico's San Juan Basin.

Saving America's treasured landscapes through landscape scale conservation efforts will be one of the major contributors our public lands will make to the carbon reduction efforts. The carbon reduction potential produced by the biological sequestration of carbon plants and soils taking up and storing carbon in many ecosystem types, including but not limited to forest, grasslands, and wetlands, has not yet been fully quantified but could be virtually endless. We have a number of demonstration projects, in fact, throughout the country focused on these particular efforts.

The experience of our land managers in pursuing these projects is part of our broader ecosystem responsibilities, and that should be useful to the committee as you develop an offset program that credits verifiable carbon reductions that are associated with environmentally sound land management policies on private lands.

In conclusion, Madam Chairman, a problem as complex as climate change takes the coordinated efforts of all the branches of the Federal Government, cooperation with States and localities, and collaboration with leaders from around the world. The Department of Interior is prepared to play a leading role in this effort.

I would also like permission to have my written remarks added to the record.

Senator BOXER. Without objection, we will.

[The prepared statement of Mr. Strickland follows:]

Statement of Thomas L. Strickland
Assistant Secretary for Fish, Wildlife and Parks
Department of the Interior
Climate Change
And Ensuring that America Leads the Clean Energy Transformation
Committee on Environment and Public Works
U.S. Senate
August 6, 2009

Chairman Boxer, Ranking Senator Inhofe and members of the Committee, I am pleased to appear on the panel before you today to discuss climate change and the work underway at the Department of the Interior to transition our energy economy to one based on clean and renewable natural resources. Ensuring that America is at the forefront of this effort presents both significant challenges and tremendous opportunities for our nation. Thank you for your leadership on this important issue.

INTRODUCTION: ISSUE OF OUR TIME

We are entering a new day for energy production and use in the United States – a time of increased renewable energy from domestic sources and more efficient use of energy from all sources – together, these are the foundation of a clean energy era.

A new clean energy economy will deliver new jobs for Americans and strengthen our long-term economic and energy security. In the 1960s, President John Kennedy described to the nation a vision of getting America to the moon within 10 years. We were able to do it in less than 10. In the same way that the Apollo project worked then, today we are going to take our "moon shot" of the 21st century, which is getting us to energy independence. As President Obama has said, there is a choice before us: we can remain the world's leading importer of oil . . . or we can become the world's leading exporter of clean energy.

The United States is well-positioned to lead the clean energy transformation and Interior's land, energy, and natural resource management responsibilities offer significant opportunities. The Department of the Interior manages 500 million acres of land, one-fifth of the land mass of the United States and another 1.7 billion acres of the Outer Continental Shelf (OCS). This land base includes areas which boast some of the highest quality renewable energy resources available for development today: solar in the southwest; wind in the Atlantic, on the Great Plains and in the west; and geothermal in the west. We are working to develop these assets to help power President Obama's vision for a new energy economy. The scope of Interior's land ownership also gives us an important role in siting the new transmission lines needed to bring stranded renewable energy assets to load centers, all in an ecologically sensitive manner.

Since coming into office, Interior has prioritized the development of renewable energy on our public lands and OCS. American business is responding. Companies are investing in wind farms off the Atlantic seacoast, solar facilities in the southwest, and geothermal energy projects throughout the west. Power generation from these new energy sources produces virtually no greenhouse gases and, when installed in an environmentally sensitive manner, they harness abundant, renewable energy that nature itself provides and with minimum impact.

CLEAN ENERGY FUTURE

Since the beginning of the Obama Administration in January, we at the Department of the Interior have been focused on these issues, working with stakeholders and our federal, state, and local partners to take the appropriate actions to set the country on a course toward a clean new energy economy.

On April 9, 2009, the Secretary and Federal Energy Regulatory Commission (FERC) Chairman Jon Wellinghoff signed an agreement that clarifies our agencies' jurisdictional responsibilities for leasing and licensing renewable energy projects on the U.S. Outer Continental Shelf. The Memorandum of Understanding establishes a process for the Department and FERC to efficiently advance the development of wind, solar, wave, tidal and ocean current energy sources, while maintaining mandated consultation with the National Oceanic and Atmospheric Administration's authorities and responsibilities for stewardship of marine ecosystems and living marine resources.

In June of this year, the Department responded to a 2007 Congressional directive with a report that outlines a recommended framework for a national carbon storage program on public lands. Such a program may help develop cleaner energy and reduce greenhouse gasses. The report, titled, *Framework for Geological Carbon Sequestration on Public Land*, is an important step toward developing a national program that makes effective use of the vast underground carbon storage capacity of federal lands, the resource management expertise of Interior's Bureau of Land Management (BLM), and the science capabilities of the U.S. Geological Survey (USGS) to reduce harmful carbon dioxide emissions into the atmosphere.

On June 23, 2009, Interior announced five limited leases to construct meteorological towers in support of offshore wind energy development off the coasts of New Jersey and Delaware, the first of their kind ever offered by the Federal Government. The following week, the Secretary, along with Majority Leader Harry Reid, released "fast-track" initiatives for solar energy development on western lands. This means we will provide resources that expedite efficient, effective, and focused environmental review. Under these initiatives, federal agencies will work with western leaders to designate tracts of U.S. public lands in the west as prime zones for utility-scale solar energy development,

fund environmental studies, open new solar energy permitting offices and speed reviews of industry proposals.

Our nation's public lands offer some of the highest renewable energy potential in the country. The BLM has identified a total of approximately 20.6 million acres of public land with wind energy potential in the 11 western states and approximately 29.5 million acres with solar energy potential in the six southwestern states. There are also over 140 million acres of public land in western states and Alaska with geothermal resource potential.

There is also significant wind and wave potential in our offshore waters. The National Renewable Energy Lab, a Department of Energy national laboratory, has identified more than 1,000 gigawatts of wind potential off the Atlantic coast, and more than 900 gigawatts of wind potential off the Pacific Coast[1].

Renewable energy companies are eager to partner with the government to develop this renewable energy potential. We have an obligation to efficiently guide development in a way that is sensitive to anticipated and unintended environmental impacts to public trust resources and responsible with taxpayer dollars. Unfortunately, today, on BLM lands in our southwestern states, there is a backlog of over 158 solar energy applications. In addition, there are some 281 proposed wind development projects on BLM lands in the west. Moving forward with these projects would further our energy and climate goals while also creating engineering and construction jobs.

To help focus the Department of the Interior on the importance of renewable energy development, on March 11, 2009, the Secretary issued his first Secretarial Order. The order makes facilitating the production, development, and delivery of renewable energy on public lands and the OCS top priorities for the Department. These goals will be accomplished in a manner that does not ignore, but instead protects our signature landscapes, natural resources, wildlife, and cultural resources.

The order also established an energy and climate change task force within the Department, drawing from the leadership of each of the bureaus. The task force is responsible for, among other things, quantifying the potential contributions of renewable energy resources on our public lands and the OCS and identifying and prioritizing specific "zones" on our public lands where the Department can facilitate a rapid and responsible move to significantly increased production of renewable energy from solar, wind, geothermal, biomass sources, and incremental or small hydroelectric power on existing structures, and biomass sources. The task force is prioritizing the intra-Department permitting and appropriate environmental review of transmission rights-of-way applications on public lands for transmission lines to deliver renewable energy generation to consumers, and is working to resolve obstacles within the Department to renewable energy permitting, siting, development, and production on federal lands without compromising environmental values.

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[1] http://www.nrel.gov/wind/pdfs/40045.pdf

Developing these renewable resources requires a balanced and mindful approach that addresses the impacts of development on water, wildlife and other natural resources while working closely with other federal agencies and state and local governments where necessary. We at Interior recognize this responsibility and it is not a charge the Secretary takes lightly.

At the same time, we must recognize that we will rely on conventional sources – oil, gas, and coal – for a significant portion of our energy for many years to come. Therefore it is important that the Department continue to responsibly develop these energy resources on public lands.

CARBON SINKS: GEOLOGICAL AND BIOLOGICAL

The challenges of addressing carbon dioxide accumulation in the atmosphere are significant. A variety of strategies are being investigated to reduce emissions and remove carbon dioxide from the atmosphere. Such strategies include "geologic carbon sequestration" – or the physical capture of carbon dioxide from major sources and subsequent injection into geologic formations and "biological carbon sequestration" – or the storage of carbon in our nation's plants and soils in ecosystems across the country.

The Department of the Interior has experience overseeing the injection of carbon dioxide into certain geologic formations. Carbon dioxide (CO_2) injection techniques have useful practical applications in processes known as enhanced oil recovery (EOR), which currently take place on some public lands managed by the BLM. These processes are utilized for a different purpose than a carbon sequestration program – that is, allowing the recovery of additional energy resources from older oil and gas fields – but BLM's experience in overseeing EOR operations may provide valuable insights into designing a carbon sequestration regulatory regime.

We anticipate the need for the BLM to collaborate with other federal agencies, tribes, states, the private sector, and public interest groups as we move forward in improving our understanding of carbon injection and storage and addressing legal and policy issues that may arise during development of geological carbon sequestration projects.

As the nation's largest land manager, the BLM is entrusted with the multiple-use management of 253.3 million acres of land, and administers 700 million acres of sub-surface mineral estate of which the surface owners are federal agencies, states, or private entities. The Department diligently executes our responsibilities to make these resources available in an environmentally-sound manner. Within the framework of a transparent public process, and necessary federal, state and local agency consultation and coordination, we carefully consider habitat, groundwater, air and other resources; mitigate impacts through best management practices, stipulations and conditions of approval; and balance development with other uses across the landscape.

In addition to experience in administering a large-scale mineral leasing program, Interior has the expertise to contribute to geologic sequestration projects in other ways, as well.

For instance, we have an existing framework for issuing rights-of-way on public land that could serve future needs for carbon dioxide pipelines across public lands. Other programmatic and land management expertise, such as the experience of the BLM and the Fish and Wildlife Service (FWS) in evaluation of potential environmental impacts of projects, will facilitate this effort. The USGS will play an important role in recommending geologic criteria that may be incorporated into a set of "best practices" for geologic site selection.

Congress has already recognized Interior's experience with geologic injection of carbon dioxide. Section 711 of the Energy Independence and Security Act (EISA; Public Law 110-140) required the USGS, as mentioned above, to complete a methodology to assess geologic CO2 storage resources with input from the Department of Energy (DOE), Environmental Protection Agency (EPA), state geological surveys, and others. Currently, the USGS is in the process of assembling review comments and expert evaluations of the methodology so that it can be finalized. The USGS plans to apply this methodology in a national assessment of geologic storage resources in depleted oil and gas fields and saline formations. The initial stages of this assessment are funded in the President's Budget for Fiscal Year 2010.

Section 713 of EISA directs the BLM to maintain records on, and an inventory of, the quantity of carbon dioxide stored within Federal mineral leaseholds. The BLM is currently implementing the carbon dioxide capture and storage provisions of the EISA and is nearing completion of an initial inventory of carbon dioxide stored within federal lands up to the end of Fiscal Year 2008 and will update this inventory annually. Section 714 of the EISA directs the Secretary of the Interior to submit a report to Congress containing a recommended framework for geological sequestration on public lands. Through the BLM, in coordination with the USGS, the EPA, the DOE, and other appropriate agencies, the Department examined criteria for identifying candidate geological sequestration sites in several specific types of geological settings.

The opportunities for carbon emissions reduction provided by the "biological sequestration" of carbon are additional important considerations. Plants and soils take up and store carbon in many ecosystem types, including but not limited to forests, grasslands, and wetlands. Pursuant to section 712 of the Energy Independence and Security Act of 2007 (P.L. 110-140), the USGS has the responsibility to conduct a national assessment of biologic carbon sequestration, ecosystem greenhouse gas fluxes, and potential effects of management practices and policies on ecosystem carbon sequestration and greenhouse gas emissions. The USGS is well underway with this work and is consulting with the Department of Energy, the Department of Agriculture and others in preparing this assessment. Combined with the work of other agencies, it will help to enhance the scientific information to support reductions in carbon emissions and increases in carbon sequestration through land use practices. Land management that stores carbon in our ecosystems has significant mitigation potential; Interior has the expertise to support carbon sequestration activities as part of its wide range of stewardship responsibilities, which also include restoration of wildlife habitat, ensuring a

clean and abundant water supply, and complementing land, wildlife, and natural resource management efforts in the face of a changing climate.

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I also would like to point out that the Interior Department has been engaged in a variety of projects that will teach us a great deal about biological sequestration, ranging from wetlands restoration projects in the mid-Atlantic and southeast, to afforestation projects in the lower Mississippi Valley, and habitat restoration projects in the west. The methodologies that USGS is developing at the direction of Congress and the experience of our land managers in pursuing these projects as part of our broader ecosystem responsibilities should be useful to the committee as you develop an offsets program that credits verifiable carbon reductions that are associated with environmentally sound land management practices on private lands.

CONCLUSION

In all of these activities, the Department of the Interior is putting a premium on integrating our dual science and land management roles. Scientists in the USGS, the Fish & Wildlife Service, and the National Park Service, for example, are working hand-in-glove with our land, wildlife and water managers who are responsible for the more than 500 million acres of public lands that we oversee. We are focused on ensuring that the USGS and other bureau scientists are collecting and analyzing data that provide relevant scientific information about natural resource conditions, the impacts of climate change on our lands, water and wildlife, and identifying best management practices to support decision-making regarding our public lands that make use of the best available scientific knowledge. This is, and needs to be, an interactive process, as the nation's natural resource managers work with scientists and identify areas that would benefit from further research on and analysis of the reality of on-the-ground changes. Scientific information – baseline data, trends detection, modeling and forecasting, together with the effective dissemination of information and decision support tools – is key to understanding and addressing climate change and its effects.

Madame Chairman, a problem as complex as climate change takes the coordinated efforts of all the branches of the federal government, cooperation with states and localities and collaboration with leaders from around the world. The Department of the Interior stands ready with our shoulder to the wheel to contribute to this effort.

Thank you. I look forward to answering your questions.

Senator BOXER. Thank all of you. You know, when Senator Inhofe went through what happened since we changed the gavel here from Senator Inhofe to myself, he left out a couple of things that I wanted to make sure we looked at. One was the Supreme Court ruling that carbon is a pollutant covered by the Clean Air Act, and the subsequent action by the EPA, very important action, that built on the work of the Bush administration that we knew, through hearings, had been there, which is to take the first steps toward an endangerment finding. And under the Clean Air Act, we have got to protect our families from pollution.

So here we are at a circumstance where the Supreme Court ruled that carbon is in fact covered by the Clean Air Act. The first steps to the endangerment finding have been made.

The other thing that happened that Senator Inhofe didn't mention is we did change Presidents.

So now you have a circumstance where you have a court, the highest court in the land, saying once there is an endangerment finding, clearly, we have to act, and we have a President who believes that this is an economic opportunity.

So my question to any of the three of you that would like to engage in it is this. One way or another, we are going to have to lessen the carbon in the atmosphere. It is either through the Clean Air Act or through some flexible legislation that we are all looking at. The House has passed a version of it which gives tremendous flexibility.

Now, my colleagues on the other side, I think I wrote it down, one of them said, it is a tax and cap scheme. I don't know of any taxes in it whatsoever and, as far as I know, there will be lots of tax credits in it to help our consumers.

So my question is, one way or another, we are going to have to address carbon pollution. Do you feel the flexibility that we could put together in a well crafted bill would make it better for businesses and our consumers and create more jobs?

Mr. SANDALOW. Without question, Madam Chairman. And I would just start by focusing on the energy efficiency opportunities that this country faces. Right now, American families and businesses are burdened with energy waste. It is like trying to run a race with an iron ball chained to your foot. There is so much that we can do as a Nation to improve our competitiveness simply by using energy more efficiently. The study that several of us have referred to says that we can save $700 billion a year in the next decade. That is not a small amount of money.

I was talking recently to a glass manufacturer who described to me how his company has made glass that would save lots of energy, but he can't move it because of the structure of the real estate markets. He can't sell this glass, which costs a little bit more, because contractors have an incentive only to put in low bids. So that is the type of problem that we need to overcome with things like codes that are in the bill that came out of the House in order to solve this problem of all the energy waste in our country.

Senator BOXER. Anybody else wish to comment?

Mr. WELLINGHOFF. Madam Chairman, I would add to that. I think one of the most important things about cap-and-trade is, in fact mechanism, and I think we need to move to market mecha-

nisms to solve our problems, but to do that we need to ensure that those markets are structured correctly. So I think that that is what we are attempting to do, is correctly structure the market in ways that we internalize the externalities to ensure that the market will make the right selections.

Mr. STRICKLAND. And I would just add, Madam Chairman, that, as part of the whole calculus to make all this work, we need to have adequate sources of renewable energy, and we believe we have that now in a variety of areas. Again, in the public lands, we have a huge backlog of applications for solar projects. We used some of the Recovery Act money to establish four offices through the Southwest to accelerate the process of these solar applications and enable Secretary Salazar to put forth regs for the development of wind on the Outer Continental Shelf, which is a huge potential resource.

Senator BOXER. OK. I also wanted to point out that, under the analysis of the House bill, it is projected that 161 new 1,000-megawatt nuclear power plants would result from that bill as a result of putting a price on carbon there through the market. Senator Alexander urges the building of 100 new nuclear power plants, and we believe that would cost ratepayers $70 billion a year. So I believe that anyone who is very fervently for nuclear power should be for this type of global warming legislation, because it will spur more nuclear power and ratepayers will be assisted through tax credits.

So I am confused as to why some of the proponents of nuclear power are missing this point, and I guess I would like to ask Mr. Wellinghoff if he has seen that analysis, because you get more nuclear power plants, it costs the ratepayers far less, and most of the nuclear power companies I know are supporting this legislation.

Mr. WELLINGHOFF. Yes, Madam Chairman. I haven't seen that specific analysis, although I think I have seen some reports of it. And, again, I think it comes back to market mechanisms. To the extent that you make fossil fuel generation more expensive and nuclear power less expensive, then ultimately it is going to drive those technologies into the market.

Senator BOXER. Thank you.

Senator Inhofe.

Senator INHOFE. Thank you, Madam Chairman.

First, before I start out, I have some unanimous consent requests to make. Last week, you inserted in the record a statement refuting the study by the Spanish Professor Alvarez on the green job study, and I would like to insert into the record that study and also his response to your statements about that.

Senator BOXER. Sure. And we will put ours back in there as well so they can be side-by-side.

Senator INHOFE. And then we will put one in, too.

Senator BOXER. Yes.

[The referenced document follows:]

BEFORE THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

HEARINGS ON "CLIMATE CHANGE AND ENSURING THAT AMERICA LEADS THE CLEAN ENERGY TRANSFORMATION"

AUGUST 6, 2009

TESTIMONY OF GABRIEL CALZADA ÁLVAREZ, PHD

My name is Gabriel Calzada Álvarez. I am an Associate Professor at King Juan Carlos University in Madrid, where I teach Environmental Economics. I am the founder and president of the Spanish think tank, Instituto Juan de Mariana, which in March 2009 released our study on the Spanish experience with "green jobs."

SUMMARY

President Obama has made clear his intention to follow Europe's lead in employing state intervention in the economy to "create" what are called "green jobs", specifically as a path out of the current economic troubles. Europe's experience actually suggests that this is precisely the wrong approach, and I appreciate the opportunity to comment for your hearing record on our research which put these claims to the test using official data.

Our study sought to answer the seminal question—what was the price of Spain's attempt to lead the world in a clean energy transformation. Our research shows that that price was high. Here are some highlights from our study:

- For every 1 green job financed by Spanish taxpayers, **2.2 real jobs were lost** as an opportunity cost.
- **9 out of 10** green jobs created by Spain over the past 10 years are no longer in existence today.
- Since 2000, Spain has spent **€571,138 ($753,778) to create each "green job,"** including subsidies of more than €1 million ($1,319,783) per wind industry job.
- Those programs resulted in the destruction of nearly **113,000 jobs** elsewhere in the economy.
- **Each "green" megawatt installed destroyed 5.39 jobs** in non-energy sectors of the Spanish economy.

Spain has already attempted to lead the world in a clean energy transformation. But my research shows that Spain's policies were economically destructive.

For a Spanish economist it is hard to understand why a market-oriented country like the U.S. with relatively low unemployment would want to learn how to create jobs from an economically interventionist country like Spain where the unemployment rate is historically much higher (presently around 18% and rising). Spain might still have some original and efficient policies to show the rest of the world but unfortunately renewables aid is not one of them.

A SHORT HISTORY OF SPAIN'S ATTEMPT TO CLEAN THE WORLD IN A CLEAN ENERGY TRANSFORMATION

Although what the president has called "new" energy sources such as wind and solar have been around for centuries, the idea of a broad state-financed regime supporting renewable energy in Europe dates back to 1997 (EU White paper "Energy for the future: renewable sources of energy"). The creation of jobs in the "renewables" industry emerged as one of the main justifications and focal points of the plan.

Ten years later, the Commission presented an energy and climate policy package that would "set the pace for a new global industrial revolution." On January 23rd 2008, the very same day that the Commission proposed the package in the new directive, Commission President José Manuel Barroso said that the proposal would be "an opportunity that should create thousands of new businesses and millions of jobs in Europe. We must grasp that opportunity."

The same idea was repeated, albeit with different tones, by various political leaders, giving fodder to a press release by the Commission that captured comments by its members under the title, "Boosting jobs and growth by meeting our climate change commitments."

Spain, the country with the greatest problem with Kyoto's cap and trade agreement—having increased emissions more than 50% over the base year when the Spanish-committed target was 15%—saw renewables as a possible solution to its emission woes.

During the 2004 general election campaign the socialist candidate, José Luis Rodríguez Zapatero, promised "a reorientation of the energy model (...) towards one that is more centralized, more diversified and safe, less wasteful and also more solidary" (meaning it requires payment by many into a system "for the common good" from which they achieve little benefit). It was a change in energy policy that would take place—and this is paramount—"built on all renewables, and in particular, solar energy."

Soon after approving a new Royal Decree, Prime Minister Zapatero defended the change from the existing energy model to his energy model "of the future"—which Spain would lead, using language similar to that now employed in the U.S. — and correlated his efforts in the promotion of renewables with the creation of a high volume of jobs in the renewable energy sector. History would partially prove him right.

PRESIDENT OBAMA PROMOTES THE SPANISH MODEL

On January 16th, 2009, president-elect Barack Obama visited an Ohio business that manufactures components for wind power generators. Under the watchful eyes of both factory workers and the press, Obama assured, amid deepening unemployment and the onset of one of the gravest economic crises in recent history, that renewable energy "can create millions of additional jobs and entire new industries."

The president then defended his energy subsidy package by citing examples from other countries: "And think of what's happening in countries like Spain, Germany and Japan, where they're making real investments in renewable energy. They're surging ahead of us, poised to take the lead in these new industries." He repeated this reference to the Spanish model as a basis for his plan on several other occasions.

President Obama is correct in observing that Spain provides a reference for the establishment of government aid to renewable energy. *No other country has given such broad support to the construction and production of electricity through renewable sources.* The arguments for Spain's and Europe's "green jobs" schemes are the same arguments now made in the U.S., principally that massive public support would produce large numbers of green jobs. The question that we and my colleagues have tried to answer through extensive academic research is "at what price?"

THE RENEWABLE ENERGY BUBBLE—HOW WAS IT CREATED?

The way Spanish politicians have supported renewable energy production is the so-called feed-in price system or tariff. Under this scheme, distributors of energy pay the producers of renewable energy a regulated price above the market price, reaching more than 100% over market price in wind energy and over 500% in solar photovoltaic energy. This system has led to a myriad of decrees by which politicians and bureaucrats have tried to find the price that would stimulate renewable energies at the lowest possible cost.

Under those stimuli wind energy grew from 1,715 installed MW at the beginning of 2000 to 14,836 MW at the end of 2008. In the same period of time solar photovoltaic energy production grew from practically nothing at the beginning to almost 3,000 MW. The growing installed capacity produced a significant growth in related jobs: from a small number of workers to 50,200 equivalent jobs (not contracts). Moreover, according to one of Spain's largest trade unions only 9.58% of the contracted green jobs at the renewable sector were in the field of maintenance and operation, and 66.27% in construction, fabrication and installation. Therefore, the growth of the installed capacity meant more public aid but it also meant more contracted workers in a field like installation, construction and fabrication that can only be sustained by additional plants that in return require new public aid.

The feed-in price system and the bubble produced a deficit to the energy distributors (called the rate deficit) that the government promised to repay. The rate deficit (mainly produced by renewable subsidies) that started in year 2000 with 250 million Euros and in year 2008 was already 5 billion Euros, has now an accumulated amount of over 16 billion Euros (more than $23 billion USD).

Given Spain's experiment with feed-in tariffs, I was very surprised to learn from the publication *Greenwire* that two US Congressmen, Representatives Bill Delahunt and Jay Inslee are preparing a similar feed-in tariff law for your country. Our experience shows this will be economically disastrous for consumers of electricity and the government. The only ones who benefit…and benefit handsomely…. are the corporate interests who are paid princely sums for their fashionable but inefficient energy.

OPPORTUNITY COST

Public investment in renewable energy cites job creation as one of its explicit goals, which, given the current economic crisis, suggests an intention of seeding a future recovery with "green job" subsidies. The problem with this plan is that the resources used to create "green jobs" must be obtained from elsewhere in the economy. Therefore, this type of policy tends to create not just a

crowding-out effect but also a net destruction of capital insofar as the investment necessary must be subsidized to a great extent and this is carried out by absorbing or destroying capital from the rest of the economy.

The money spent by the government cannot, once committed to "green jobs", be consumed or invested by private parties and therefore the jobs that would depend on such consumption and investment will disappear or not be created. Moreover, if the electricity produced by these sources ends up costing more to consumers, economic damage is compounded.

Investment in green jobs will only prove convenient if the expense by the public sector is more efficient at generating wealth than the private sector. This would only be possible if public investment were able to be self-financing without having to resort to subsidies, i.e., without needing to absorb wealth generated by the rest of the economy in order to support a production that cannot be justified through the incurred incomes and costs. We have calculated that the total public subsidy in Spain, both spent and committed, totals 28,671 million Euros (€28.7 billion or appx. $41.4 billion USD at present exchange rates), and sustained 50,200 jobs. In other words every green job the government program has tried to create has cost 0.571 million Euros ($824,000 USD). *This number should also be placed in the context of an economy that is less than 1/10th the size of that in the United States.* (2008 Spain GDP $1.378 trillion vs. $14.29 trillion for US)

In order to know how many net jobs are destroyed or avoided—as opposed to "created or saved"—by a green job program, for each one that it is intended to create we use two different methods: with the first, we compare the average amount of capital destruction (the subsidized part of the investment) necessary to create a green job against the average amount of capital that a job requires in the private sector; with the second, we compare the average annual productivity that the subsidy to each green job would have contributed to the economy had it not been consumed in such a way, with the average productivity of labor in the private sector that allows workers to remain employed.

JOBS

Using Spain as a model, and optimistically treating data funded in part by the European Commission, we find that for every renewable energy job that the State manages to finance, by two different methods, that the U.S. should expect a loss of at least 2.2 jobs on average, or about 9 jobs lost for every 4 created, *to which we have to add those jobs that non-subsidized investments with the same resources would have created.*

The study calculates that the programs creating those jobs also resulted in the destruction of nearly 110,500 jobs elsewhere in the economy, or 2.2 jobs destroyed for every "green job" created.

Since 2000 Spain spent €571,138 to create each "green job", including subsidies of more than €1 million per wind industry job.

ENERGY

Each "green" megawatt installed destroys 5.28 jobs on average elsewhere in the economy: 8.99 jobs lost per mWh of photovoltaics, 4.27 by wind energy, and 5.05 by mini-hydro. ("mini-hydro" includes low-head and other inefficient forms of hydropower)

These costs do not appear to be unique to Spain's approach but instead are largely inherent in schemes to promote renewable energy sources.

The total over-cost—the amount paid over the cost that would result from buying the electricity generated by the renewable power plants at the market price—that has been incurred from 2000 to 2008 (adjusting by 4% and calculating its net present value [NPV] in 2008), amounts to 7,918.54 million Euros (appx. $11.4 billion USD)

The total subsidy spent and committed (NPV adjusted by 4%) to these three renewable sources amounts to 28,671 million Euros ($41.35 billion USD at present exchange rates).

WHO PAYS?

To pay for this experiment, Spanish citizens must therefore cope with either an increase of electricity rates or increased taxes (and public deficit), as will the U.S. if it follows Spain's model.

The price of a comprehensive electricity rate (paid by the end consumer) in Spain would have to be increased 31% to repay the historic debt generated by this rate deficit mainly produced by the subsidies to renewables, according to Spain's energy regulator.

Renewables consume enormous taxpayer resources. In Spain, the average annuity payable to renewables is equivalent to 4.35% of all VAT collected, 3.45% of the household income tax, or 5.6% of the corporate income tax for 2007.

The regulator should consider whether citizens and companies need expensive and inefficient energy—a factor of production usable in virtually every human project—or affordable energy to help overcome the economic crisis instead.

The Spanish system also jeopardizes conventional electricity facilities, which are the first to deal with the electricity tariff deficit that the State owes them.

During this period, renewable technologies remained the beneficiaries of new credit while others began to struggle, though this disparate treatment was solely due to subsidies, mandates and related programs. As soon as subsequent programmatic changes take effect, which has become necessary due to "unsustainable" solar growth, its credit will also cease.

Principally, the high cost of electricity affects costs of production and employment levels in metallurgy, non-metallic mining and food processing, beverage and tobacco industries.

The high cost of electricity due to the green job policy tends to drive the relatively most electricity-intensive companies and industries away, seeking areas where costs are lower. The

example of the stainless steel manufacturer Acerinox, which exported its growth from Europe to Kentucky thereby creating U.S. and not European manufacturing jobs, is just such a case. I am surprised that the United States, which has seen the benefits of lower electricity prices in attracting business investment and jobs from other countries, would be considering a similar course and expecting a different result.

CONCLUSION

The study offers a caution against a certain form of green energy mandate. Minimum guaranteed prices generate surpluses that are difficult to manage. In Spain's case, the minimum electricity prices for renewable-generated electricity, far above market prices, wasted a vast amount of capital that could have been otherwise economically allocated in other sectors. Arbitrary, state-established price systems inherent in "green energy" schemes leave the subsidized renewable industry hanging by a very weak thread and, it appears, doomed to dramatic adjustments that will include massive unemployment, loss of capital, dismantlement of productive facilities and perpetuation of inefficient ones.

These schemes create serious "bubble" potential, as Spain is now discovering. The most paradigmatic bubble case can be found in the photovoltaic industry. *Even with subsidy schemes leaving the mean sale price of electricity generated from solar photovoltaic power 7 times higher than the mean price of the pool, solar failed even to reach 1% of Spain's total electricity production in 2008.*

The energy future has been jeopardized by the current state of wind or photovoltaic technology (more expensive and less efficient than conventional energy sources). These policies will leave Spain saddled with and further artificially perpetuating obsolete fixed assets, far less productive than cutting-edge technologies, the soaring rates for which soon-to-be obsolete assets the government has committed to maintain at high levels during their lifetime.

This proves that the only way for the "renewables" sector—which was never feasible by itself on the basis of consumer demand— to be "countercyclical" in crisis periods, or lead a state out of economic difficulty— is also via government subsidies which of course is a problematic approach. These schemes create a bubble, accelerated as soon as investors find in "renewables" one of the few profitable sectors while when fleeing other investments. Yet it is axiomatic, as we are seeing now, that when crisis arises, the Government cannot afford this growing subsidy cost either, and finally must penalize the artificial renewable industries which then face collapse.
In sum, I would urge the Committee to closely investigate the experience that other nations have had with renewable energy schemes as we have done with our analysis of the Spanish model. Deliberately pursuing more expensive and less efficient energy sources is a road to economic disaster, and many citizens of a nation are hurt when such policies are pursued.

Senator INHOFE. Also, since you made the statement it is not a tax, I would like to insert into the record the statement by the Chairman of the Finance Committee and a member of this Committee, Senator Baucus, who says it is a tax measure, it is a tax bill, and the House bill referred to the Committee will be automatically referred to the Finance Committee as a tax bill into the record.

Senator BOXER. Sure. There are tax credits in it, yes, Senator. Go ahead.

Senator INHOFE. OK.

[The referenced statement was not received at time of print.]

Senator BOXER. We are going to start this clock regardless of who puts what in the record. I took it out of my time, so go right ahead.

Senator INHOFE. Let me just ask the three of you. One of the consistent things that we keep coming up with, it goes all the way back to when Vice President Gore had Tom Wigley ask him the question, he said that if we were to pass the Kyoto Treaty, and for our discussion purposes, the Kyoto and all the bills that were offered in 2003, 2005, and 2008 are essentially cap-and-trade bills.

Wigley came out with the response that what would happen if all developed nations would live by the emission requirements of Kyoto. He said it would reduce the temperature by not more than seven one-hundredths of one degree Celsius. Then we had, just the other day, Chip Knappenberger, an environmental scientist in the New Hope Environmental Services, came out with the same thing. He came out with it would reduce it by one-tenth of one degree. Then Lisa Jackson said it wouldn't reduce it at all.

So I want to ask each panel member do you think, if we were to pass the Markey bill as it is today, that it would have the effect of reducing the CO_2 worldwide? Real quickly.

Mr. SANDALOW. I do, Senator Inhofe. I think the analyses you are citing assume that America won't lead and that America won't innovate. As I travel around the world, what I hear is the rest of the world is waiting for the United States to take strong steps and eager to follow American leadership in this area, and so many others. And I also believe in American entrepreneurial spirit and our ability, once entrepreneurs get strong signals from this city, to move forward.

Senator INHOFE. We are running out of time here.

I think that this is an honest difference of opinion because we have all the statements from people, from the officials in India and China and elsewhere, that say, no, we are not going to do it. But again, anyone else want to respond to that question?

Secretary Strickland, do you think it is going to reduce the overall CO_2 if we pass this thing?

Mr. STRICKLAND. I am not a scientist, Senator, as you know, and I don't have the scientific background to be able to offer my own independent judgment. I support the position of the Administration with respect to the goals of that.

Senator INHOFE. We have heard, time and time again, that America possesses just 3 percent of the world's oil reserves and that we use 25 percent of the world's oil. Yet, that 3 percent number refers only to the Nation's 21 billion barrels of proven reserves. Now, to prove reserves, you have to drill, and if you can't drill, then

you can't prove the reserves. Eighty-three percent of America's Federal onshore lands are either inaccessible or restricted due to our policies here. Eighty-five percent of the offshore continental United States is still off limits.

Now, a more honest assessment combines our 21 billion of proven reserves—Senator Barrasso talked about this—with the MMS, the BLM, the USGS estimates of undiscovered technically recoverable oil resources. That shows American oil resources equal to 149 billion barrels of oil, or 7 times the number cited by the Democrats, and those are conservative Government estimates.

And he would say don't forget coal that is methane hydrates and oil shale. The Rand Corporation estimates up to 1.1 trillion recoverable barrels of oil from oil shale in the Green River formation, Colorado, Utah, Wyoming. To put that into perspective, 1.1 trillion barrels equals more than 2,000 years' worth of imports from Saudi Arabia.

So I think it is clear that we have these resources, and I would say this. In the statement that you made saying there are two alternatives—this is your statement, Secretary Strickland—you said either we can remain the world's leading importer of oil or we can become the world's leading exporter of oil. I think there should be a third one, and that is develop our own resources. We are the only country in the world that doesn't develop our own resources.

I guess the question I would have is do you agree with these analyses? Do you think we ought to develop our own resources? Let's start with you, Secretary Strickland.

Mr. STRICKLAND. It is the position of the Administration—and Secretary Salazar supports this position, as do I—that we should actively and aggressively develop our conventional energy resources. And since this new Administration came into office, January 21, our first day at Department of Interior, we have offered just under 2,000 parcels for lease, 2.3 million acres. There were bids brought in on 845,000 acres.

I accompanied Secretary Salazar to New Orleans for one of the OCS bids in the spring. We have another bid coming up in August with respect to additional offshore lands. We are actively looking at the whole OCS in its entirety. We believe there is substantial opportunity to continue to develop conventional oil and gas. We believe we need a balance. We also think there has been an undervalued and underdeveloped alternative in renewable resource on our public lands up to this point, so we are moving quickly to try and bring some balance, but that is not at the expense of our conventional commitment. We agree there are additional opportunities.

Senator INHOFE. Secretary Strickland, I really appreciate that response. In fact, I agree with your response. It is an all of the above response and I appreciate it. Thank you very much.

Thank you, Madam Chair.

Senator BOXER. Thank you, Senator.

Senator Lautenberg.

Senator LAUTENBERG. I want to ask a question in response to the requests we hear for further development of our own resources.

Mr. Sandalow, if we develop more of our oil and energy resources as they are defined today, do we help global warming be reduced?

Mr. SANDALOW. The most important steps we can take to fight global warming, Senator, are to improve energy efficiency, to innovate with new renewable energy sources, to bring in low carbon sources. Developing our own fossil resources in an environmentally responsible manner in a comprehensive way is important for achieving a number of objectives, but the most important thing we can do to fight global warming in the short term are energy efficiency and then renewable energy investments.

Senator LAUTENBERG. Energy efficiency. So, therefore, as we contemplate touching the abundance of oil and gas in our country, we therefore do not automatically control the growth of global warming. And I think we ought to stop going through this charade and step up to the plate and say, look, perhaps we can find some more oil, and we want to reduce our cost for living, etcetera, et cetera, but I would ask you this.

Leading scientists say that the United States must cap emissions by at least 20 percent by 2025, and this study that I talked about before showed that we can reduce our energy use by 23 percent by 2020 at little or no cost, using energy efficiency. How crucial is it to our long-term objective of reducing carbon emissions in our world that we get on the glide slope of at least 20 percent by the year 2020?

I would ask you, Mr. Sandalow.

Mr. SANDALOW. In my view, Senator, it is very important to get started. It is important to get started and take the steps needed to send the right incentives to businesses and families around this Nation. There are such huge opportunities here, and what we just need is a consistent and clear policy structure.

Senator LAUTENBERG. Mr. Wellinghoff.

Mr. WELLINGHOFF. I would agree, and I agree with the statements of Secretary Sandalow. It is absolutely essential that we start on this, and energy efficiency really is the key, because it is the lowest cost resource that we have available in this country, and that is why it is important to move this into markets and to allow buy a market mechanism like cap-and-trade to have things like energy efficiency rise to the top of our energy resource stack.

Senator LAUTENBERG. The International Energy Agency says that achieving science-based emissions reductions will require an annual global investment—annual global—of $400 billion a year on energy research and development. The GAO estimates that the U.S. Government spends just $1.4 billion per year on energy R&D. How much should our Government be investing in research and development to meet our share of this reduction goal?

Mr. SANDALOW. Thank you for the question, Senator. Our country, in the past several decades, has under-invested in energy research, and under-invested very dramatically. This is one of Secretary Chu's top priorities at the Energy Department, is to increase our investment in this area in clean energy R&D, in bringing the best minds in this country into clean energy research. If we do that, we can solve these problems.

Senator LAUTENBERG. Mr. Wellinghoff.

Mr. WELLINGHOFF. Well, in addition to research, we really need to do development deployment, and that is really what we are doing at FERC, is trying to develop and deploy the things that we

need to do to get these strategies in place, such as renewables and energy efficiency. So both are important, R&D and D&D are important as well.

Senator LAUTENBERG. But we are talking about sums of money to be invested. Do you agree that we have been far short of what we have to do to——

Mr. WELLINGHOFF. Yes, absolutely.

Senator LAUTENBERG. So one of the things that we have established, Madam Chairman, is that at least we are discussing global warming like it is real, and not just somebody's fictional view of what is happening in our world. Thank you.

Senator BOXER. Thank you, Senator Lautenberg.

Senator Alexander is next.

Senator ALEXANDER. Thanks, Madam Chairman.

The Chairman mentioned the relative cost of nuclear and wind. The National Academies made a very interesting report this week on our energy future. They said that the relative cost of building a comparable amount of nuclear and wind would be about the same. You would have to build 180,000 wind turbines to equal 100 new reactors, and that wouldn't include the cost of transmission, which must be hundreds of new transmission towers, or maybe thousands, for the wind turbines, and it doesn't include the cost of backup power, since, after you build the wind turbines, you still have to have nuclear, coal, or something else for when the wind doesn't blow.

The Senator from Rhode Island mentioned the hand of Government subsidizing dirty energy. That is not true in terms of electricity. The biggest subsidies by far go to wind, which is 19 times per kilowatt hour times the subsidy for nuclear, much more for coal per kilowatt hour, and 30 times even all other renewables.

Mr. Strickland, your Department is sort of the custodian of our national landscape, and we are celebrating 100 years of protecting it. What are you going to do about 180,000 new wind turbines that are 50 stories tall, many of them in the West, and thousands of miles of transmission lines? And the solar thermal plants that are being built—well, to equal one nuclear plant, it would take a solar power plant 30 square miles; that is 5 miles on each side. And they tell us in the Southeast to use biomass, and I figured that we would have to continuously forest and area the size of the Great Smoky Mountains to equal one nuclear reactor, and we would have hundreds of trucks roaring in and out every day carrying the stuff.

Some conservationists are talking about a renewable energy sprawl. Are you developing any policies to deal with that?

Mr. STRICKLAND. Senator, we are. Right now, the BLM is looking at solar and involved in a programmatic EIS to look at just that very point that you make. Rather than just let this develop haphazardly with individual projects that come in, let's look at where they are best located that takes into account some of these environmental issues as well as transportation issues. We are looking at transportation corridors in the same way we are working with local and State governments out in the West. We are working closely with the Western Governors' Association. So the idea is to try and take into account the very points you make.

The environmental considerations, I am responsible for a big part of the enforcement of the Endangered Species Act. There are real issues that we will process and work through.

Senator ALEXANDER. Well, we wouldn't want to destroy the environment in the name of saving the environment.

Mr. Sandalow, did I remember right—I hope I did—that you wrote or told me one time that you thought that, with a concerted effort over 20 years, we might be able to electrify half our cars and trucks without building a new power plant?

Mr. SANDALOW. That is correct, Senator.

Senator ALEXANDER. I am hopeful——

Mr. SANDALOW. I just wanted to add I am congratulating you for all your work on this topic. I know you bought the first plug-in vehicle in the Washington, DC, area, and I want to congratulate you on that.

Senator ALEXANDER. Well, thank you for that. Did I remember right, also, did you ever make a computation about how much that might reduce our reliance on foreign oil?

Mr. SANDALOW. It can dramatically reduce our reliance on oil, Senator, yes. I don't have the numbers at the tip of my tongue, but it is quite significant.

Senator ALEXANDER. You are dealing with policy over there, and I have already congratulated Secretary Chu for his interest in nuclear power, but what I am struggling with is why do we have a renewable energy standard? Why don't we have a clean energy standard? The hearing is not about renewable energy, it is not about a national windmill policy; it is about clean energy. So why are we picking and choosing and subsidizing—why do we have a mandate? The Chairman said that we are going to build a lot of nuclear plants, but we don't have a mandate to do that. We have mandates in effect, and we are proposing more, that basically require Tennesseans and people in the Southeast to buy wind from South Dakota, which makes no sense, or to force us to put 50-story wind turbines on our ridge tops, which are our most treasured and sacred places. We don't want to see them. When the wind doesn't blow, it doesn't make any sense.

So why don't we have a clean energy standard or why don't we have a base-load clean energy standard and a renewable energy standard? Wouldn't that produce a lot more pollution-free, carbon-free electricity more rapidly?

Mr. SANDALOW. Well, Senator, the bill that was passed out of the House contains a very powerful mechanism for doing roughly what you are describing——

Senator ALEXANDER. But it excludes nuclear power.

Mr. SANDALOW. Well, it includes a cap-and-trade mechanism, and the cap-and-trade mechanism——

Senator ALEXANDER. I am asking you about a mandate. We have a mandate for wind and solar, really, mainly wind is the practical effect. Why not do the same for base-load power?

Mr. SANDALOW. I guess, Senator, the bill, as a whole, accomplishes the objectives that you are promoting here. That is the point that Senator Boxer has already made.

Senator ALEXANDER. So we don't need the renewable mandate, then.

Mr. SANDALOW. I think it is a helpful part of the overall mix. And Senator, I think there is going to be discussion in this chamber, and all ideas should be brought forward on this.

Senator ALEXANDER. Thank you, Madam Chairman.

Senator BOXER. Thank you, Senator.

Now, let me see my list here. Senator Merkley is next.

Senator MERKLEY. Thank you very much, Madam Chair.

Thank you for your testimony. As I hear the discussion about what we can achieve through increased energy efficiency and the amount of renewable energy that can be produced—and often it is couched in the time line of 2030. I think some of the statistics that were mentioned, Mr. Wellinghoff, I believe you said we can produce hundreds of gigawatts of renewable energy by 2030; Mr. Sandalow, I believe you said that wind could do 20 percent of our energy demand by 2030. Isn't it possible to take these factors and weave them into a coherent strategy to eliminate our dependence on foreign oil?

Mr. WELLINGHOFF. Senator, yes, I believe it is, and I think part of it is what the dialogue between Secretary Sandalow and Senator Alexander, with respect to moving toward electrification of our transportation system; that really is the key. If we want to move off of foreign oil, we have to electrify that transportation system and ensure that we have the clean, reliable electric energy to provide that energy for the transportation system. But I think it is very doable, yes.

Mr. SANDALOW. I would strongly agree with Chairman Wellinghoff and just highlight the announcements made yesterday. More than $2.4 billion of grants under the Recovery Act to promote exactly this. I think it has the potential to be transformational in terms of our country's reliance on oil. This is the future.

Senator MERKLEY. Mr. Strickland, do you want to add to that?

Mr. STRICKLAND. No, I totally agree with that, and I think that heretofore, just within the Department of Interior, there had not been active efforts to look at our public lands, inventory them, put a regulatory framework in place to accelerate permitting so that we could actually access and develop those renewable resources that are there, as well as the transmission piece, which Chairman Wellinghoff was speaking to. We need to get these pieces in place, the basic infrastructure, to help facilitate the development of our renewable resources, which are just there.

Senator MERKLEY. So I think I just heard three yeses to the question of could these be woven together, energy efficiency and renewable energy, to eliminate our dependence on foreign oil. I think it would be really helpful to have the Administration lay out just such a more detailed strategy, because it is a huge challenge to this country to be dependent upon a few nations for foreign oil. It is a huge cost to be spending $2 billion a day on foreign oil, and we could create a lot of jobs by spending that money here in the United States.

And then we really have a vision that we could lay out to the American people of a triple win, triple win on national security, on creating jobs here, and a triple win, the third being reducing the carbon dioxide in our atmosphere and good stewardship of our planet, leadership and stewardship of our planet.

So I just want to encourage you all to work to try to present that. The year 2030 is well into the future, but maybe when the numbers are crunched and we see what could be produced by all the investments being made, it could be done in a much shorter period.

I wanted to specifically pursue the comments about the electrification of our passenger transportation, and I applaud Senator Alexander for his work in this area. I have heard statistics along the lines that if we were to have all of our cars produced in the near future able to go 30 miles on simply electricity, and have braking systems, regenerative braking systems to recapture the energy loss when you slow down a very heavy vehicle, that we could reduce by 80 percent the carbon dioxide generated by car transportation.

Are these numbers in the right area, or do you have better numbers? And would it be feasible to have an aggressive strategy in which we basically say, at some date in the future, indeed, every new car produced in America will have to go 30 miles on electricity, have regenerative braking, and attempt to really drive the huge savings in fuel, which contributes to the national security issue, and in the reduction of carbon dioxide?

Mr. SANDALOW. There is no question that the savings can be very substantial, Senator Merkley. That is for two reasons. First, electric motors are much, much more efficient than standard internal combustion engines; and second, they allow us to tap in to low carbon energy sources such as wind or solar or nuclear. So the carbon emissions from a fleet that is electrified is going to be much less.

You mentioned 2030. Around that time, maybe I will be a grandfather, and I think someday my grand-kids are going to look at my kids and say, what, you mean you didn't plug in cars when you were young? I think they are going to think that is as odd as not having cell phones today.

Senator MERKLEY. Any other comments or thought about that effort?

Mr. WELLINGHOFF. Yes, Senator Merkley. I think your numbers are correct.

There are actually two very good studies that have been done on this issue, one by the Pacific Northwest National Labs and another by EPRI and the NRDC jointly that looked at what the carbon reductions would be both for automobiles and then what the overall carbon reductions would be if we moved to an electric transportation system. So definitely there would be very large reductions in carbon, and it has been shown that it is all feasible utilizing electricity to move that direction.

Senator MERKLEY. Thank you all very much.

Senator BOXER. Thank you.

Senator Barrasso.

Senator BARRASSO. Thank you, Madam Chairman. I would like to defer to Senator Voinovich.

Senator BOXER. Senator Voinovich.

Senator VOINOVICH. Thank you, Senator Barrasso.

I introduced a bill with Byron Dorgan called NESA, the National Energy Security Act, and one of the reasons I did that is because of the fact that I have been concerned for a long time that we haven't harmonized our energy, our economy, our environment, and

our national security; and if the public knew how vulnerable we were today in terms of oil, they would be shaking in their boots.

It seems to me that today over 60 percent of our oil is coming from overseas, and about 60 percent of that is coming from the OPEC nations. We send about 240 billion to 300 billion overseas to countries that produce this oil. We have no idea of the environmental impact that that is having.

So I thought to myself on many occasions what we should be doing as a Nation, from a public policy, security, energy, and so forth, is that we should take advantage of all of the natural resources that we have, Mr. Strickland; and I talked with former Senator Salazar about this, in terms of our own oil.

At the same time, we should be as aggressive as anyplace in the world to find a way that we use less oil so that perhaps, in a dozen years, we would be out there as the country that is least reliant on foreign sources of oil and the country that uses oil the least. Then we would be, I think, in terms of competitiveness, right up there where we should be.

So I am glad to know that you are moving forward, and I wish the President, when he talks about the issue of becoming oil independent, should talk about the fact that not only are we going to use less, but we are going to go after those areas where we can responsively find oil. And I would like you to look at that bill. It is sponsored by many generals, admirals who are concerned; it talks about finding more, using less; it talks about 2050, that 85 percent of our vehicles would be electrified; it talks about the fact, Mr. Wellinghoff, that we need the grid. And EPRI says that we are going to need $165 billion to do the grid, and we need the grid not only for wind and solar, but we need it for the rest of the energy that we produce here in the country.

The other thing that I want to comment on is the issue of—in your testimony, you talked about a major reason why low carbon renewable resources and energy efficiency are not used more extensively, that the cost of greenhouse gas emission is not reflected in the price of energy. To summarize your approach, if we simply tax energy more so it costs more and never build another coal or nuclear plant, then people would use less and switch to less reliable sources.

Now, that is something that I have a hard time understanding. I think you once said that we didn't have to build. If we did solar and wind, we wouldn't have to have nuclear or we wouldn't have to have coal, or we might not have to have gas. And it just defies logic, and I would be interested, Mr. Sandalow, in your comment on this. We get 50 percent of coal, 20 percent gas, 20 percent nuclear, and the rest of it is renewable somewhere, as I mentioned in my earlier remarks. Eight-tenths of 1 percent solar, 1.4. I have talked to the best experts in the world, and they said that you have to do all of that. But if you think that some day down the road we are going to take care of our energy needs with solar and with wind is just plain naive. What is your reaction to that? How can you say something like that when the facts are different?

Mr. WELLINGHOFF. Senator Voinovich, that is not exactly what I said. What I said was, depending upon our ability to look at a number of scenarios with respect to the market and how the market

will operate, it may be possible to bridge to a low carbon energy future utilizing a combination of our renewable resources, which would include solar, wind, geothermal, hydrokinetics, biomass, and energy efficiency and demand response and natural gas.

If you look at that in combination, I think everyone would agree, every expert I have seen and talked to would agree that it is feasible, depending upon how we structure our markets.

Senator VOINOVICH. Fifty years from now, 100 years from now? I mean, let's get serious.

Mr. WELLINGHOFF. Certainly a transition, there is no question about it. But we need to look at things like natural gas, for example. In this country, we have probably over 100 years' worth of natural gas. Secretary Sandalow indicated that we have now revised our coal figures. There is probably 100 years or less of coal. If we look at the two and compare them, natural gas, when you burn it, puts out half the carbon that coal does. From that perspective, ultimately, it would seem to me to make more sense to emphasize a bridge with natural gas, combined with energy efficiency and renewable resources, than it would to a bridge with carbon-intensive coal. So from that standpoint——

Mr. VOINOVICH. I am out of time, but I want to make one point, OK? You are talking about natural gas. We encouraged our electricity to go to natural gas. Our gas prices went up to the top. We lost millions of jobs in this country because of the high natural gas cost. I had people in my office, Bayer manufacturers move jobs from the U.S. because of our high natural gas cost. When we did that policy, we didn't pay attention to the impact it had on our economy. So all these things relate to each other. You can't do this thing in a cocoon.

Mr. WELLINGHOFF. And I am not suggesting that we do. Our natural gas supply resource base has been increased by more than 50 percent in the last 3 years. We found vast amounts of new natural gas that we never knew existed before. We need to look at that, consider that as how it can fit in to the bridge of getting into a low carbon society.

Senator BOXER. Thank you very much, Senator Voinovich.

Senator Cardin.

Senator CARDIN. Again, thank you, Madam Chair.

I want to thank the witnesses for their testimony.

I think we all agree with Senator Voinovich that there is not one source that is going to solve our problems for energy in America, that we have to look at all the different sources. But I would point out I think it is naive not to look at renewables and doing a better job with renewables in trying to reach our goal of energy security, of having energy reliable sources for our economy and leading on global climate change and reducing our carbon footprint.

Several of you have mentioned what is happening in other countries. Secretary Sandalow, you specifically mentioned that. I guess my concern is whether America is going to wake up one day and find the innovations that we came up with, that were developed here in America, perhaps even with Government support, are all of a sudden being used in other countries and literally purchased by other countries, making us once again dependent upon energy developed in other parts of the world for our own energy needs.

I will give you just one example. We are developing in Baltimore algae-based ethanol. It has promise. If it works, it could be a tremendous source of energy, and its carbon footprint is negative. That is a new technology. There are going to be companies that are going to move ahead on it, whether they are here in America or in another country.

I worry that we may not be doing enough to keep this technology here in America with the jobs for the use of that technology based in America, rather than based in another country. A lot of this is going to be very fungible, and we are going to be able to import energy. I don't want to import energy; I want to have the energy produced right here in America.

I do applaud, again, the American Recovery and Reinvestment Act, the stimulus package. We wanted that to have a major impact on this issue, and what the Department of Energy did yesterday was a major step forward on electric cars and batteries. But I do worry that we may be missing the opportunity for allowing our markets to develop the jobs here in America.

Your response?

Mr. SANDALOW. Senator Cardin, in my view, your concern is very well founded and borne out by some of our recent history. The technology behind the photovoltaic cell was developed here in Bell Labs, and now other countries have the lead in manufacturing that technology. The technology behind the Prius battery was developed with U.S. Government support and is now mainly commercialized elsewhere. We need strong policies in order to make sure that we develop the technologies of the future here and that we keep them here.

Programs like the one announced yesterday, programs like the bill that was passed out of the House are absolutely essential to making sure that the United States leads the clean energy revolution.

Senator CARDIN. I think Americans would be surprised to learn that the Prius technology was developed in America. I hear from my neighbors all the time about the Prius. Well, we helped develop it. The problem is we didn't keep the technology here; we let it slide. Now we are getting back to it. We are getting back to it. I think we are taking the right steps right now. But I just hope we have the staying power in order to accomplish the goal that all of us wants to see, America being energy independent in an environmentally friendly way.

Secretary Strickland, I want to get you on the management of public lands for one moment. Public lands are critically important for energy production in America. Can you just tell us where we are as far as the use of public lands for renewable energies and where you see us as far as I hope changing that equation, using more of our public lands for renewables?

Mr. STRICKLAND. Senator Cardin, I think we are in our very early stages in terms of using public lands in terms of the potential for renewable energy. It was just this spring that regulations were, for the first time, put in place to provide for the development of offshore wind in the Outer Continental Shelf. Now, there was one project, at least, the Cape Wind project, that had gone forward with kind of some interim regs. At least the application for that

project had gone forward. So we are very much in our infancy, but we are very much moving quickly to put the infrastructure in place.

With respect to solar, much the same. We have limited proposals for solar up until recently. Now we have a huge backlog of private sector interest in developing solar on our public lands. As I mentioned a few moments ago, we used some of our Recovery Act dollars to the Department to put four offices in place throughout the Southwest to help deal with that backlog so we can get these projects through the permitting system, and those that meet the standards for environmental review and otherwise make sense and can attract the capital will come online.

So we are early on in this effort, but there is huge potential.

Senator CARDIN. Madam Chair, I just want to urge the committee—I think it would be good for our committee to have information as to the amount of public lands that are being devoted to renewable versus traditional mineral extractions. I would urge you to ask for that information.

Senator BOXER. Senator, I would be glad to organize a committee letter, and whoever would like to sign it, we will make it an official request.

Senator Barrasso.

Senator BARRASSO. Thank you very much, Madam Chairman.

Mr. Wellinghoff, you said in April that there is no need to build new coal or nuclear power plants in the United States. You also said the renewables like wind, solar, and biomass will provide enough energy to meet base-load capacity and future energy demands. You later said that base-load capacity is going to become an anachronism. Ten Senators sent a letter to the President in response to your comments. We were troubled that the Nation's top power industry regulator would make what I believe were reckless and unrealistic comments.

I am going to ask, Madam Chairman, that that letter be submitted as part of the record.

[The referenced letter was not received at time of print.]

Senator BARRASSO. Secretary Salazar recently testified before the Energy Committee, and you talk about Senator Cardin's questions about the amount of public land being used for renewables. Secretary Salazar testified that 138,000 acres of land—138,000 acres of land—would be needed to build a wind farm with the capacity to replace one coal-fired power plant. Well, that is roughly three and a half times the size of Washington, DC.

But there are hundreds of coal-fired power plants in the United States, and I guess the question comes down to are we willing to set aside an area three and a half times the size of the District of Columbia for a wind farm to replace each one of these coal-fired power plants.

How do you do the math on that?

Mr. WELLINGHOFF. First of all, Senator Barrasso, I did respond to a question by Senator Voinovich which was very similar to your question, that initially I would like to clarify. I did not say that we would not need those types of facilities, either coal or nuclear.

What I did say was that, in fact, under appropriate market scenarios, I believe it is possible to construct a combination of renew-

able resources which would include not just wind but also geothermal. We are finding, for example, much more geothermal than we ever knew existed. There are literally hundreds of gigawatts of geothermal in geopressure wells in Texas that we did not know existed or had the technology to extract. We are finding literally hundreds of gigawatts of hydrokinetic resources available in our rivers and streams and offshore in the oceans and wave energy, as well as biomass and other renewables.

But add to that the 23 percent energy efficiency that McKinsey talks about in their study. Add to that the 188 gigawatts of demand response that we found in our study. Combine that with our 100 years of natural gas that we have in this country. There is a scenario, I believe, in a market construct that could be a least cost scenario for this country where we could in fact move to a lower carbon transition utilizing just those resources. That is what I said.

So, in that context, I think there are challenges with wind and the land that it takes to put that wind up, but I think also Secretary Salazar said there are estimates of 800 to 1,000 gigawatts of wind off the Atlantic Coast. Again, we have plenty of land out there in the ocean to take care of the area that we need to ultimately develop that wind. So I think we do have the resources, and I think we do have the land area potentially to develop it if we look at all the resources and how they can be combined together.

Senator BARRASSO. So in terms of Senator Cardin's question about how much land is being used for the renewables onshore that he just asked for that number, you may want include some of those offshore issues as well. Thank you.

Mr. Strickland, if I could, the President of the American Farm Bureau testified before this committee. When he was here, he said there would be winners and losers in the agriculture community based on Waxman-Markey. You are from the West, the Rocky Mountain West in Colorado. Western ranchers whose operations, you know, are heavily dependent on the use of Federal lands for livestock forage have very limited offset opportunities under this bill.

The ranchers are constrained in the types of grazing practices that they can use on Federal land, and Federal lands themselves don't really qualify for offset opportunities. So the majority of the West if Federal land; half of Wyoming, a great portion in Colorado. I am concerned about how the agriculture community in the intermountain West could possibly survive under Waxman-Markey, given what the President of the American Farm Bureau has had to say.

Why is western agriculture put, to me, at a disadvantage, and do you have any solutions for your Department?

Mr. STRICKLAND. Well, in terms of the issues that we deal with relative to access to public lands for agricultural purposes, we see that as a continued important value and critical to the economy of the West, so we don't believe that that is at issue or at risk here. We also believe that there are outstanding opportunities for carbon sequestration, biological carbon sequestration that involves collaboration and cooperation with the agricultural community.

In fact, Senator Inhofe, I know, has been a leading proponent of conservation partnerships, and just earlier this week, Senator

Inhofe, I was out in Montana and I met with a Montana rancher who has sold an easement to his ranch to keep it in agricultural production; yet, it helps facilitate very important wildlife values on the front range of the Rockies in Montana. So very clear examples of how we can partner between the public and private sector to advance environmental values, and I think there are opportunities along those lines to look at biologic sequestration and to work with the agricultural community so that those kinds of uses of the land are seen as part of the solution.

Senator BARRASSO. Thank you.

Thank you, Madam Chairman.

Senator BOXER. Thank you, Senator Barrasso.

Senator Whitehouse.

And then we are going to move to our next panel.

Senator WHITEHOUSE. Thank you very much.

Secretary Strickland, first of all, thank you for your service as a United States attorney. We former U.S. attorneys need to stick together. Also, please pass our regards to our friend and colleague, Secretary Salazar.

You just mentioned wildlife. I understand that the wildlife adaptation amendments that have accompanied previous Senate legislation in the climate change area are gathering broad bipartisan and multi-regional support. Is that your observation as well?

Mr. STRICKLAND. It is, Senator. That is a very important role, frankly, we believe for the Department of Interior, obviously, Department of Agriculture with Forest Service lands as well. But the adaptation challenges and issues and responsibilities that we have with our public lands and more broadly to protect wildlife and to deal with the real world impacts of climate change impacts on land and species is extremely important, and I know you have shown great interest and leadership on this and we would like to work with you on this.

Senator WHITEHOUSE. Very good. Thank you.

Chairman Wellinghoff, years ago I practiced before the Federal Energy Regulatory Commission in an era when electric utilities were far more vertically integrated. Since then, we have seen them break out into transmission companies, transcos; generation companies, gencos; distribution companies, discos; and I would like your thoughts on whether we should be trying to incent the electric utility industry to move toward conservation companies as well, conscos, where their conservation efforts can become a profit center for them in ways that will offset the diminished sales that are associated with conservation.

Mr. WELLINGHOFF. I think we absolutely should, Senator. In fact, the FERC is doing that at this point in time. We are incenting both distribution utilities and private third parties to become much more involved in both energy efficiency and demand response by incorporating into the wholesale organized markets in this country, the ITOs and the ISOs, tariffs that allow demand response and energy efficiency to be actually bid up into those wholesale markets.

To the extent we can have those markets open and allow for the demand side, as well as the supply side, to participate in them, it will encourage both distribution utilities and third parties that will aggregate customers and reduce their loads and bid that into those

markets to reduce the overall costs and improve the efficiency of the markets.

Senator WHITEHOUSE. That is a good price signal into the market under existing market structure. My question went more to whether we should try to—there have been efficiencies in the market that have been captured by the disaggregation into transmission, distribution, and generation.

Mr. WELLINGHOFF. Right.

Senator WHITEHOUSE. Should we also be thinking about pursing a similar disaggregation so that the conservation portion of a utilities portfolio actually has to be separate, and therefore more distinct and competitive and go beyond just a market signal into the existing market?

Mr. WELLINGHOFF. I am sorry, I didn't understand that part of it, but, yes, I believe we should. The more we can disaggregate and unbundle those services and make them more competitive, ultimately, I think the more players will get in, the more entrepreneurs will get in who will have more ideas of how to do it in a more robust way and will be able to drive down costs for consumers. Yes, I would agree.

Senator WHITEHOUSE. Thank you.

My last question is to Secretary Sandalow, and it relates to nuclear power. Over time, a lot of objection has manifested itself to nuclear power, primarily around safety. But the U.S. Navy and the European power agencies have demonstrated that nuclear power can be managed safely; around cost, because ratepayers—whom I was in front of Chairman Wellinghoff's agency trying to defend—were getting creamed by the cost of the nuclear power plants.

But it appears that as we move more toward modular systems, we can manage the cost aspect better; and then the third big piece has been disposal, that it creates perhaps the most dangerous hazardous waste that mankind is capable of creating in terms of its long-term effects, and we don't have a means for getting rid of it.

There is a technology, called traveling wave nuclear technology, that appears at least to create nuclear power off of our existing nuclear waste stocks without adding to the nuclear waste stock, and becomes a net gain in terms of our nuclear waste threat exposure. Are you following that? And if you would like to take it as a question for the record, since I have just run out my time, please feel free to do so, but I would like to get the Energy Department's answer on that.

Mr. SANDALOW. I am not personally, but we will get back to you on that, Senator.

Senator BOXER. Thank you, Senator Whitehouse, very much, and to all my colleagues.

I found this to be extremely important, and I thought the three of you were very direct in answering our questions, and I appreciate it.

So we are going to follow up with, hopefully, a bipartisan letter, and it is going to ask you particularly for the issue of how much land is available offshore and onshore for renewable development, Mr. Strickland. Then I will also add to that, if you could confirm, because I don't want to ask you any more questions, if you could confirm that it is true that 68 million acres of undeveloped offshore

oil and onshore oil leases are still not in production. Because I think that is an important part for all of us that say we need everything. We need to know what leases are out there that haven't been acted upon. If you could confirm that.

But I just wanted to thank all three of you very much for your time and your answers. Thank you very much.

Senator WHITEHOUSE. Madam Chair.

Senator BOXER. Yes.

Senator WHITEHOUSE. Never mind. You have a second panel. We will proceed to that.

Senator BOXER. OK. Thank you.

So thank you very much.

Now we will call up our second panel. It is two very important witnesses, Fred Krupp, the President of the Environmental Defense Fund; and Bill Fehrman, the President and CEO of MidAmerican Energy Company, primarily services Iowa, Illinois, and South Dakota.

Mr. Krupp, are you somewhere out there? Oh, he is trying to get through. All right.

If you can excuse our witness, he needs to get up to the—thank you very much.

Well, Mr. Krupp, we will start with you, and then we will proceed to Mr. Fehrman, or vice versa. Whatever you two would like is fine with us.

STATEMENT OF FRED KRUPP, PRESIDENT, ENVIRONMENTAL DEFENSE FUND

Mr. KRUPP. That is fine.

Chairman Boxer, I am honored to be here today. The stakes couldn't be higher. On the current path by the end of this century, Key West and the Everglades will be under water; the American Southwest will be at risk of truly catastrophic droughts; and summers in Michigan will be like summers in Texas today. These are just a few of the things that we learned from the authoritative science report that the U.S. Government released this past June.

And yet I am optimistic. My message is simple: we can achieve strong emission targets by 2020; we can achieve those targets at low cost; and in meeting those targets, we can create new jobs and new businesses.

So my first point, we can achieve strong targets by 2020. This has been studied again and again. The EPA has looked at it; the Department of Energy has looked at it; so has MIT and McKinsey & Company. These teams of experts have used different tools and different assumptions, but they all come to the same conclusion: we can cut emissions in 2020 by 17 to 20 percent or more below 2005 levels.

My second point, we can reduce emissions at low cost. The EPA has done an exhaustive analysis of H.R. 2454. The Agency found that, between now and 2050, the annual cost to the average household will be less than the cost of a postage stamp, and the poorest families will actually have a few more dollars in their pockets. Just 2 days ago, the Energy Information Administration, the EIA, came to the same conclusion. The cost of the House bill will be very low.

Between now and 2030, the EIA says that the average household cost will be about 22 cents a day, about a dime per person.

Now, my third point is this: lowering our emissions will create new businesses and new jobs. One of the most important studies of how we can reduce our emissions was done by the respected consulting firm McKinsey & Company. They looked at dozens of ways to cut our emissions, and here is what they found. This chart, Exhibit 1, that I would like to introduce for the record.

Now, in just one of those areas, just one of those bars is coal power plants and the technology CCS, where new builds can be done with enhanced oil recovery. And I want to just talk about one slice of that bar. CCS, of course, means carbon capture and storage. It means capturing the carbon dioxide from a power plant or factory and burying it deep underground. There are three main ways of capturing carbon dioxide. I am just going to focus on one of those, the Choate ammonia process.

A team of researchers at Duke University has been studying the supply chains behind 11 different low carbon solutions. One of those solutions is called Choate ammonia technology for capturing CO_2. You can see here that what Duke found about this supply chain. There are dozens of different benefits and workers in the work force that will be involved to make the Choate ammonia process work.

Let me just give you a few examples. We will need more miners, steelworkers, chemists, pipe fitters, designers, engineers—every type of engineer—construction workers, computer modelers, geologists, and factory workers to make the thousands of different components that will go into the finished products.

Now, finally, the last exhibit, I would like to show some of the specific companies around the country that are poised to play a role in creating this technology, companies in Virginia and Texas and Arizona, New Mexico, just literally everywhere. And as you can see, we are just looking at the component manufacturers of just one of hundreds of technologies, and companies all over the country that will benefit.

In conclusion, putting a ceiling on greenhouse gas emissions is an act of patriotism twice over—it is the right thing to do for our kids and grand-kids, and it is the right thing to do to help America lead the clean energy revolution, as it has led every other technological revolution the past century. The time to pass the law is by early December so the United States can walk into Copenhagen with the strongest hand to create a good treaty.

[The prepared statement of Mr. Krupp follows:]

Written Testimony of Fred Krupp
President, Environmental Defense Fund
before the
U.S. Senate Committee on
Environment and Public Works
on "Climate Change and Ensuring America
Leads the Clean Energy Transformation"

August 6, 2009

Executive Summary

My testimony today makes three main points.

1. Overwhelming evidence shows that we can meet 2020 emissions targets.

The bill recently passed by the House, H.R. 2454, and similar bills in the Senate, have been analyzed by many different sets of economists and engineers. Using different models and different assumptions, these studies all reach the same conclusion: we can reduce U.S. greenhouse gas emissions by 17%, 20%, or more by 2020, as compared to 2005 emissions. One of the most powerful tools for reducing emissions is also the most familiar: energy efficiency.

2. We can achieve these emissions targets at low cost.

The most authoritative study of the House legislation, by the EPA, shows that – even ignoring the costs of doing nothing, which are very large – the bill's annual cost to the average household will be just $80 to $111 (in present value). That's just 22 to 30 cents a day for the average American family – less than the cost of a postage stamp. To put it another way, it's about *a dime a day per person*. And because of special protections for low-income families, the lowest quintile of households will actually see a small net benefit from the bill.

Perhaps even more notably, the EPA analysis projects that under H.R. 2454, consumers will actually *save* money on their utility bills in the short run (through the year 2020), compared to business as usual. That's because even as the bill will keep household energy prices low, it contains other provisions to help boost energy efficiency and reduce energy consumption.

And study after study shows there are readily available tools to achieve emissions reductions at modest cost. One of the most powerful is energy efficiency. McKinsey & Company's latest analysis, for example, focuses solely on energy efficiency measures – and finds that we could achieve the required reductions by 2020 solely through energy efficiency measures, at low or even *no* net cost.

Part of the low cost is because good program design lets you get the biggest bang for the buck. A new Duke University policy brief released this week found that just 1.3% of all U.S.

manufacturers emit enough GHGs to be included under the threshold of 25,000 tons specified in ACES. Yet that 1.3% – about 4,500 of 350,000 manufacturers – is responsible for 82.5% of all manufacturing emissions.

3. We can create jobs – while we achieve the emissions targets.

Building a low-carbon economy can be a major – perhaps *the* major – economic driver for the U.S. economy over the next few decades. That's because behind every low-carbon solution is a long supply chain brimming with American jobs. A pioneering set of studies by researchers at Duke University has laid this out in detail. As the Duke studies show, low-carbon solutions – from energy-efficient windows to carbon capture and storage – will spawn new jobs in mining, component manufacturing, final product manufacturing, design, engineering, construction, marketing, and sales.

Introduction

I am honored to be here today as this Committee considers ways to combat climate change and ensure the United States leads the world in the coming clean energy revolution.

The stakes could not be higher. Already we are seeing signs of a changing climate – in the melting glaciers of our mountains, in the open waters of the Arctic, in dying coral reefs off south Florida and in disappearing terrestrial ecosystems. We see those signs in killer heat waves such as those that hit Europe a few years ago, and in droughts and disruption to agriculture in much of the world today. If we fail to act, we will commit our children and our children's children to a planet that is unrecognizable from the one our parents and grandparents knew. Inaction is simply not an option.

And yet my message is one of optimism and hope. As a nation, we've met challenges before and forged a stronger and more vibrant economy as result. That opportunity is before us again. By passing a comprehensive cap-and-trade program to control greenhouse gas emissions, we will unleash the enormous innovation and entrepreneurial drive of the American economy. Building a new energy infrastructure will mean jobs and investment right now, right here at home. And a cap-and-trade program will position us to lead the world into the clean energy economy, providing the technologies and the talent that will be in high demand throughout the world over the coming decades.

With the right policies in place, we can look forward to a fierce battle among brilliant scientists and entrepreneurs to make their names – and their fortunes – by making clean energy more affordable. Last week, for example, Robert Nelsen, co-founder of a venture capital firm, told a House committee that a start-up company's own tests show that it has developed a way to generate solar power at about half the cost of today's technology. Another company, Ausra, is betting that concentrated solar power will be the ticket to clean energy, and recently backed up that bet by building a factory in Las Vegas that has employed as many as 150 people. Still

another firm, Verdant Power, is working on harnessing the power of the tides to generate low-carbon energy.

Though the opportunities for innovation and entrepreneurship are vast, the challenge before us can seem daunting. Science tells us we must reduce our emissions of greenhouse gases by 80% below current levels by the middle of this century, if we are to have an odds-on chance of avoiding dangerous tipping points in the climate system. To be on track to achieve that long-term goal, we must start cutting emissions throughout the economy as soon as possible, and bring them down to 17 to 20 percent below 2005 levels by the year 2020.

In my testimony today, I look at the best available evidence on how we can achieve that 2020 target. The record is clear: with known technology, we can meet and exceed that goal. And putting a cap on carbon will stimulate a spate of new technologies – and new business methods, like third-party financing of energy efficiency improvements – that will only strengthen our hand. In doing all this, we will build a stronger and more prosperous American economy.

Below, I provide the details behind those conclusions. I start by looking at the evidence from several different economic analyses of the opportunities for early emissions reductions. Although these studies make dramatically different assumptions, they reach the same conclusion: the potential for reducing emissions is vast. We have the technologies to get started now, and to achieve big reductions in emissions at low cost over the next decade. And with an emissions cap that results in a price on carbon, we will generate new tools that will do so even more efficiently.

In effect, these studies offer a road map to achieve a 2020 target of reducing emissions by 17 to 20% below 2005 levels, even without the innovation that we know will come.

That many independent studies reach the same conclusion gives us enormous confidence that achieving a 2020 target does not depend on a single set of assumptions or a single silver bullet. Rather, there are multiple ways to get to where we need to go. What matters is that we get started now.

After taking stock of the macroeconomic evidence, I then hone in on two particular areas that could make major contributions to achieving our goals: energy efficiency and carbon capture and storage. (Carbon capture and storage, or "CCS," means capturing carbon dioxide at power plants or factories and pumping it into underground geological formations for long-term storage.) Each of these areas can dramatically reduce emissions while creating jobs and establishing American technological leadership.

A key point in all of this is that, contrary to doomsday predictions from extremist think tanks, the costs to American households of capping greenhouse gases will be minimal: less than the cost of a postage stamp per day. The EPA's analysis of the clean energy bill passed by the House says that, over the entire life of the bill, the annual cost to the average household will be just $80 to $111 (in present value). That is just 22 to 30 cents a day for the average American family – less than the cost of a postage stamp. To put it another way, it's about a dime a day per person. And

according to the Congressional Budget Office, the bill's special protections for low-income families mean that households in the lowest income quintile will see an average annual net *benefit* from the bill of about $40 in 2020.[1]

A final word on timing: the rest of the world is watching our political process closely, because our leadership is crucial to achieving an international agreement on reducing greenhouse gas emissions. The key date is this December, when U.S. negotiators will meet with their counterparts from around the world in Copenhagen. I strongly urge the Senate to work with the House and the President to pass a strong climate bill before the Copenhagen conference convenes in December.

1. The potential for low-cost abatement

With just the technology we already have, we can meet a 2020 target of reducing emissions by 17 to 20% below 2005 levels. That conclusion emerges from analyses by the Environmental Protection Agency (EPA), the Department of Energy's Energy Information Administration (EIA), the Massachusetts Institute of Technology (MIT), and McKinsey & Company. Each of these studies projects that the necessary emissions reductions can be made, at marginal costs as low as $18 per ton. In fact, these studies estimate that the abatement potential far exceeds the roughly 1 billion tons needed to meet a 17% target.

In the formal macroeconomic modeling done by EIA, MIT, and EPA, emitters are expected to overcomply with emissions targets in the early years of a cap-and-trade program to build up an allowance "bank" that will keep costs low when targets tighten later on. In fact, while there is ample potential for international emissions reduction credits,[2] the U.S. can meet or beat the 2020 target based on domestic emissions reductions alone.

Crucially, none of these studies take into account the innovation and technological breakthroughs that will be unleashed by putting a cap on carbon. I return to this point below, in my conclusion.

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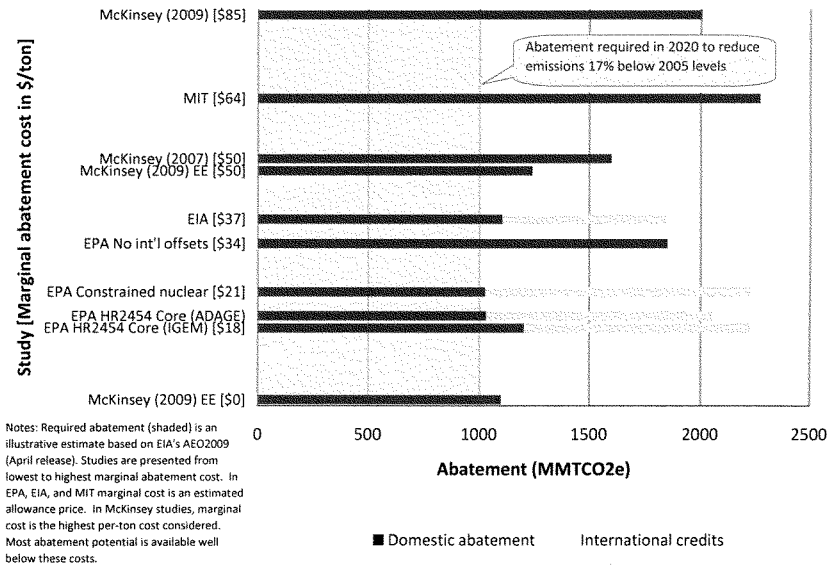
[1] Letter from Douglas W. Elmendorf, Director, Congressional Budget Office, to the Hon. David Camp (June 19, 2008).

[2] International emissions reductions that meet quality standards – i.e., reductions that are additional, measurable, and verified – would result in tradeable credits. These emissions reductions could be achieved, for example, by reducing tropical deforestation below an agreed national baseline.

Figure 1 — Estimated abatement potential in 2020, relative to that required under H.R. 2454.[3]



As Figure 1 shows, each of the EPA, EIA, MIT, and McKinsey studies shows we can achieve a 17% reduction in emissions below 2005 levels relying solely on domestic abatement. And the EPA and EIA studies show that, by using international credits (such as for reducing tropical deforestation), we can achieve much higher levels of emissions reductions, at a lower cost per ton. Note that the marginal abatement cost for the McKinsey 2009 study is the highest per-ton cost considered. Most abatement potential is available well below these costs.

[3] Source: EDF analysis of EPA, EIA and MIT models and McKinsey studies.

1.1. Results from "top-down" analyses of U.S. climate legislation

Broadly speaking, there are two different ways of looking at the economic impact of a policy such as a carbon cap. One is a "top-down" analysis, using a macroeconomic model of the entire U.S. economy. The other is a "bottom-up analysis," which looks at the likely impact of a policy change on particular industries. I begin by describing the results of the most important top-down analyses.

EPA's Analysis of H.R. 2454

The best single analysis of the House legislation has been done by the Environmental Protection Agency, using two of the most widely respected and credible macroeconomic models: the ADAGE model maintained at the Research Triangle Institute, and the IGEM model run by a team at Harvard and Northeastern Universities.

The models look at emissions reductions broken down by three sources: (1) sectors that are covered by an emissions cap (electric and natural gas utilities, major manufacturers, and petroleum), (2) domestic "offsets" (activities on farms and in forests that store more carbon or reduce carbon emissions), and (3) credits for international emissions reduction (such as reducing destruction of tropical forests). Reductions are measured in metric tons of "carbon dioxide equivalent," a measuring tool that puts other greenhouse gases, such as methane and nitrous oxide, on the same scale as CO_2. (The term $MMTCO_2e$ means million metric tons of CO_2-equivalent.) All reductions are measured relative to the models' "Reference" case, which represents business as usual – that is, in the absence of any new climate legislation.

For 2020, the results of the ADAGE and IGEM models are as follows:

- Emissions reductions from sectors covered by an emissions cap: 808 million metric tons of carbon dioxide equivalent (ADAGE) and 1,028 $MMTCO_2e$ (IGEM), or an average of 918 $MtCO_2e$;
- Emissions reductions from domestic offsets: 186 $MMTCO_2e$ (ADAGE) and 176 $MMTCO_2e$ (IGEM), or an average of 181 $MtCO_2e$; and
- International emissions reductions, such as from reducing tropical deforestation: 1,021 $MMTCO_2e$ (IGEM).

These numbers are from the EPA's "Core" policy scenario, embodying a central set of assumptions about how the legislation will be implemented. Of course, model outcomes often depend heavily on the underlying assumptions. For that reason, EPA also runs alternative scenarios to test the sensitivity of model results. In particular, EPA analyzed a scenario in which nuclear power under climate legislation is constrained to be the same as in the reference case, and another scenario in which international credits are assumed to be completely unavailable. As

Figure 1 shows, the underlying conclusion remains: even in these alternative and highly constrained scenarios, the EPA analysis identifies abundant abatement opportunities, well beyond what is required to meet the targets in the legislation.

Comparable macro studies show similarly large potential

I summarize here the results of two other top-down, macroeconomic studies of cap-and-trade legislation. Both studies echo the EPA analysis in finding the abatement potential at hand to meet 2020 targets for emission reductions – and to do so affordably. (Again, these studies are conservative in that they do not account for future technological innovation that a cap would unleash.)

The Energy Information Administration (EIA) has not yet released its analysis of H.R. 2454. The numbers presented here are from its analysis of the 2008 Lieberman-Warner bill, which would have required cumulative abatement over the period 2012-2050 at levels similar to H.R. 2454.

For the Lieberman-Warner bill, the EIA modeled emissions reductions of about 1,844 $MMTCO_2e$ by 2020. Abatement would be achieved from a combination of new clean energy sources, carbon capture and storage, and energy efficiency. In particular, EIA estimates that in 2020, abatement from covered entities would be about 825 $MMTCO_2e$, offset purchases would amount to 1,019 $MMTCO_2e$, and abatement from CCS would be about 147 $MMTCO_2e$. Domestic and international offsets will cover 55% of required abatement by 2020 and the rest will come from known technologies, including 8 percent from CCS.

A modeling team at MIT also analyzed the 2008 Lieberman-Warner bill, finding that the required emissions reductions could be achieved from a mix of nuclear power, carbon capture and storage, and renewable energy such as wind and solar.[4] The MIT team then re-ran new scenarios with updated costs for CCS and without a direct CCS subsidy.[5] Even so, the MIT model shows only small increases in nuclear – and no coal with CCS use until after 2020. Until that year, the MIT model shows CCS being used only for natural gas – and even there, only if the most stringent emissions limits are in place. In other words, the MIT model achieves large near-term emissions cuts without significant reliance on CCS or new nuclear power.

A close look at the electric power sector

In the near term, a substantial fraction of domestic emissions reductions are expected to come from the electric power sector, which accounts for over one-third of total U.S. emissions (and roughly 40% of the emissions that would be covered by H.R. 2454). A close look at projections

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[4] Paltsev et al. 2008, *Assessment of U.S. Cap-and-Trade Proposals*, MIT Joint Program on the Science and Policy of Global Change, at 146, Appendix D.

[5] Paltsev et al. 2009. *The cost of climate policy in the U.S.*, at 173.

for electricity generation provides additional insight into the modeling results – and additional confidence that we can meet the emissions targets in the legislation. While all of these models rely on the same basic building blocks – nuclear power, renewable energy, carbon capture and storage, and energy efficiency – they combine them in very different ways to get the same end result.

- The ADAGE model identifies considerable abatement potential from biomass (its share rising from 0.6% of generation in the reference case to 4% in the policy case) as well as wind and solar power (increasing from 1.8% to 2.8%). New state-of-the-art coal plants (integrated gasification combined-cycle) equipped with carbon capture and storage are projected to come online, providing roughly 5% of power generation under the policy scenario (versus zero in the reference case). But the single biggest contribution comes from energy efficiency: the reduction in energy demand under the program amounts to roughly 10% of energy demand, or roughly twice the contribution of CCS.

- The EIA model relies somewhat more heavily on nuclear power (its share increasing from to 22% of generation in the policy scenario versus 20% in the reference case) and renewable sources (jumping from less than 13% to over 17% of generation). On the other hand, energy demand does not fall by nearly as much, so that energy efficiency accounts for much less of the abatement in the sector. (CCS plays an important role by 2030, but its growth in the near term is not detailed in the EIA report.)

- In contrast, MIT's model shows very little increase in electricity from renewables – only 10% more than business as usual. Likewise, the MIT model projects only small increases in nuclear power. The largest impacts come from fuel-switching and from reduced use (energy efficiency) – which account for around 20% in the MIT analysis of Lieberman-Warner, and over 10% in MIT's latest modeling run.

In short, the top-down macroeconomic models take a range of approaches and employ a range of assumptions. But all of them find abundant abatement potential to meet and even exceed a near-term emissions reduction target of 17% below 2005.

Finally, I should point out what may be obvious: what models predict today is not precisely what the market will select in the future. But the models provide valuable insight into the range of market results that we can expect.

1.2. "Bottom-up" studies confirm 2020 abatement potential

The macroeconomic studies I just described take a top-down approach to modeling the U.S. economy. These studies capture broad patterns of substitution inside the economy, along with major areas of emissions reduction. They explicitly account for the interactions of markets for labor, capital, materials, and outputs. That's in many ways the right approach, but these models

do not attempt to represent in detail the technologies that will actually do the job of emissions reduction. For that task, we can turn to "bottom-up" studies, which tell the story from the perspective of the businesses that will actually do the heavy lifting.

In a series of recent studies, the management consulting firm McKinsey & Company has been a leader in applying this approach to the emissions reduction potential of the U.S. economy. The message from McKinsey's work is clear, and confirms what I discussed above: we have the technologies to meet ambitious 2020 abatement targets at a very low cost. Happily, in many cases, the technologies identified by McKinsey could even provide cost *savings*.

In fact, history tells us that businesses will usually find ways to do even better than analysts predict at the outset. Adoption of a cap-and-trade system for sulfur dioxide in the 1990s, for example, meant that utilities had to come up with results – but it left up to the utilities how to achieve them. The result was to redirect R&D towards scrubbers that removed more pollution, while giving electric utilities a strong economic incentive to adopt more cost-effective scrubbers.[6] And the biggest changes spurred by cap-and-trade were process innovations that cut pollution at much lower cost than anyone had expected.[7] Thanks to all this, the cost of reducing acid rain pollution proved to be only about a third of what was projected at the time of enactment.

The same has happened as the United States has regulated a wide range of different pollutants. The details are set forth in the attached EDF fact sheet, "Air quality measures consistently cost less than predicted."

McKinsey's economy-wide analysis of costs (or savings) from moving to a low-carbon economy

In 2007, McKinsey published a survey of abatement opportunities in the United States that could be available at a cost under $50 per ton by the year 2030. The McKinsey survey catalogued 250 abatement options, grouped in 75 categories in five sectors: buildings, industry, power, transport, and agriculture, waste and forestry (as a group). In its mid-range case – which does not assume aggressive deployment of technologies or the impact of an economy-wide cap-and-trade program – McKinsey estimated that U.S. emissions could be reduced by 3,000 $MMTCO_2e$ in 2030. Much of this abatement potential is likely to be available quickly.

McKinsey estimated that half of the total abatement potential (1,500 $MMTCO_2c$) would be available with carbon prices below $10/ton, while over 60% (1,860 $MMTCO_2e$) would be available under $25/ton. Moreover, many of these low-cost technologies achieve considerable savings in energy costs once installed. As a result, we can expect to see early deployment of many

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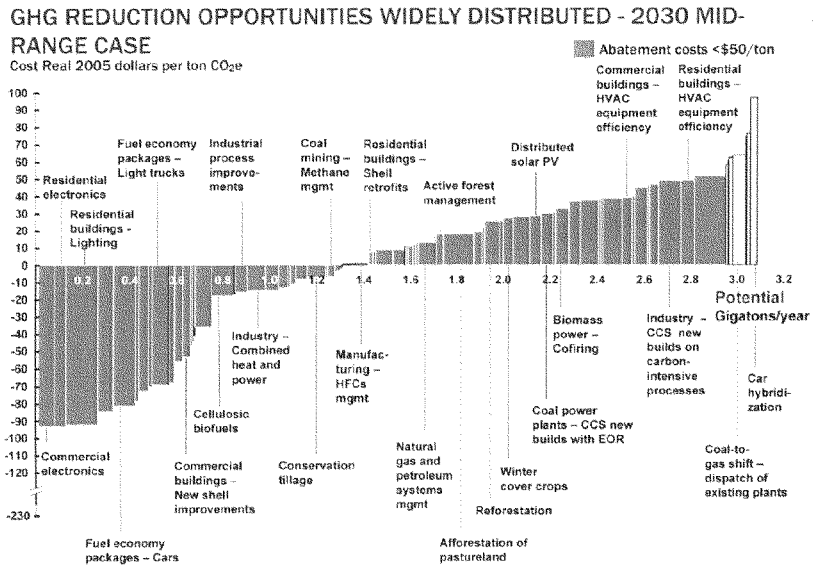
6 David Popp, *Pollution control innovations and the Clean Air Act of 1990*, Journal of Policy Administration and Management, 22(4): 641-60 (Fall 2003); Nathaniel O. Keohane, *Environmental Policy and the Choice of Abatement Technique: Evidence from Coal-Fired Power Plants*,, working paper (2005).

7 Dallas Burtraw, *Innovation Under the Tradable Sulfur Dioxide Emissions Permits Program in the U.S. Electricity Sector*, Resources for the Future Discussion Paper 00-38 (September 2000).

of these abatement opportunities as market participants seek to reduce their exposure to the possibility of higher energy costs.



Although the 2007 McKinsey study did not estimate the abatement opportunity that might be available in 2020, EDF derived the numbers above from McKinsey's analysis for the mid-range case, for which EDF has access to the underlying data. EDF considered each of the 75 McKinsey abatement categories individually and excluded all that do *not* represent low-cost, readily available technologies. We were left with four categories of near-term abatement opportunities: agricultural and forestry offsets; energy efficiency gains in residential and commercial buildings; fuel economy improvements in automobiles, and process changes in industrial and power sectors. These total 1,600 $MMTCO_2e$ of annual abatement opportunities, available at a cost below $50 per ton. And because these opportunities appear to be low-cost, *early availability* technologies, their full annual abatement potential should be available by 2020. Excluded entirely from this total were *all* new alternative power sources, *all* industrial processes assumed to require major capital expenditures, and *all* ambiguous categories, as well as carbon capture and sequestration and expansions in nuclear power.

Earlier this year, McKinsey published a new survey of global potential for reducing emissions. In that study, McKinsey updates its estimates for total abatement opportunity in the United States. It identifies 2,000 $MMTCO_2e$ of abatement potential per year by 2020 at a cost below

€60/TCO_2e (or about $85/ton).[8] Some 1,500 $MMTCO_2e$ are available at €20/TCO_2e ($30/ton) or below, 850 $MMTCO_2e$ are available at *zero* net cost, after accounting for savings over the lifetime of the investment. This total includes some categories left off before, such as new alternative power sources, nuclear power, and carbon capture and sequestration.

The McKinsey studies find that the United States is likely to have the necessary technologies available, at low or even no cost, to meet and even exceed the *total* abatement that would be required to reduce emissions in 2020 by 17% or even more below 2005 levels. That is true even though these studies assume little innovation in the application of low-carbon technologies. Indeed, McKinsey is highly conservative: it considers only abatement opportunities either available on a commercial scale or already developed and awaiting deployment.

2. Energy efficiency

Energy efficiency has long played a critical role in economic growth. Since 1970, U.S. economic output has expanded by more than three-fold, per capita incomes are twice as large today, and yet energy and power resources have grown by only 50% over the same period.[9] California has seen even larger increases in economic output with – remarkably – no increase in per-capita electricity consumption.

Nevertheless, energy efficiency has been difficult to capture in top-down macroeconomic modeling. If we look at the historical trends, energy efficiency has often played a much larger role than originally estimated.[10] Even the most credible current models (like those in EPA models effort) may continue to underestimate the potential role of energy efficiency in achieving low-cost reductions in energy use.

McKinsey's report on energy efficiency potential

Energy efficiency is the cheapest and most often overlooked resource for reaching our emission reduction targets. In July 2009, McKinsey published a new study focused on energy efficiency potential in the United States.[11] The analysis looks *only* at investments that pay for themselves

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[8] Exhibit A.V.1 of the 2009 McKinsey *report, Pathways to a low-carbon economy: version 2 of the global greenhouse gas abatement cost curve.*

[9] Laitner, John A., *The Positive Economics of Climate Change Policies: What the Historical Evidence Can Tell Us,* American Council for an Energy-Efficiency Economy, Washington, D.C., July 2009. http://aceee.org/pubs/e095.pdf?CFID=3136298&CFTOKEN=29476767

[10] For example, a 1979 National Research Council report estimated that if the size of the U.S. economy were to double, and if energy prices adjusted for inflation remained the same, energy consumption would rise from about 72 quads in 1975 to 135 quads in 2010. The NRC model projected that if energy prices were instead to double, energy demand might grow to only 94 quads by 2010. However, in the past 35 years the economy has instead nearly tripled, and energy prices have grown on average about 70%, but total energy use is estimated to be just under 100 quads next year. In other words, energy use under an economy that has tripled in size is far below what was predicted if the economy were merely to double.

[11] The study is available at www.mckinsey.com/clientservice/electricpowernaturalgas /US_energy_efficiency.

over their lifetime (so-called "NPV[Net Present Value]-positive opportunities"),[12] and only at energy savings opportunities (as opposed to improvements in generating energy). Despite these constraints, McKinsey identifies emissions reductions totaling 1,100 $MMTCO_2e$ by 2020.

Happily, McKinsey reports that these energy efficiency measures pay for themselves even without any additional incentives. The savings in energy costs – $1.2 trillion in present value – exceeds their upfront cost of $520 billion. As a result, we could achieve these emissions reductions by 2020 and at the same time save $680 billion through 2020. And these calculations are based on a carbon price of *zero*. With a carbon price of $30 per ton of CO_2e, energy savings potential would increase by 8%, while at $50 per ton it would grow by 13%. With these carbon prices, the energy efficiency measures described in the McKinsey study would result in emissions reductions by 2020 of 1,188 $MMTCO_2$ (at $30/ton) and 1,243 $MMTCO_2e$ (at $50/ton).

To be sure, there are obstacles that interfere with capturing all of these savings For example, home builders typically try to minimize their upfront costs, which may mean skimping on technology (such as highly efficient HVAC equipment) that costs a bit more but would save buyers large amounts of money over time. Similarly, owners of commercial builders may be on the hook to pay for capital upgrades (such as more efficient lighting) while tenants pay the utility bills (and thus would enjoy the resulting savings). In addition, some energy efficiency opportunities must overcome engrained habits – or require people to make changes in behavior that they may resist. To overcome those obstacles, McKinsey argues for a comprehensive, holistic approach combining purely market-based approaches – such as putting a cap on carbon – with standards, education campaigns, innovative financing instruments, and other measures.

Analysis by Synapse Energy Economics

A May 2009 analysis by Synapse Energy Economics Inc. (and commissioned by EDF) confirms many of these energy-efficiency results. The Synapse study shows that the emissions reduction targets in H.R. 2454 could be cost-effectively achieved – and even surpassed – through proven energy-efficiency measures and modest implementation of agriculture and forestry offsets. For example, Synapse found that implementing policies to achieve 2% annual, cumulative savings from energy efficiency would result in avoidance of 1,120 $MMTCO_2e$ annually by 2030. This represents a 40% reduction below 2010 greenhouse gas emission levels for the electricity sector, and can be achieved very cost-effectively. The average cost of electric utility efficiency programs is often only about 3 to 4 cents per kilowatt-hour, compared to the national average electricity price of 9 cents per kilowatt hour. In other words, it can be much cheaper to avoid using energy than to generate more of it.

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[12] McKinsey assumes a 7% discount rate in its base case.

Potential for job creation

In its pioneering study, *Manufacturing Climate Solutions*, Duke University's Center on Globalization, Governance & Competitiveness has analyzed a variety of low-carbon technologies to look at the business and job opportunities they will create.[13] The Duke team examines the value chain behind these technologies, and finds they will create a wide range of new jobs, from mining of raw materials, to manufacturing of components, to finished product manufacturing, and finally to installation and (in some cases) monitoring. To date, the Duke team has examined eleven low-carbon technologies, seven of which are in energy saving technologies: LED lighting, high performance windows, anti-idling truck technology, electric heat pump water heaters, industrial waste heat recovery systems, hybrid drivetrains for trucks, and insulation. (In addition, the study details supply chains for concentrated solar power, Super Soil systems for methane capture, carbon capture and storage, and wind power.)

In each case, a single low-carbon solution generates a complex web of economic activity – and of American jobs. Just an illustrative list of component manufacturers in the supply chain for electric heat pump water heaters counts 43 companies in 19 states. Thirteen component manufacturers in six states in the supply chain for high-performance windows alone have over 100,000 employees; and this does not yet count other portions of the supply chain from raw materials such as aluminum, vinyl and lumber to window manufacturers, wholesalers, retailers and contractors. On the whole, the seven energy efficiency supply chains account for hundreds of thousands of jobs all across the United States. Projected conservatively, looking at all the technologies for all the states, there are tens of thousands of small businesses poised to benefit from a cap on carbon.

3. Carbon capture and storage

3.1. CCS is "Ready to Roll"

The successful deployment of carbon capture and storage solutions, including geologic sequestration, is a critical path for adapting coal, the world's most abundant but carbon-intensive fossil fuel, to a carbon-constrained future. According to an IEA study released in 2006, CCS could rank, by 2050, second only to energy efficiency as a way of cutting greenhouse gas emissions. The Intergovernmental Panel on Climate Change (IPCC) projects that CCS could, by 2100, contribute 15 to 55% of the greenhouse gas reductions needed to avert catastrophic climate change.

As a technical matter, CCS is ready to begin deployment today. In fact, Gardiner Hill, BP's Director of CCS Technology, calls it "ready to roll." Four full-scale CCS projects exist today –

[13] http://www.cggc.duke.edu/environment/climatesolutions/

one of which, the Sleipner project in Norway, has been in operation since 1996.[14] The Department of Energy recently announced that projects by Basin Electric Power Cooperative in North Dakota and Hydrogen Energy International in California have been selected for up to $408 million in funding from the American Recovery and Reinvestment Act for advanced technologies to reduce CO2 emissions. One project is for an existing power plant, while the other is for a new facility. Many other large-scale CCS projects are also pending in the U.S. and around the world.[15]

To achieve greater deployment, what is really needed is a market driver and a clear regulatory framework for the technology. CCS is currently expensive, and to reduce costs we need more experience at integrating the various technologies at large scale. But these are just more reasons to adopt a carbon cap now – to prompt more investment and advance the technology. A recent Harvard study says that "the cost premiums for generating low carbon electricity with CCS are found to be broadly similar to the cost premiums for generating low carbon electricity by other means." The study also suggests that costs are likely to drop 65% by 2030.[16]

On the storage side, geologic sequestration of carbon dioxide is clearly feasible under the right conditions. It has been successfully demonstrated in a number of field projects, including several large projects. The IPCC Special Report on Carbon Capture and Storage concluded in 2005 that the fraction of CO2 retained in "appropriately selected and managed geological reservoirs" is likely to exceed 99% over 1000 years. Although determining the suitability of a particular site requires extensive homework (such as geologic characterization) about specific sites, it is clear that the total storage capacity is huge. The IPCC estimates there is enough capacity worldwide to permanently sequester 1,100 gigatons of CO2. (For comparison, global emissions from large stationary sources are approximately 13 gigatons per year.)[17] A preliminary estimate in the Department of Energy's Carbon Sequestration Atlas suggests that storage capacity in the U.S. and Canada might handle 1,100 years of emissions from stationary sources.

The IPCC also concluded that the local health, safety, and environmental risks of CCS are comparable to the risk of current activities such as natural gas storage, enhanced oil recovery, and deep underground storage of acid gas if there is "appropriate site selection based on available subsurface information, a monitoring program to detect problems, a regulatory system and the appropriate use of remediation methods to stop or control CO2 releases if they arise." (Enhanced oil recovery involves pumping a gas (such as carbon dioxide) underground to make it easier to extract oil.) The IPCC and others also find that the risk of leakage will tend to decrease with time.

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[14] The other CCS projects are the In Salah project in Algeria, the Snohvit project in Norway, and the Weyburn projects in Wyoming and Canada.

[15] A recent International Energy Agency study includes a survey of existing and planned projects. IEA, *CO_2 Capture and Storage: A Key Carbon Abatement Option* (2008).

[16] http://belfercenter.ksg.harvard.edu/files/2009_AlJuaied_Whitmore_Realistic_Costs_of_Carbon_Capture_web.pdf

[17] IPCC Special Report on Carbon Dioxide Capture and Storage (2005).

On the regulatory front, EPA is on track to adopt rules about geologic sequestration within the next few months. And many states are currently writing their own rules as well.

3.2. CCS: a jobs engine

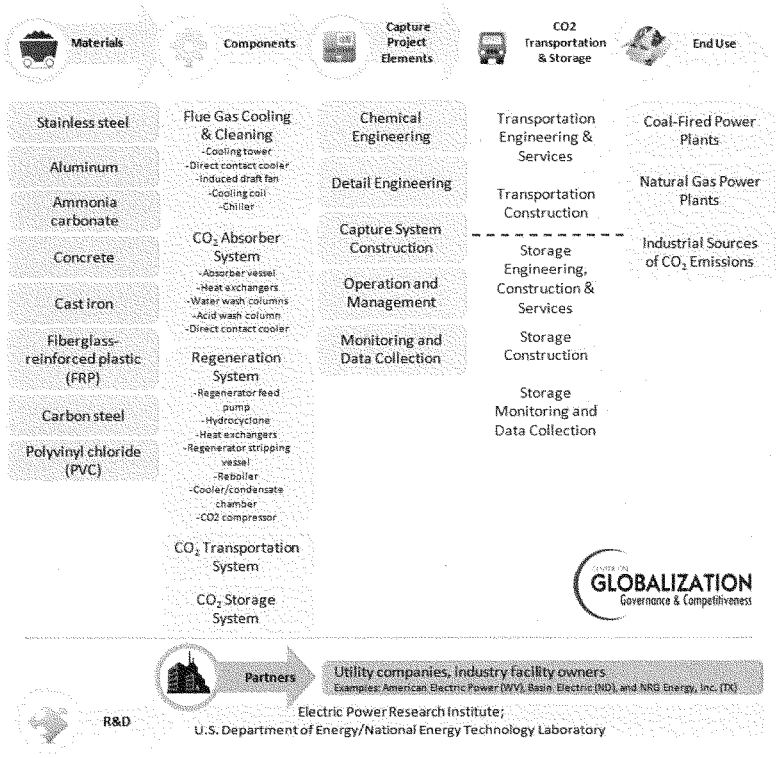
As described above, capturing and storing carbon dioxide would enable continued use of fossil fuel combustion for power generation and industry use while limiting the release of CO2 into the atmosphere. But deployment of CCS technology at large scale will do more: it will spur development of an entire new industry, with a large and robust supply chain.

There are three general processes for CO2 capture: pre-combustion, post-combustion, and oxy-fuel capture. These processes separate and condense CO2 so it can be transferred in liquid form to a long-term storage location.

I commend to you the latest chapter of the Manufacturing Climate Solutions report by Duke University.[18] That report illustrates the economic potential of CCS by detailing the value chains for one particular technology – the chilled ammonia capture process. This chart – a simplified value chain for this technology– will give you the idea:

[18] The complete report is available at www.cggc.duke.edu/environment/climatesolutions/

Simplified Value Chain for a CO_2 Capture Technology: The Chilled Ammonia Process



Note that the value chain includes raw materials (which need to be mined or collected), component parts (which need to be manufactured), processes (which need to be engineered), and transportation and storage (which require a variety of service workers). Each of these points along the value chain is an opportunity to create jobs for skilled workers such as steel workers, manufacturing technicians, welders, pipefitters, chemical and civil engineers, and construction workers. Looking just at construction, Alstom estimates that building a chilled ammonia process facility for a 600 MW power plant would take three years and require 2,000 construction jobs. And Powerspan officials estimate that a CCS facility for a 100 MW power plant would take between three and four years to construct and create up to 500 jobs at its peak.[19]

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[19] Procopis, 2009.

These jobs would be created all over the country. And these examples are for just one part of the value chain for just one of the three types of capture technologies. Each way of capturing carbon will have its own value chain of materials, components, project elements, transportation and storage, and end use.

The Duke researchers have shown the same thing for ten other low-carbon technologies. It turns out, for example, that American manufacturers are world leaders in making energy-efficient windows – and that those manufacturers, in turn, rely on a long American supply chain of component manufacturers and providers of raw materials. The Duke research shows the same story again and again, for technologies as diverse as LED lighting and methane capture from animal wastes.

4. Conclusion

I've summarized the results of many different economic studies. All show we can reach ambitious emissions reduction targets by 2020 with known technology at an affordable cost. In fact, although H.R. 2454 calls for a 17% reduction target, the economic evidence I've discussed here shows that a 20% reduction is easily within reach.

But reducing emissions is only half the story.

We will also see tremendous innovation. At the turn of the last century, the largest environmental problem facing large cities such as New York was horse manure. Tens of thousands of horses produced more than a thousand tons of manure each day. That meant that hundreds of horses were needed just to haul the manure away, not to mention the land necessary to house and feed the horse population. The fight between food and fuel was very real even then, and the model of cities looked unsustainable. We know, of course, what came next: the combination of Henry Ford and John D. Rockefeller saved the day, and oil-powered cars replaced horses as the main means of transport in New York and across the United States.

Fast forward 100 years, and we face a new problem: weaning ourselves off of oil. We know that the tools are already out there to do so – we just need to use them. We also know that markets have proven time and time again that they are the most powerful way to unleash that innovative potential and make the impossible possible. Cap-and-trade with ambitious emissions reduction targets establishes such a market and enables us to use the power of markets as an unambiguous force for good.

What's driven progress in the U.S. economy is technological innovation – in the context, of course, of a market economy that has provided incentives for that innovation. We've led the way in the major economic transitions of the past century: wide-scale mass production; the development of semiconductors; the space age; the Internet age. The smashing success of semiconductors illustrates the central importance of technology to U.S. economic growth. From the invention of the transistor in 1948, to the development of integrated circuits in the 1950s and

1960s, to the emergence of microchips in the 1990s – at every stage, the United States has led the world, and our leadership in this area has led to our phenomenal postwar growth.

For the upcoming decade, clean energy can play the same role in the U.S. economy that building a powerful military machine to win World War II did in the 1940s – and that the computer revolution did in the 1990s. Putting a ceiling on carbon emissions will inspire American innovation that will position the United States competitively for growth in the worldwide transition to a low-carbon economy. Though Europe and Japan have already started down this road, we will start before China, India and other emerging economies. But eventually all countries will join the international system to limit carbon emissions.

The nations that lead the hunt for low-carbon technologies will find that a huge market awaits them. Will we develop and export the coming wave of low carbon technologies – like carbon capture and sequestration, next-generation solar panels, and powerful lightweight batteries – so that jobs and businesses stay in America? Or will we sit back and wait, only to find ourselves importing those technologies from overseas?

In my view, it's not a difficult choice: let's harness American ingenuity now to rebuild our economy and protect the planet at the same time.

APPENDIX

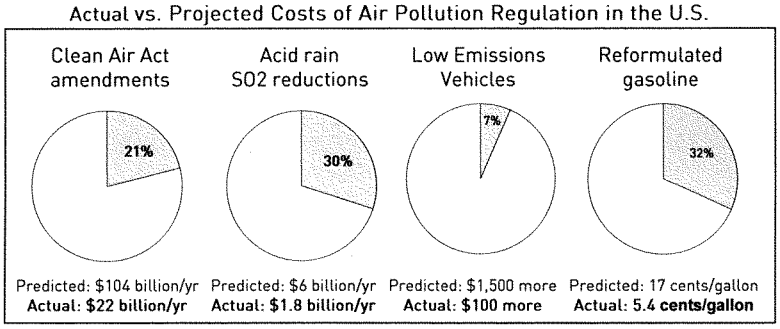
Air quality measures consistently cost less than predicted

In December 1970, the Clean Air Act became law. A triumph of bipartisanship, the statute has delivered cleaner, healthier air to millions of Americans. It has also proved to be one of the most cost-effective regulatory programs in American history. The U.S. Environmental Protection Agency (EPA) valued the total health benefits through 1990 at $22.2 trillion and the total compliance costs over the same years at $0.5 trillion, resulting in net monetary benefits of $21.7 trillion. The Clean Air Act continues to deliver these benefits, supplemented by the considerable health and environmental gains from the Clean Air Act Amendments of 1990.

Dire predictions and cost-effective results

Each time EPA has considered new clean air standards, it has been challenged with claims that meeting the new standards would not be feasible, practical or affordable. Yet time after time, the reverse has proved true. Benefits have overwhelmed the costs, which have been consistently lower than predicted. (See the figure below and the table on the reverse side).

Actual vs. Projected Costs of Air Pollution Regulation in the U.S.



The cost of cleaning America's air has been consistently lower than projected. This figure shows the actual cost of air pollution regulation as a percentage of initial predicted costs.

Cap-and-trade is the best approach to reducing emissions

One of the most innovative aspects of the Clean Air Act is its cap-and-trade approach to reducing emissions of sulfur dioxide, a precursor to acid rain. Initial analyses of the program warned of high costs, but these fears were not realized. In fact, the program demonstrates that properly designed market-based approaches can reduce emissions ahead of schedule and at far lower cost than conventional command-and-control regulation. The cap-and-trade approach provides incentives to reduce emissions, leads to low-cost environmental results and turns pollution reductions into marketable assets. Since its inception, the program has achieved 100% compliance in Phase I, reduced emissions at least 35% below 1990 levels and cost far less than projected.

Comparison of predicted costs of clean air programs with actual costs

Program	Predicted costs	Actual costs
Clean Air Act (CAA) amendments	**1990:** "The study we are releasing today estimates that the cost of the various proposed amendments . . . could be as high as **$104 billion** per year."[a]	**1995:** Five years after implementation, EPA estimated that the CAA amendments cost **$22 billion** per year.[b]
Acid rain	**1990:** The EPA estimated that Phase II costs would be **$6 billion** per year.[c] **1990:** The Edison Electric Institute estimated that SO2 reductions would cost the electric utility industry **$3.6–4.5 billion** per year.[e]	**2005:** The Office of Management and Budget estimated that the annual cost of reducing SO2 is **$1.1–1.8 billion**.[d]
Low emissions vehicles	**1994:** Automobile manufacturers estimated that low emission vehicles would cost **$1,500** more than comparable car models.[f] **1990:** The California Air Resources Board estimated the average incremental cost of a low emissions vehicle to be **$170**. Industry estimates in California were **$788**.[h]	**1995:** One year after this estimate, Honda placed a Civic subcompact model on the market that emitted less than half of what was permitted under California law. This vehicle cost only **$100** more than comparable models.[g] **1998:** The actual incremental cost of low emission vehicle technology was **$83**.[i]
Reformulated gasoline in California	**1991:** The California Air Resources Board predicted that reformulated gas would lead to a price increase of **12–17 cents** per gallon.[j]	**1998:** The actual price differential was **5.4 cents** per gallon.[k]

a Business Roundtable. "Clean Air Act Legislation Cost Evaluation." January 18, 1990.
b E.H. Pechan & Associates, Inc., contracted by EPA. "Clean Air Act Section 812 Prospective Assessment—Cost Analysis Draft Report". September, 1995.
c National Acid Precipitation Assessment Program. "Report to Congress: An Integrated Assessment." 2005. Available at: http://www.al.noaa.gov/AQRS/reports/napapreport05.pdf.
d Ibid.
e Materials sent to editors and writers by the Edison Electric Institute describing the impact of the Clean Air Act Amendments on the electric utility industry. December 17, 1990.
f Sierra Research, Inc., "The Cost Effectiveness of Further Regulating Mobile Source Emissions." February 28, 1994.
g *The New York Times*, "Honda Meets a Strict Emission Rule." August 30, 1995.
h W. Harrington, R. Morgenstern, P. Nelson (Resources for the Future), "On the Accuracy of Regulatory Cost Estimates." January 1999. Citing Cackett,"The Cost of Emission Controls on Motor Vehicles and Fuels: Two Case Studies," presented at the 1998 Summer Symposium of the EPA Center on Airborne Organics, MIT Endicott House, Dedham, Mass. July 9–10, 1998.
i Ibid.
j Ibid.
k Ibid.

August 25, 2009

Responses to Supplemental Questions
Submitted by Senator Cardin and Senator Klobuchar
To Fred Krupp
President, Environmental Defense Fund
After testimony before
The U.S. Senate Committee on Environment and Public Works
August 6, 2009 Hearing: Climate Change and Ensuring America
Leads the Clean Energy Transformation

Questions from:

Senator Benjamin Cardin

1. America is the land of innovation. So many of today's modem conveniences were invented and have technologically evolved here in the US. While we know that from a manufacturing stand point, countries like China have surpassed the US. Yet the US remains a global leader when it comes to innovative development and production of quality.

While the US may be a little late getting into the production of clean energy technologies, what is your sense of the US's ability to "catch up," so to speak, with the rest of the world? Do you think that as clean technology and clean energy begins to take hold in the US that rest of the world will look to the US to provide the best and most efficient clean energy technology? How wide is the gap?

It's true that China has become the world leader in wind and solar power manufacturing and is attempting to take the pole position in one of the next great clean-energy sectors, vehicle electrification. But that is by no means the end of the story.

Taking the wind energy industry as an example, we see the U.S. and China in a race to the top. Globally, 2008 saw record 29 percent growth in wind energy installations. The U.S. increased its installed capacity by 50 percent and surpassed Germany to become the number one wind generator in the world. And China doubled its generating capacity for the fourth year in a row.

For the U.S., the increase in generation brought an increase in manufacturing along with it – which accounted for an injection of more than $17 billion into the economy, 55 new production facilities and some 13,000 new direct jobs, bringing total direct employment in wind manufacturing, construction, operation and other direct services to 85,000 according to the American Wind Energy Association.

At the same time, domestically manufactured wind turbine components grew to make up a greater portion of the parts going into wind facilities installed in the U.S. – from under 30 percent in 2005 to about 50 percent in 2008. That's the good news – and it proves the larger point that we don't need to cede manufacturing to overseas suppliers.

U.S. investment in clean-energy technologies exploded in 2007 and 2008, outpacing most sectors. And after sputtering in early 2009, it is again on the rise across a broad range of categories – including electricity generation and smart grid applications, efficiency technologies, vehicle electrification and alternative fuels. The question is: will this investment appetite prove to be bubble, or will it be a portent of long-term growth?

The answer almost certainly lies in whether we as a nation decide to lay a foundation for stable, predictable growth in clean energy. Renewable electricity and renewable fuel standards, tax incentives, and efficiency mandates for vehicles, appliances and buildings have been important tools for driving innovation and growth – and they can continue to play a role. But as we've seen time and again, they tend to produce only incremental results – geared toward the next mandate or looking no further than beyond the expiration of a particular tax incentive. In order for the U.S. maintain and capitalize on its competitive advantage as world leader in technology innovation, we need to provide a framework for long-term investment decisions through a cap-and-trade program. Testifying last year before Congress, Mission Point Capital Partners Senior Director, Daniel Abbasi, summarized this point well:

> "A long-term stable price signal for carbon is imperative to encourage innovation and to promote investment. It needs to be long enough to reward investors for locking up their capital in asset-intensive, long lead-time energy projects and taking on the associated technical, construction and market risks. Moreover, only a long-term carbon price will motivate investment in a the supply chain companies that must scale up and thrive if we're to drive down the price of low-carbon energy. While we're finding some attractive investments today, candidly we are also holding back a lot of 'dry power' – or uninvested capital – and the economic downturn is only partly to blame. The biggest factor is continued uncertainty over whether Congress will pass a cap-and-trade bill."

2. This analogy has been drawn on before, but when the US decided to formally join the Allies and engage in World War II the US industrial economy completely shifted to a war time economy. In a matter of months auto manufacturers and other industrial plants stopped production on civilian operations and focused entirely on building for the war effort. I realize that this may be an extreme example and I'm not to equate our situation to World War II but it does go to show that when pressed our economy can in fact transform quickly and put people to work on projects that are important to the nation. How long do you think it would take for an economic transformation to clean energy to take place in the US? What would need to happen from a policy statement to set us on that course?

The World War II comparison is useful, I think, in illustrating the agility of the American economy when called to a larger purpose. And while we want to be careful and respectful with the analogy, there is value in highlighting the fact that effectively addressing climate change is critical to our long-term security. It is important to recognize, however, that the industrial transformation required

by the war effort took a much different shape than what is required of us today. Rather than a shifting of resources from one purpose to another, here we are talking about an evolutionary process.

Fortunately, we already have at our disposal the means to achieve the near-term emission reductions that science tells us are necessary. A recent report by McKinsey & Company found that through currently-available energy efficiency measures alone, the U.S. could reduce greenhouse emissions by 23 percent by 2020 compared to business as usual – and in doing so, we could realize energy savings worth $1.2 trillion for a capital investment of only $520 billion. Energy efficiency is not the only tool in the tool box, of course. But the broader point – that we already have cost-effective solutions for our near-term goals – merits reinforcement as we contemplate a path forward.

Meeting our longer-term greenhouse gas reduction targets, on the other hand, will indeed require a comprehensive shift in the ways we produce, store, transmit and use energy. Rather than having government try to pick technology winners, we believe the innovative capacity of the private sector should be unleashed to simultaneously solve the climate crisis and lay the foundation for U.S competitiveness in the 21st Century. What's lacking now is the appropriate condition of predictable, long-term demand. That, of course, is the genius of a cap-and-trade approach. It creates that demand and allows market forces to guide investment decisions as a science-based cap is gently phased in over four decades. Accordingly, we would anticipate that the transformation to a clean-energy economy would, generally speaking, evolve over that same time horizon.

Senator Amy Klobuchar

1. Could you please expand briefly on the innovation needed to build and link a new energy transmission system across the country. How quickly can a smart grid realistically be deployed? Are there limitations that restrict the speed at which this technology can be adopted? What technological improvements are needed to include every American home in a smart grid system?

Smart grid has come to mean many things to many people. For some, its about updating and expanding the several regional electric transmission systems we have in this country, making them more reliable and improving their ability to integrate large scale wind and solar into the grid. For others, its about the promise of providing consumers with real time information about the cost of electricity so that they can make smarter choices about when and how to use electricity, or making it easier to install roof top photovoltaic solar at a home or business or to plug in and charge the batteries of a hybrid electric vehicle.

All of these things are important attributes of what a smart grid can achieve, but what is often lost in the conversation is that a true smart grid is not about any one of these functions in isolation, but how we create an integrated and dynamic system where all of these functions can happen simultaneously and where they compliment each other to bring greater reliability and less impact over the long term, both financially and environmentally, than if we continued to develop our nation's electric generation and delivery infrastructure in the conventional way.

Done right, a "smart" grid facilitates deployment of a wide variety of innovations in energy technologies and services, in the same way the physical infrastructure underlying the internet has facilitated a revolution in information and communication services. A revolution in how we generate, deliver and consume electricity is critical to our nation's ability to remain competitive in a high technology global economy and equally critical to achieving the significant and necessary greenhouse gas pollution reductions necessary to avoid the worst consequences of global warming, as well as achieve other important environmental objectives.

Congress and the Administration have already taken an important step in realizing the promise of the smart grid by allocating over $4.5 billion in federal stimulus dollars to the demonstration and deployment of smart grid technologies. But there are three things that Congress can do to help ensure that we get the most out of this investment.

First, as I have said many times, a cap on greenhouse gas pollution is essential to generating the price signal necessary to support a wide variety of investments in low-carbon technologies. But, beyond this, it is critically important that Congress and the Administration continue to pursue policies that encourage the development of competitive, well-regulated wholesale energy markets, where the attributes of a reliable and environmentally sound electric generation delivery system are explicitly valued and priced. Further, the federal government should enact incentives that encourage state public utility commissions to enact innovative retail rate structures that reward consumer investments in energy efficiency, demand response and distributed renewable energy technologies, and fairly compensate utility investments in innovative technologies and programs that help consumers understand their energy choices and enable them to use this information to reduce the total cost of their monthly utility bill. EDF believes that the most sustainable energy and environmental policies

are ones built on availability and transparency of information, and regulatory reforms of this type at both the federal and state level are as critical to the success of the smart grid as the technology deployment itself.

Second, as Congress wrestles with the important issue of permitting and siting new interstate transmission capacity, it is critical that any decisions to build new transmission capacity be predicated on a comprehensive regional planning process built from the "bottom up." A smart grid future means that actions taken at the distribution system level, such as demand response, energy efficiency or distributed renewable energy deployment, can be an equal partner with new electric transmission capacity in achieving regional grid reliability; and their aggressive deployment can reduce or eliminate the need for transmission in certain cases. Federal mandates for better system planning should require the full range of available solutions be assessed, with the view that new interstate transmission is only one of several options available for transforming our electric transmission and delivery system into a platform for supporting low carbon electricity choices.

Third, one of the most important steps Congress can take toward a smart grid future is through oversight of how federal stimulus dollars for smart grid deployment are spent. Priority should be given to projects that demonstrate how the sum of a wide variety of technologies and services, integrated through a sophisticated grid, is greater than what any one technology or service could achieve if deployed independently. Equally important, Congress should be looking for projects that maximize environmental bang for the buck. In the Energy Independence and Security Act of 2007, Congress framed the value of smart grid investments broadly in terms of facilitating distributed generation, renewable energy technologies, energy efficiency and demand response, with the implication that the environment will be well-served by their deployment. The American Recovery and Reinvestment Act of 2009 further states that stimulus projects should, among other things, advance "...environmental protection, other infrastructure that will provide long term economic benefits." However, beyond this there is little specific congressional guidance to the Department of Energy as to how to best achieve this intent. Environmental Defense Fund respectfully suggests that there are four environmental priorities for smart grid investment. These priorities are:

1. Reduction of greenhouse gas pollution.
2. Reduction of criteria and hazardous air pollutants generally, but specifically in nonattainment areas, economically disadvantaged communities and/or communities suffering disproportionate environmental burdens, and upwind areas impacting these areas.
3. Conservation of water resources.
4. Minimization of adverse impacts to wildlife and sensitive habitats and ecosystems.

Criteria for evaluating these priorities are laid out in the following chart.

Priority	***Metric***
Reducing GHG Pollution	Tons of CO2 avoided per year Pounds of CO2 avoided per kilowatt hour produced
Reducing Criteria and Hazardous Air Pollutants • Nonattainment areas	Tons of NOx, SO2, VOC, CO, PM, HAPs avoided per year Pounds of NOx, SO2, VOC, CO, PM, HAPs avoided per kilowatt hour produced

- EJ communities
- Upwind areas impacting Nonattainment or EJ areas

Water Conservation	Avoided water consumption per kilowatt hour produced
	Avoided water consumption per capita in electric utility service territory, with particular attention to reduced or avoided water pumping and long-range transport and reduced or avoided municipal water treatment (pre- or post-use)
Minimization of Impacts to Wildlife, Habitat, Sensitive Ecosystems	All of the above, plus:
	Amount of undeveloped acres of land avoided
	Amount of new large scale generation and transmission capacity delayed or avoided as a consequence of reducing electricity demand, as benchmarked against approved utility resource plans and/or RTO reliability plans

We hope that members of Congress will adopt these four benchmarks as their own and use the suggested metrics as a way of evaluating DOE's success in deploying smart grid stimulus dollars in ways that truly achieve Congressional intent.

2. Last Month, Google announced it may have found a way to produce electricity using large scale geothermal energy at a cheaper price than coal. Given that companies like Google are making major strides in developing clean energy technologies, and that countries like China are outpacing our investments in clean energy technology, what will it take for us to go far enough in supporting R&D for clean energy technologies?

After almost 20 years of decline in federal support for clean energy R&D, Congress and the White House have agreed there is a need for a dramatic ramp-up of research investment. President Obama has called for a 10-year investment of $150 billion in clean energy R&D – representing a five-fold increase over recent funding levels. The House and Senate appropriations bills are generally keeping pace with the President's FY2010 budget request. The real investment increase, however, is a product of the American Recovery and Reinvestment Act – which included $39 billion for energy research investments at DOE along with $20 billion in tax incentives for applied research, demonstration and deployment of clean energy. This represents a higher level of research investment than the domestic energy industry has ever known. The question at hand is whether today's renewed emphasis on energy research will be sustained over the long run or whether stimulus funding will prove to be a one-time jolt.

Sending a long-term price signal through a comprehensive cap-and-trade program will be the most important way to move a massive quantity of private dollars into deploying clean energy technologies including accelerating private research investment. That said, public investment in

basic and applied research along with demonstration programs will remain a critical component of enhancing U.S. competitiveness since at the early stage of researching technologies private spending is less likely. To keep pace with global competition, the U.S. will need to make a long-term commitment to aggressive investment in energy R&D.

China, for example, is reportedly investing more than $600 billion in clean energy research over the next decade, and South Korea says it will invest almost 2 percent of its GDP into clean energy R&D each year for the next five years (the U.S. equivalent would be approximately $700 billion annually).

By a number of estimates, the U.S. needs to enhance and sustain energy research funding to at least $15-30 billion annually over the next decade in order to meet the technology challenges that lie ahead and not lose ground to global competition. Such an investment would not be unheard of. The Apollo Program received almost $200 billion between 1963-72 (in 2002 dollars). Certainly, a national commitment on this order would be more than justified to address the economic, environmental and security issues at play as we attempt to avert catastrophic climate change.

Senator BOXER. Thank you very much.
Mr. Fehrman, welcome.

STATEMENT OF BILL FEHRMAN, PRESIDENT AND CEO, MIDAMERICAN ENERGY COMPANY

Mr. FEHRMAN. Thank you. Chairman Boxer, Senator Inhofe, and members of the committee, thank you for inviting me to testify.

MidAmerican Energy Company is the largest utility in Iowa and also serves customers in Illinois, Nebraska, and South Dakota. Our generation mix is about 50 percent coal, 20 percent renewables, 20 percent natural gas, and 10 percent nuclear, and we lead the Nation in utility-owned wind generation. Our parent company, MidAmerican Energy Holdings Company, is a subsidiary of Berkshire Hathaway.

MidAmerican supports reasonable emission reduction goals, and we fully commit to taking the necessary productive actions to meet these goals at the lowest possible cost to our customers. Controlling costs is critical because the slogan "make the polluters pay" hides the fact that it is our customers and your constituents who will actually pay for whatever program is implemented.

Cap-and-trade embraces two concepts. It is the declining caps in the Waxman-Markey bill that will force companies to make productive investments to reduce greenhouse gas emissions, much like the investments described by the first panel. What we oppose is the trade part of cap-and-trade and its allowance allocation methodology. The bill's market trading mechanism imposes an unnecessary second cost on our customers, the cost of buying unproductive emission allowances for every ton of emissions while they also pay for the new infrastructure to actually reduce those emissions. We don't need market signals from a trading program to act; we only need the compliance targets.

The bill's formula for distributing free allowances to utilities splits them 50/50 between emissions and retail sales. Free allowances based on retail sales means that utilities with nuclear and hydro generation will receive allowances that they do not need. It also means that utilities with coal and natural gas generation will not receive enough allowances. This inequity will be extremely costly for our customers and the customers of our sister utility in the West, PacifiCorp.

Specifically, MidAmerican will only receive 49 percent of the allowances needed to meet the bill's requirements. This creates a shortfall of 11 million allowances in just the first compliance year, which, at $25 per allowance, will cost our customers $276 million.

In addition, another allocation of allowances, to merchant generators, will create an unlevel playing field for regulated utilities that make wholesale sales into the same market without allowances.

These are just some of the inequities created by this Wall Street allowance trading scheme in its distribution formula. In our view, there is no value added by imposing the cost of a volatile and speculative market-based trading program on a highly regulated industry. The way to remedy this is to give States a choice. Keep the caps in place, but permit each State, on a utility-by-utility basis, to either participate in the trading program or to develop an alter-

native mechanism for working directly with their regulated utilities to meet the caps under a State implementation plan without the trading.

In both cases, the Federal Government would set the standards and enforce the penalties for noncompliance as it does for many environmental programs today, and the industry would then be responsible for implementing the program.

There is precedent for this approach. While not a perfect analogy, when Congress, 2 years ago, raised fuel economy standards, it gave auto makers a simple, understandable standard and told them to comply. No allowances, no offsets, no trading; just a standard and a mandate to meet it.

However, if you remain wedded to the bill's trading mechanism, then all free allowances should be distributed based on emissions, like the successful acid rain SO_2 cap-and-trade program it is supposed to be modeled on. Under the acid rain program, the free allowances only went to the emitters that actually need them for compliance. Under Waxman-Markey, utilities with nuclear and hydro generation will receive billions of free windfall allowances that they do not need for compliance.

The acid rain program gave out 90 percent of its allowances to emitters, and the allowances were freely distributed over the life of the program. Not here. Under that program the proceeds from the auctions are redistributed to emitters that have actual compliance obligations. Not here. Under that program, once an emitter meets its emission reduction target, i.e., meeting the cap, it has met its compliance obligation. Not under Waxman-Markey, where a utility could meet its emission reduction target and still be required to purchase millions of additional allowances.

Changes to the bill must also eliminate the penalty for early action. Utilities around the country have built thousands of megawatts of renewable resource in the past decade. Our company, for example, has installed around 1300 megawatts of wind since 2004. Under this bill, our early action reduces our historic emissions and thus reduces our allowance allocations, forcing us to buy even more.

If the goal is to actually reduce emissions, we must advance the construction of renewable resources, significantly enhance energy efficiency programs, change customer behaviors, develop carbon capture and storage, and expand the nuclear power fleet.

I appreciate the chance to be here this morning, Chairman Boxer, and would be glad to answer questions you might have.

[The prepared statement of Mr. Fehrman follows:]

Written Testimony of William J. Fehrman

President, MidAmerican Energy Company

Senate Environment and Public Works Committee

August 6, 2009

Chairman Boxer, Senator Inhofe, and members of the Committee: Thank you for inviting me to testify today before your committee. I am Bill Fehrman, president of MidAmerican Energy Company, which is the largest utility in Iowa, serving more than 720,000 electric customers in Iowa, Illinois, and South Dakota. Our generation capacity mix is about 50% coal, 20% renewables (including wind, hydro, and biomass), 20% natural gas, and 10% nuclear, and we lead the nation in utility ownership of wind generation.

Our parent company, MidAmerican Energy Holdings Company, is a subsidiary of Berkshire Hathaway and is also the parent company of our sister utility, PacifiCorp. PacifiCorp serves 1.7 million electric customers in California, Idaho, Oregon, Utah, Washington, and Wyoming and is the second largest utility owner of wind generation in the United States. Collectively, our two utilities own five times more wind generation than any other utility.

I thank you and your staff for your many climate change hearings, but there is a difference between climate change issues and a climate change bill. For this reason, my testimony focuses on H.R. 2454 (the Waxman-Markey bill) and the changes to this bill that are necessary to reduce greenhouse gas emissions efficiently and effectively.

MidAmerican will achieve whatever emission reduction goals that Congress establishes. We, like other regulated utilities, will work with our state regulators to develop plans to construct additional low- and zero-carbon emitting power plants and take other productive actions that will meet those goals at the lowest possible cost to our customers. This is a critical point to understand with respect to the implementation of federal climate change legislation: Whatever bill Congress passes will not provide a regulated utility with a plan for reducing emissions. That plan will be developed at the state level. Controlling costs while achieving emission reductions is critical because the slogan "Make the polluters pay" hides the fact that it is our customers – and your constituents – who actually will pay for whatever program is implemented.

I. The Double Cost of Cap-and-Trade

Cap-and-trade embraces two concepts. It is the declining caps in the bill that will force companies to reduce their greenhouse gas emissions. We strongly support reasonable emission reductions, although they will entail major new costs for additional energy efficiency programs, costs to physically reduce emissions from existing power plants (such as fuel switching to natural gas), and investments to add more renewable energy resources, transmission, and integration equipment to ensure a safe and reliable electricity system. What we oppose is the trade part of cap-and-trade, because the bill's trading mechanism imposes an unnecessary and unproductive second cost on our customers – the cost of buying emission allowances for every ton of emissions, while at the same time paying for the new infrastructure to reduce those emissions. That is the hidden cost of the cap-and-trade system. It will require consumers to pay twice: first for emission allowances and then for the cost of the new infrastructure to reduce greenhouse gas emissions. Moreover, the trading mechanism forces highly regulated utilities to participate (and

spend customer funds) in a volatile and speculative allowance trading market. We don't need market signals to act – we only need the compliance targets.

The bill's allocation formula, which is split 50-50 between emissions and retail sales, ensures that customers of coal-dependent utilities will pay even more. By including a retail sales component instead of just focusing on emissions, the bill creates significant inequities across companies and customer classes and results in dramatic winners and losers. For example, as demonstrated in Attachment 1, MidAmerican will only receive 49% of the allowances needed to meet the bill's requirements. This creates a shortfall of over 11 million allowances in just the first compliance year. At $25 per allowance, that translates into $276 million in additional costs for our customers. And this penalty is not limited to Midwest utilities. Our parent company's Western utility, PacifiCorp, faces a shortfall of more than 20 million allowances – and more than $500 million in customer costs in just the first year. The bill's 50-50 formula will result in a wealth transfer from customers of utilities with coal-fired generation to those with hydro- and nuclear-power stations – which don't need the allowances to comply with the cap. This formula guarantees inequities and dramatic transfers of wealth among utilities. In addition, another allocation of allowances – to merchant generators – will create an unlevel playing field for regulated utilities that make wholesale sales into the same market without allowances.

Regardless of the allocation formula, the bottom line is that these allowances will not reduce greenhouse gas emissions by one ounce. In fact, their cost will make it harder for customers to pay for the productive part of this bill – the cost of building the less carbon-intensive infrastructure to actually meet the caps.

It is important to understand that the act of procuring allowances is unproductive and will not reduce greenhouse gas emissions. In fact, the requirement to purchase allowances diverts dollars that could instead be used productively to actually reduce emissions by investing in the less carbon-intensive infrastructure necessary to meet the caps. And it is these investments that will ultimately achieve the necessary reductions in greenhouse gas emissions.

II. Alternative Compliance Mechanism: Cap and No Trade

In our view, there is no value added by imposing the costs of a market-based trading program on a highly regulated industry that will already have to make enormous long-term investments to reduce greenhouse gas emissions. The caps alone will force the industry to make the necessary and productive changes that add value to their customers. There is no need for utilities and their customers to incur the second cost – and risk – of the trading market, with its speculators, the new Wall Street products, and the hundreds of billions of dollars in auction revenues that will come from customers and be directed towards other programs that may not benefit them. You can achieve all of this by permitting each state, on a utility-by-utility basis, to either participate in the allocation and trading program or to develop an alternative mechanism working directly with their regulated utilities to meet the caps under a state implementation plan without the added cost of trading.

In both cases, the federal government would set the standards and enforce the penalties for non-compliance, as it does for many environmental programs, and industry would implement the program. There is plenty of precedent for this approach. This is not a perfect analogy, but when

Congress two years ago raised fuel economy standards, you gave the automakers some flexibility, but you basically set a simple understandable standard and told them to comply. No allowances, no offset, no trading, no borrowing, no banking – just a standard and a mandate to meet it.

Owners and users of electric generation need clear, certain and predictable rules, regulations and incentives in order to make sound long-term and least-cost decisions to implement legislation to reduce greenhouse gas emissions. Emitters should be offered an alternative compliance mechanism that does not involve speculation, trading, and the exchange of billions (or perhaps trillions) of dollars. The focus of electricity sector planning should be long-term price stability, not long-term price volatility.

I have attached draft language for MidAmerican's proposed alternative compliance mechanism as Attachment 2 to my testimony. This alternative compliance plan amendment retains the same greenhouse gas emissions caps for 2020, 2030 and 2050 as the Waxman-Markey bill, but it eliminates the need for customers to pay twice. It accomplishes this by allowing a state to choose to have its regulated utilities avoid the costs of the trading market and work directly with their state regulators to meet the caps – which the regulated utilities would have to do anyway.

There is nothing novel about this alternative approach. In fact, the amendment proposes the same approach for implementing and enforcing the emissions cap that is used in other federal environmental laws and that has been used in utility regulation for more than a century: Congress or state legislatures enact a legal requirement and then state regulators, regulated

companies, interested parties, and experts determine the most efficient way to meet the requirement.

Key aspects of our alternative compliance plan amendment include:

- States, not utilities, determine whether to participate in the trading market or to use the alternative compliance approach. The determination requires legislative action approved by the governor because the entire state will be impacted by this decision.
- To protect consumers, only electric utilities whose rates are regulated by the state can qualify for the alternative compliance approach.
- Utilities must meet the same 2020, 2030 and 2050 caps whether the state chooses the market trading approach or the compliance alternative offered by the amendment.
- The same penalties apply for non-compliance.
- Alternative compliance plans must contain details of the measures that will be undertaken to ensure compliance with the caps.
- Alternative compliance plans must be updated at least every four years.
- Alternative compliance plans adopted by the state must be filed with the state and federal environmental agencies that enforce the Clean Air Act amendments.
- Utilities that serve more than one state can be subject to an alternative compliance plan in one state and to the trading market in another state.

This alternative compliance amendment lets states choose to focus on pursuing the most efficient ways of reducing greenhouse gas emissions to meet the federal caps, while at the same time

protecting their citizens. This tackles the real problem – reducing greenhouse gas emissions – but eliminates costly and useless allowance trading.

III. Allowance Allocation Alternatives

The Waxman-Markey allocation formula in §783(b) ("Electricity Local Distribution Companies") arbitrarily splits free allowances 50-50 between emissions attributable to retail electricity and retail electricity deliveries. This methodology ensures that customers of utilities that generate or purchase significant amounts of coal- and natural gas-fueled energy will receive far fewer allowances than needed to offset increased customer costs when compared to nuclear and hydro-dependent utilities whose actual emissions attributable to their retail electricity sales are minimal. The allocation of half of the free allowances based purely upon retail electricity deliveries will create wealth transfers from customers of utilities with coal-fired generation to those with hydro- and nuclear-power stations.

Customers of utilities with coal-fired generation begin the Waxman-Markey cap-and-trade program with insufficient free allowances because of three factors. First, the annual free allowance allocation to the electricity sector is already below actual sector emissions and the allocation declines annually. Second, as noted above, free allowances are not allocated based purely upon emissions, but rather split 50-50 with half allocated based upon retail electricity deliveries. And finally, some of the free allowances are allocated to merchant generators, which potentially create windfall profits because the savings are not passed on to their customers. Cumulatively all three of these factors place more of the Waxman-Markey cap-and-trade program's costs disproportionately on customers of utilities with coal-fired generation.

There are ways to mitigate wealth transfers among utilities and avoid windfall profits to merchant generators. Some argue that §783(b)(4) ("Prohibition Against Excess Distributions"), which was added just before the final vote, solves these problems, especially the 50-50 split. This section states that "no electricity local distribution company shall receive a greater quantity of allowances . . . [for retail sales] than is necessary to offset any increased electricity costs to such company's retail ratepayers, including increased costs attributable to purchased power costs, due to enactment of this title."

While the intent of the section is encouraging and its title is well-intentioned, the functionality of the provision does not appear workable for several reasons, nor does it address the overall inequities that would occur across utilities and customers. Specifically:

1. The section does not prohibit excess free allowances to a utility beyond the costs it incurs as a result of emissions attributable to retail electricity. Instead, excess distributions are prohibited above what is necessary "to offset increased electricity costs." Unfortunately the language lacks a focus on emissions driven costs and a method to ensure equity when analyzing electricity cost increases among utilities. That is a key distinction and one that must be resolved to avoid significant wealth transfers. Free allowances should be used to offset price increases incurred by a utility to reduce emissions attributable to its existing retail product.

2. It will be impossible to determine how electricity prices increase "due to enactment of this title" versus increases in electricity prices that may have occurred due to normal market forces.

3. The ambiguity of the term "increased electricity costs" provides opportunities for utilities to include a multitude of internal overheads, loadings, administrative costs, and other factors into the ultimate electricity price to serve its customers. There will be a clear incentive to make the calculations as favorable as possible in order to retain the full free allowance distribution.

4. Allowances for the next compliance year are required to be distributed by September 30th of the preceding year. As a result, there is no way to calculate the theoretical excess distributions for the next calendar year when the increases in electricity prices have yet to be realized by the utility.

5. In order for the provision to function, there would need to be a multi-year "look back" period. Under this scenario, potential over-allocations would need to be surrendered a year or more after the remaining utilities required them for compliance, thus driving up their costs. In addition, challenges would exist if certain utilities had already sold the excess allowances and passed on the windfall on to their customers. As a result, electric rates for some customers could vary widely from year to year.

If you remain wedded to the trading scheme in the Waxman-Markey bill, you must move to an emissions-based method of allocation to address the concerns of regional disparities and inequalities, the cost impact on and wealth transfers between different utility customers, and unintended consequences.

First, to make the program work more like the successful acid rain SO_2 cap-and-trade program it is supposed to be modeled after. Under the SO_2 program, the free allowances only went to the emitters that actually needed them for compliance. Under Waxman-Markey, utilities will receive billions of free windfall allowances for their nuclear and hydro generation – allowances they don't need for compliance or to offset emissions-related price increases, so they can turn around and sell them for windfall profits in the carbon market. The acid rain program gave out 97% of its allowances to the emitting sources, and the allowances are freely distributed over the life of the program. Under the SO_2 program, the proceeds from the auctions are redistributed to emitters that have actual compliance obligations. Not here. Under the SO_2 program, if an emitter met its emission reduction target, it met its compliance obligations. Under Waxman-Markey, a utility with coal-fueled resources could meet its emission reduction target and still be required to purchase millions of additional allowances costing customers billions of dollars, functioning more as a revenue generator than an emissions cap.

Second, if you want to retain an allocation of allowances for retail sales, take the advice of the California Public Utilities Commission and the California Energy Commission, which determined that "nuclear, hydro, and renewable sources … do not need [free allowances]." CPUC-CEC Final Opinion at 159.

These agencies, which held many hearings and workshops on the implementation of California's own global warming legislation (A.B. 32), instead recommended adoption of a fuel-differentiated output-based allocation method, under which free allowances are allocated only to emitting resources. This formula, according to these California agencies, would "reduce, and could largely eliminate, wealth transfers [among different local distribution company customers]." They specifically recommended:

> With a fuel-differentiated output-based allocation, allowances would be allocated only to deliverers of electricity from emitting resources, using weighting factors based on fuel type … the use of weighting factors would reduce, and could largely eliminate, wealth transfers from customers of coal-dependent retail providers to customers of natural gas dependent retail providers. This reduction of wealth transfers would be accomplished by providing emitting deliveries with allocations that more closely reflect their emission levels. CPUC-CEC Final Opinion on Greenhouse Gas Regulatory Strategies (October 6, 2008) (CPUC Rulemaking 06-04-009) (CEC Docket 07-OIIP-01) ("CPUC-CEC Final Opinion") at 158. See http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/92591.pdf

To correct these inequities in the Waxman-Markey bill, you should:

1. Freely allocate allowances only to utilities in proportion to their emissions attributable to their retail sales. Such an allocation method avoids wealth transfers between utilities. Eliminate §783(b)(3) ("Distribution Based on Deliveries") of the Waxman-Markey bill.

2. Modify §783(b)(2) of the Waxman-Markey bill ("Distribution Based on Emissions") and rely upon an updating emissions-based allowance allocation method as a way to avoid complicated "historic emissions baseline" calculations; avoid penalizing new, more efficient fossil power plants; and address concerns expressed by hydro- and nuclear-dependent utilities that are growing beyond their current zero-carbon portfolio.

3. Use a simplified, less onerous emissions calculation methodology that relies on approved allowance allocation weighting factors based on fossil fuel types. For example, the California agencies (see p. 11, above) recommended weighting factors whereby coal units receive twice as many allowances for megawatt-hours produced than natural gas units. CPUC-CEC Final Opinion at 159. Such an approach has the added benefit of rewarding more efficient coal- and natural gas-fueled units compared to older, less efficient units, which would otherwise receive more allowances because they have higher average emissions rates.

4. Eliminate §783(c) ("Merchant Coal Units") and §783(d) ("Long Term Contract Generators") of the Waxman-Markey bill, which provide free allowance allocations to merchant coal units and long-term power generators. These sections create (a) an unlevel playing field for utilities that also have wholesale sales of excess power and (b) opportunities for windfall profits to merchant generators. Long-term contract generators with contracts that do not allow for the recovery of emissions-related compliance costs could simply be given the right to renegotiate the terms of such agreements with federal oversight.

5. As a heavily regulated sector, electric utilities are required to pass through any excess costs or revenues to their customers. Under an appropriate emission-based allocation methodology, extending the period of time and increasing the number of allowances that are freely distributed to electric utilities will not produce windfall profits for utilities.

Increase the Waxman-Markey's §782(a) annual free allowance budgets for the electricity sector to reflect the actual emissions reduction targets for specified sources identified within §703(a). Annual electricity sector free allowance budgets that are more stringent than the §703(a) emissions reduction targets obligate the sector to subsidize emissions reductions that would otherwise occur within other sectors of the economy or transform the cap-and-trade program into merely a new revenue stream for the federal government. These inequities, coupled with the very strong likelihood of other sectors achieving their mandated emission reductions through electrification (i.e., transportation), unfairly places the majority of the burden and cost for reducing emissions or raising revenues economy-wide on electricity customers.

IV. Reward Early Action

Utilities around the country have built thousands of megawatts of renewable energy resources in the past decade. Our company, for example, has installed almost 1,300 megawatts of wind since 2004. We are the largest utility owner of wind generation in the country, and we are proud of this accomplishment which has greatly reduced our carbon intensity. How does the bill treat our customers for this early action to reduce carbon emissions? It penalizes them. That early action reduced our historic emissions intensity, thus reducing our allowance allocations and forcing us to buy even more allowances in the market. Attachment 3 to my testimony demonstrates MidAmerican's decreasing carbon dioxide emission intensity. The allowance trading mechanism in this bill thus penalizes our customers for every kilowatt-hour produced by those wind generators. If the goal of the trading program is to incentivize generators to build low- and zero-emission power plants, it makes no sense whatsoever to penalize the customers of early movers

who did exactly that – before the bill's enactment. Such voluntary investments made prior to any state or federal mandate should be recognized by the cap-and-trade program by converting excess renewable energy certificates into a form of carbon offset.

V. Ensure a Robust Offsets Market

Offsets – credits for emission reductions from sources outside the cap – have the potential to produce significant cost savings in the Waxman-Markey cap-and-trade program. Preliminary economic modeling conducted by PacifiCorp with the Electric Power Research Institute suggests that the volume of compliance eligible carbon offsets will have a dramatic impact on the price of allowances. For example, in 2012, assuming a supply of 2 billion offsets available every year through 2030 (which is the amount authorized by the bill) – one allowance (representing one metric ton of carbon dioxide) is forecast to be about $17.55. However, if the carbon offsets market is illiquid and only slowly grows to about 500 million compliance eligible carbon offsets available by 2030, the price of carbon beginning in 2012 is estimated to be closer to $91.03 and increasing thereafter. Such a dramatic swing in the price of allowances directly reflects what one assumes is the annual supply of compliance eligible carbon offsets.

These findings are consistent with the recent Environmental Protection Agency study, which assumes that the full availability of offsets allowed under the bill will be utilized each and every year. If they are not, allowance prices would increase by nearly 90% by 2015. It is therefore critical to ensure the existence of a robust offsets market from the onset of the program – or to permit the use of other categories of offsets, such as excess renewable energy credits that utilities have accumulated under the renewable electricity standard provisions in the bill.

VI. Market Manipulation

Due to the expected magnitude of the carbon allowance market, market abuses are a real possibility. Under the Waxman-Markey bill, utilities – the ones that actually need the allowances for compliance – will be forced to compete with Wall Street investment banks, hedge funds and speculators. As §724(b) makes absolutely clear, the "privilege of purchasing, holding, selling, exchanging, transferring, and requesting retirement of emission allowances, compensatory allowances, or offset credits shall not be restricted to the owners and operators of covered entities, except as otherwise provided in this title." (Emphasis added.) Those entities do not generate electricity and do not need allowances for compliance; they want them for commissions. If we have learned anything from securitized mortgage trading and credit default swaps, it is that market regulation has unfortunately not prevented abuses, no matter how aggressive the oversight. The easiest way to cure this problem is simply to delete the word "not" from §724(b).

We only need to look back a few years in the SO_2 allowance market to see the impact that speculators can have on the market price of allowances. During the fourth quarter of 2005, SO_2 allowance prices quickly doubled from around $800 to over $1,600 as a number of speculators began acquiring significant allowance positions. Within three months, the volatile allowance market dropped back to around $800 as profitable positions were liquidated, thus requiring those utilities that acquired allowance positions at the top of the market to write off millions of dollars in lost value.

The magnitude of the carbon market, however, will far exceed that of the sulfur market. In fact, the allocation of carbon allowances in 2016 will be over 600 times greater than the allocation of sulfur allowances under the acid rain program. According to several market analysts, if the Waxman-Markey bill is passed into law, the global carbon market could become the largest commodity in the world – larger than the crude oil and natural gas markets combined. In fact, the Commodities Futures Trading Commission projects a $2 trillion carbon futures market within five years, with up to 180 million private contracts per year.

VII. Technology Discussion

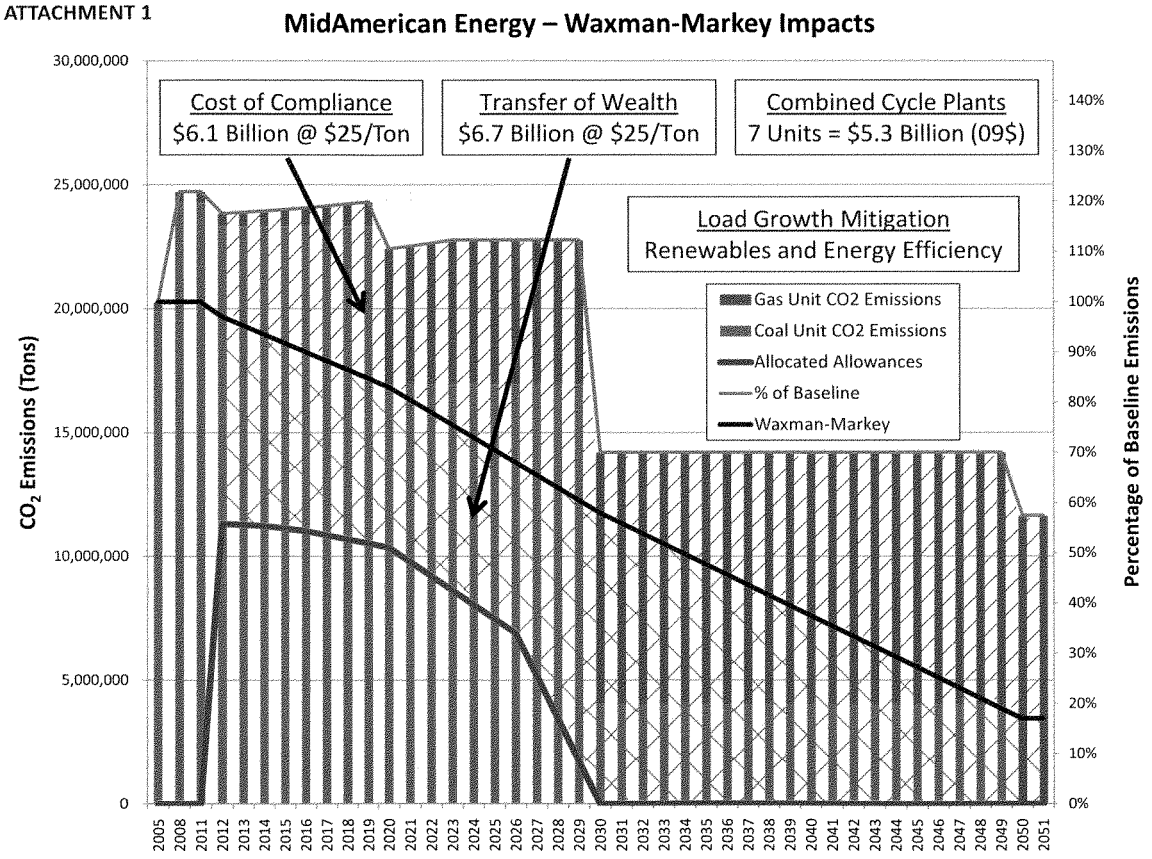
If the goal is to actually reduce emissions, we must advance the construction of renewable energy projects, significantly enhance energy efficiency programs, change customer behaviors, develop carbon capture and storage and other new technologies, and expand the nuclear power fleet.

If there's no technology to "trade" for, cap-and-trade is really a tax. Cap-and-trade can only work when there is something to trade. If low-carbon technologies are not available, utilities just pay compliance costs, which is a fancy term for a tax. Meanwhile, the emissions are unchanged. As outlined in the graph in Attachment 1, even if all of MidAmerican Energy's coal-fueled units were converted to combined cycle combustion turbine units burning natural gas (a much higher cost fuel), the 83% target would still not be close to being achieved. With 70% of our nation's electricity generated from fossil fuels, buying allowances or offsets is the only short-term answer. As I have noted, addressing climate change will require massive long-term new infrastructure and very significant technological innovation.

VIII. Conclusion

Most important, Chairman Boxer, I urge this committee to hold these types of hearings after you release your draft bill but before you mark it up. Many stakeholders have valuable input and different insights – some quite different from ours – so the more you hear reactions to an actual bill the better your final product will be. Even better, consider holding several work sessions prior to releasing the bill to address these critical issues. We would be pleased to support these work sessions in any way that is helpful. It is critical that greenhouse gas reductions be done right – in an equitable and least cost manner to mitigate impacts on those who will ultimately pay the bill – our customers and your constituents.

ATTACHMENT 1



ATTACHMENT 2

"SEC. XXX.—ALTERNATIVE COMPLIANCE MECHANISM.

"(a) IN GENERAL.—Title VII of the Clean Air Act (as added by section 331 of this Act) is amended by adding the following new part after Part F:

"PART G—ALTERNATIVE COMPLIANCE MECHANISM FOR RATE-REGULATED ELECTRIC UTILITIES

"SEC. 871. CERTIFICATION TO CONGRESS.

"(a) DEFINITIONS.—For purposes of this part:

"(1) The term 'rate-regulated retail electric supplier' means an electric utility that sold not less than 4,000,000 megawatt hours of electric energy to electric consumers for purposes other than resale during the calendar year prior to the enactment of this Act pursuant to rates that are subject to review and acceptance by regulatory authorities in one or more states.

"(b) STATE CERTIFICATION.—

"(1) Not later than 1 year after the date of enactment of this Act, each State shall certify to the Administrator of the Environmental Protection Agency, by legislative act effective upon signature of the governor, which of the rate-regulated retail electric suppliers providing retail electric service within that State shall meet the requirements of Title VII of this Act through the program established in Part C of Title VII of this Act and which shall meet the requirements through a state alternative compliance plan developed under section 872.

"(2) If a State certifies that one or more of the rate-regulated retail electric suppliers providing retail electric service within that State will be subject to an alternative compliance plan, the State is authorized to implement and enforce the requirements of Title VII of this Act through a state alternative compliance plan developed under section 872.

"(3) A rate-regulated retail electric supplier that complies with a State's alternative compliance plan developed under section 872 shall be deemed to be in compliance with any requirements under Title VII of this Act, excluding any reporting requirements under section 713.

"(c) PENALTIES FOR NON-COMPLIANCE.—

"The penalty for noncompliance described in section 723 shall apply to a State's failure to comply with its alternative compliance plan; provided that a certifying

State may seek to recover the costs of the penalty for non-compliance described in section 723 from the rate-regulated retail electric supplier covered by the alternative compliance plan if the certifying State determines that the cause of non-compliance was the direct result of an action or inaction by such rate-regulated retail electric supplier.

"SEC. 872. STATE ALTERNATIVE COMPLIANCE PLANS

"(a) REQUIREMENTS.—Within 1 year after the date of submitting the certification under section 871(b)(1) of this Part, the State agency responsible for regulating the electric rates of the rate-regulated retail electric supplier shall adopt an alternative compliance plan for each rate-regulated retail electric supplier which has been identified as being subject to a plan. The State shall promulgate any laws or regulations necessary to provide for the implementation, maintenance, and enforcement of the requirements described in this section.

"(b) CONTENTS OF ALTERNATIVE COMPLIANCE PLANS.— Each alternative compliance plan of a State shall—

"(1) identify the rate-regulated retail electric supplier providing retail electric service within that State that will be subject to the alternative compliance plan;

"(2) determine the quantity of greenhouse gas emissions attributable to the retail electric service provided within the State by the rate-regulated retail electric supplier in 2005;

"(3) require that, if the rate-regulated retail electric supplier owns or operates a covered EGU within the State as defined in section 116 of Title I of this Act, the covered EGU must meet the performance standards established by that section; and

"(4) set forth in detail the measures that will be required to be undertaken by the rate-regulated retail electric supplier to satisfy the emissions reduction targets for 2020, 2030 and 2050 of Sections 703 of Part A of Title VII of this Act for the proportion of its total emissions that are subject to regulation by the State adopting the alternative compliance plan.

"(c) REGIONAL CAP AND TRADE PROGRAMS PROHIBITED.— Participation in a regional cap and trade program or comparable program shall not be deemed a permissible measure under subsection (b)(4).

"(d) UPDATES TO PLANS.— Alternative compliance plans shall be updated by the State at least every four years.

"(e) FILING OF PLANS.—

"(1) Within thirty days after adoption by the State agency responsible for regulating the electric rates of the rate-regulated retail electric supplier, an alternative compliance plan or update shall be filed with the State environmental agency delegated enforcement authority of U.S. Code Title 42, Chapter 85.

"(2) The State environmental agency delegated enforcement authority of U.S. Code Title 42, Section 7410 shall file the alternative compliance plan or update with Administrator of the Environmental Protection Agency as a State Implementation Plan control measure.

"(f) ALLOCATION OF ALLOWANCES.— A rate-regulated retail electric supplier that is subject to a state alternative compliance plan under this section shall not receive allowances under Part C of Title VII this Act for the proportion of its total emissions and retail sales that are subject to regulation by the State adopting the alternative compliance plan. Except as provided in this section, a rate-regulated retail electric supplier subject to an adopted alternative compliance plan shall not be subject to the provisions and rules of Part C.

"(g) OFFSETS.— In addition to other measures to satisfy the emissions reduction requirements under subsection (b)(4), a rate-regulated retail electric supplier that is subject to a state alternative compliance plan under this section shall be authorized to receive offset credits under Part D of Title VII of this Act as follows:

"(1) Offset credits under Section 732 for over-compliance for federal renewable energy credits issued pursuant to Title I of this Act and tendered by the owner of such credits to the extent the credits have not been submitted to comply with the annual compliance obligation under Title I, Section 101(b) of this Act or otherwise retired pursuant to a federal program;

"(2) Offset credits under Section 732 for over-compliance for total annual electricity savings as defined in Title I, Section 101(a) of this Act to the extent the total annual electricity savings have not been submitted to comply with the annual compliance obligation under Title I, Section 101(b) of this Act;

"(3) Offset credits under Section 740 for early action for megawatt hours of renewable energy that would have qualified for issuance of federal renewable electricity credits pursuant to Title I of this Act but for the fact that the energy production occurred after January 1, 2005 but prior to December 31, 2011; and

"(4) Offset credits under Section 740 for early action for megawatt hours of electricity savings between January 1, 2005 and December 31, 2011 that would have qualified as total annual electricity savings as defined in Title I, Section 101(a) of this Act but for the fact that the measures were placed into service prior to the enactment of Title I.

"(h) PUBLIC-PRIVATE COLLABORATION.— A rate-regulated retail electric supplier that is subject to a state alternative compliance plan under this section shall collaborate with the State agency responsible for regulating the electric rates of the rate-regulated retail electric supplier to develop a long-term integrated resource plan designed to ensure compliance with the requirements of this section.

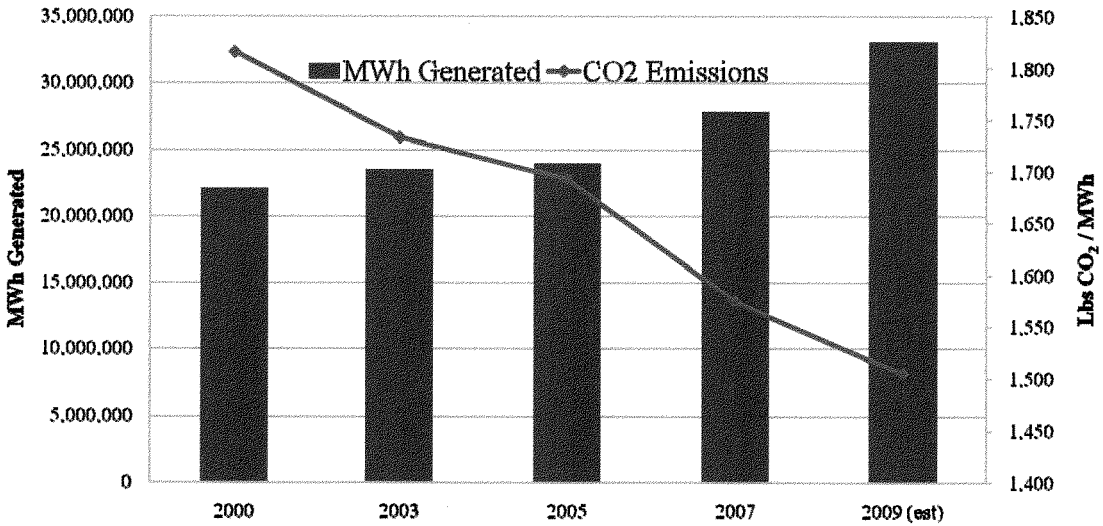
"(i) APPLICABILITY OF CLEAN AIR ACT PROVISIONS.—

"(1) A rate-regulated retail electric supplier that is subject to a state alternative compliance plan under this section shall not be subject to the following provisions of the U.S. Code as long as the plants remain in compliance with the state's alternative compliance plan: Title 42, Sections 7411, 7412, 7413, and 7470 through 7479.

"(2) The exemptions in Part C of Title VIII of this Act shall apply to a rate-regulated retail electric supplier that is subject to a state alternative compliance plan under this section.

ATTACHMENT 3

MidAmerican's Wind Benefit
Decreasing Carbon Footprint



MidAmerican ENERGY

Environment and Public Works Committee Hearing
August 6, 2009
Follow-Up Questions for Written Submission

Questions for Fehrman

Questions from:

Senator Amy Klobuchar

1. **Could you please expand briefly on the innovation needed to build and link a new energy transmission system across the country? How quickly can a smart grid realistically be deployed? Are there limitations that restrict the speed at which this technology can be adopted? What technological improvements are needed to include every American home in a smart grid system?**

   A: The term "smart grid" has been used to apply to a number of different concepts, ranging from technologies installed in homes to allow consumers to monitor and manage their energy use all the way to infrastructure for the delivery of renewable energy. Concerning the latter, virtually all policy makers agree that existing transmission infrastructure is inadequate to reliably integrate new renewable resources to demand centers. We are already seeing the impact of transmission limitations on wind development, with interconnection queue backlogs and forced curtailments. Moreover, the transmission grid was not designed for the long-distance continental transport of power, and will require enormous study to ascertain the best plan to meet potential requirements of climate change initiatives.

   MidAmerican Energy Holdings Company and its platform subsidiary, PacifiCorp, are addressing these and related issues in connection with Energy Gateway, a major transmission expansion program announced by PacifiCorp in May 2007. As proposed, it will add approximately 2,000 miles of new transmission line across the West. Construction is underway on one Energy Gateway segment and outreach, siting and permitting processes continue for several others. This project, which will cost at least $6 billion to $7 billion, is the first transmission investment of this scale in the region in at least 15 years.

   Many regulators and legislators recognize the fact that the existing transmission grid across the West is becoming more and more constrained. As the North American Energy Reliability Council noted in its November 2008 report, "Innovative planning and operational mechanisms will be needed as states and provinces attempt to deliver 'clean energy' over already heavily-loaded transmission lines to meet renewable portfolio standard requirements."

   A stronger and more versatile grid will help alleviate that congestion, ease transmission bottlenecks, enhance domestic energy security, enable new markets for renewable energy sources and ensure delivery of electricity to customers at a reasonable overall cost. The new Energy Gateway lines will move power from generation resources to high customer growth areas, particularly in Utah, Oregon and Wyoming. They also will support the needs of Western states that are seeking

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increased use of renewable energy. Much of that renewable energy, particularly wind, is expected to come from Wyoming and adjacent states.

MidAmerican believes that policies to modernize the nation's electric transmission system are needed to reliably integrate new renewable resources from resource-constrained areas to demand centers. As demonstrated by the North American Electricity Reliability Council, the existing national transmission infrastructure is inadequate to meet the nation's rapidly-shifting domestic energy needs, with transmission limitations, interconnection queue backlogs and forced curtailments all hindering the large-scale development of renewable energy.

In order to facilitate long-distance transport of power, and to meet the future requirements of a national renewable portfolio standard and carbon reduction laws, MidAmerican supports transmission policy incorporating the following elements:

- Consolidating authority for transmission siting and permitting on federal lands in order to expedite the development of new transmission projects, especially in the Western states.
- Federal incentives for unsubscribed capacity of new transmission projects in cases where a developer is already prepared to take a lead role in financing and construction of a core project.
- Maintaining the primacy of the states in the siting and permitting of interstate transmission projects.
- Support from the Federal Energy Regulatory Commission in providing incentives for smart grid and other renewable energy transmission investments in line with the risks.

2. **Last Month, Google announced it may have found a way to produce electricity using large scale geothermal energy at a cheaper price than coal. Given that companies like Google are making major strides in developing clean energy technologies, and that countries like China are outpacing our investments in clean energy technology, what will it take for us to go far enough in supporting R&D for clean energy technologies?**

A: If the goal is to actually reduce emissions, we must advance the construction of renewable energy projects, significantly enhance energy efficiency programs, change customer behaviors, develop carbon capture and storage and other new technologies, and expand the nuclear power fleet.

On the availability of carbon capture and storage (CCS) technology, MidAmerican's views are based on a realistic assessment of the current state of technological development and obstacles preventing commercial penetration. First, we agree with a key point in the Electric Power Research Institute's (EPRI) report, *Advanced Coal Power Systems with CO_2 Capture: EPRI's CoalFleet for Tomorrow Vision,* that if CCS technologies are not developed to commercial readiness in the next 10-12 years,

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their potential to help meet energy needs in a low-carbon future will be far less certain. While large-volume carbon dioxide storage demonstrations exist, an integrated capture and storage system at a power plant is not currently in operation. Other formidable obstacles have yet to be resolved, including pipeline siting and permitting and liability related to geologic storage.

Furthermore, in the report *Creating Our Future: Meeting the Electricity Technology Challenge*, EPRI models a "Limited Portfolio" scenario in which natural gas use expands rapidly from 2010-2020 when uncertainty exists regarding availability of new nuclear and CCS after 2020. Under this scenario, EPRI estimates that the cost of electricity (relative to 2007) would increase 90% in 2030 and 210% in 2050.

This underpins an essential point: a sustained investment over the next 10 years will greatly advance the development of clean energy technologies. However, it is difficult to determine whether these technologies will perform as designed. Therefore, assumptions about the level of market penetration are not reliable predictions and should be taken with a healthy measure of skepticism when factored into economic modeling.

As such, MidAmerican supports Section 114 of H.R. 2454, which establishes an industry self-financing mechanism to raise $10 billion over a 10-year time period for the development and deployment of CCS technologies. Furthermore, full funding of the programs authorized in the Energy Policy Act of 2005 would also help to advance technologies on a commercial scale.

Senator BOXER. Thank you very much, Mr. Fehrman.

I have so many questions. I want to talk about the speculation issue raised, because I was a former stockbroker on Wall Street, so I understand what happens when there is speculation, and we have all seen it with futures, and there is cause for some concern, and that is why I would not support a bill unless it really had very tough oversight.

But I wanted to ask you and Mr. Krupp this question. In the Waxman-Markey bill, they put a floor of $11 on the price. Some utilities have come to me and said what about a collar. So I would like to ask your response to that, Mr. Fehrman and Mr. Krupp.

Mr. FEHRMAN. The aspect of a collar would certainly promote upside protection on the cost to the customer. But fundamental, even with a collar and the allowance trading program, in and of itself still would impose a second cost on customers which we find would not be productive, and the reason for this is if a customer is going to spend a dollar, we want that dollar to be spent on actually investing in infrastructure to reduce carbon emissions. The need to spend a second dollar to buy an allowance to get up to a cap does not seem productive or useful for us. So, fundamentally, we would want to stay——

Senator BOXER. Well, if you are worried about the consumer, I am as well, and we are going to make sure our consumers are not hurt.

Mr. Krupp, could you talk about that? Many other utilities do support the Waxman-Markey bill, and I understand it is probably dependent on their mix and so on. But some are very heavily coal, like Duke Energy is very strongly in support of this. So if you could talk about the collar, but also this. Get back to the point. The Supreme Court said carbon is covered under the Clean Air Act, so we are going to clean up. We have to clean up the pollution to protect your customers, my constituents, everybody. And you talked about, Mr. Krupp, some of the issues if we don't do this. So, without getting into that, we are going to have to do it. And it just strikes me as unusual that a business person would rather choose a hard cap and no ability to get allocations, no ability to get offsets. It seems to me that is going to really put costs for them through the roof and miss the opportunity at all this job creation, all the money we need to do coal sequestration, which I also strongly endorse.

So, Mr. Krupp, if you could respond.

Mr. KRUPP. Yes. Thank you.

MidAmerican is in a very unique position. They have made some business decisions that I think, in retrospect, were bad business decisions. They just opened a new 800 megawatt coal-fired power plant in 2007. They wholesale 30 percent of their electricity they sell to their wholesale market. Under Waxman-Markey, the allocations follow the electrons, so the allocation goes to the people they are selling to, the customers. So the best way to protect the customers is to do it by having the allocations go to the LBCs for the benefit of their customers. So I think MidAmerican is a very special case that reflects a series of decisions that they made.

Certainly, the proposition you have asked me about specifically, a cap but no trade, would be extraordinarily expensive to consumers, because trading gives us the flexibility to hunt down the

lowest cost options. Trading gives customers and the companies that serve them the flexibility to switch fuels, to do carbon sequestration, to open a new wind turbine or a new nuclear power plant, and no trading makes just the single utility responsible, and they may not have the flexibility to do all these other things, so I don't think——

Senator BOXER. Could you comment on the collar idea?

Mr. KRUPP. The price collar specifically is just another word for a safety valve, and the big problem with a safety valve is that it busts the integrity of the cap. It means that we are not going to guarantee the environmental reductions. We won't be able to say to other nations that we are making reductions; therefore, we want you to make reductions, too.

So the price collar response is a legitimate concern about price, but it responds in a way that violates environmental integrity. So there are many other things in the Waxman-Markey bill that control costs; the whole cap-and-trade mechanism, the allocation to the retail consumers. I understand MidAmerican doesn't get all the allocation it would like, but the fact that the allocation goes directly to the consumers controls prices. And in terms of market manipulation, I stand with you, Chairman Boxer, whatever comes out of this committee needs to have jail time for those who manipulate the market. There should not be any exotic derivatives; trading should be publicly on exchanges.

Senator BOXER. OK, I would just ask you to look at a collar in a slightly different way, because if we know 11 is the low price and we know that at that point we can still give the market signal, then I don't know why—and I am not going to go into a debate with you—we can't consider this as one way to put more certainty. I am looking at it is all I am saying.

Senator Inhofe, we will give you an extra 40 seconds too.

Senator INHOFE. Oh, that is fine. Thank you, Madam Chairman.

Mr. Fehrman, were you here during my opening statement?

Mr. FEHRMAN. I was.

Senator INHOFE. And you heard me quote a long, long list of Democrat House and Senate members that strongly reject the whole concept of cap-and-trade. That is augmented by Jim Hanson, who is probably the strongest voice, historically, for the limitations of CO_2. He said cap-and-trade is a temple of doom, it would lock in disasters for our children and grandchildren. Ralph Nader, cap-and-trade is not going to work; it is too complex.

So there are a lot of people who join us in saying this thing isn't going to work, and frankly, it is not going to pass. But you have stated, on the Make Polluters Pay, the slogan that they are using—and they are very good at these slogans, and you have stated that it is your customers and my constituents that are going to pay for this. Now, the other side responds and says that the bill's worker adjustment protection and consumer refund provision will offset these costs. Would you elaborate on that?

Mr. FEHRMAN. Absolutely. At MidAmerican, we have not had an electric base rate increase since 1995, and we are a leader in renewable generation. To Mr. Krupp's comments about our mismanagement, if you will, of our company, we obviously take exception with that with the fact that we have not had rate increases.

This bill, when you look at the exorbitant costs that the trading component of this would add to our customers for no value, we just find it unreasonable for us to take those fees for allowances and apply that to our customers, when we would be much better off taking those dollars, investing in additional renewables, additional non-carbon-emitting resources such as nuclear, and actually reducing our emissions to meet the caps. That is our fundamental issue with this bill.

Senator INHOFE. Thank you, Mr. Fehrman. You mention that you oppose the trading part of the cap-and-trade. Can you further explain how purchasing of the allowances and the subsequent trading of them will not reduce greenhouse gas emissions, I think you said, by one ounce?

Mr. FEHRMAN. Correct. Again, when you look at the way the Waxman-Markey bill is set up, it takes your 2005 emissions and applies a declining cap to that level. There are two pieces of the costs, there is the cost of compliance, which is actually taking your actual emissions and driving it down to the level of the cap; and then there is a second component to this bill, which is buying allowances from your very first emission of CO_2 up to the cap. That cost provides no benefit and no value and doesn't reduce CO_2 in any manner. The cost to reduce CO_2 is the cost to change our infrastructure and actually reduce emissions.

Senator INHOFE. Well, I appreciate that. Then I will last ask you your view on the carbon capture and storage technology. When would it be available, in your opinion, on a commercial scale?

Mr. FEHRMAN. When we look at carbon capture and technology and the opportunities for the advancement of that commercially, we find that there is exceptional work going on in the industry, there are pilot projects being done, and believe that in a number of years, be it 5 years, be it 10 years, that there will perhaps be carbon capture and technology applications available. However, we would also say, though, that the sequestration of carbon pumping millions and millions of tons of carbon into the ground has not been studied. We do not know the impacts of that, nor do we know the permitting requirements, the litigation around that, what happens if it burps, so on and so forth. So there are a number of issues still from a business perspective that we need clarity around in order to fully understand the impacts of carbon capture and sequestration.

Senator INHOFE. It seems to me that I believe and several other people believe, in fact, the majority of people believe that the technology isn't here in a lot of these things, on renewables and other things, and it would just seem to me—and I covered this in my opening statement—that if we have all these resources and we are the only country that doesn't develop our own resources, that we ought to be able to use our own resources as that bridge to wherever it goes, whatever timeframe out in the future when the technology is there. So I appreciate very much your witnessing.

Thank you, Madam Chairman.

Senator BOXER. Thank you so much, Senator Inhofe.

Senator Whitehouse.

Senator WHITEHOUSE. Thank you very much, Madam Chair.

With respect to the observation the Ranking Member just made, that the technology isn't here, it strikes me that in light of our existing incentives, that is sort of a self-fulfilling proposition. The technology isn't here for some of these technologies because we have not met the market in the incentives and investment for their development.

So the technology is in Spain and the technology is in Denmark and the technology is emerging in China and the technology is all around the world. But I find it unsatisfactory as an ultimate answer that we would observe that the technology isn't here. That is the problem we are actually trying to solve with this piece of legislation.

I see both heads nodding, and I appreciate it.

I will confess, Mr. Krupp, that I have been a bit of a skeptic on carbon capture and sequestration, carbon capture and storage, as you call it. Your testimony says that it is ready to roll. Could you elaborate a little bit on that?

Mr. KRUPP. Sure.

Senator WHITEHOUSE. Make me a little bit more comfortable about the prospects for carbon capture and storage.

Mr. KRUPP. Absolutely, Senator. The idea that it is ready to roll actually wasn't a phrase original to me, I was quoting an official at British Petroleum, noting that in Norway there is massive amounts of carbon capture already going on. And to your earlier point, the reason it goes on in Norway is there is a price on carbon in Norway, so they are avoiding the cost of putting that in the atmosphere.

This observation that you need a driver is exactly the chicken and egg problem that Jeff Immelt of GE has pointed to; until there is a driver, there is no reason to capture carbon. Luckily, many companies are anticipating regulations in the United States and some companies around the world, where there are already regulations, are developing the technologies; Mitsubishi in Japan, Alstom in France. In West Virginia, on the Nation's largest coal-fired power plant, Mountaineer, the Alstom company has teamed up with AEP to begin installing a Choate ammonia process, as was already demonstrated viable in Wisconsin by Wii Energy.

So I agree that EPA will have to write regulations and define how carbon can be safely kept underground. Fortunately, in the last year, the Bush administration and EPA began that task, so that process is well underway. I would reassure you, Senator, that our Nation does burn a lot of coal. Half of our electricity is generated by burning coal, and we should leave a path open to clean up that coal from carbon dioxide, just as we have been able to clean it up from sulfur dioxide.

Senator WHITEHOUSE. And in the same way that I mentioned earlier, that the existing arrangement of Government influences on the energy market is not a pure state of nature from which variance equals interference, there is also not a natural state, legally, on this.

The U.S. Supreme Court has determined as the law of the land that carbon is a pollutant subject to Clean Air Act regulation. That really gives the EPA no choice but to take appropriate action under its lawful responsibilities to regulate the emissions of carbon. And

if we follow that route, which at this point is really a given, since the highest court in the land has decreed that this is what shall be, the alternative to that is really where we are trying to go with the clean energy legislation.

Would you agree with me that the choice is between a regulatory model that would provide for no allowances, no input through the legislative process, in any event, versus a legislated solution to get to the same result?

Mr. KRUPP. Well, I would agree, Senator, the choice is between having EPA regulate or having Congress legislate, and there is no question in my mind that having Congress legislate a robust and flexible program can protect consumers and minimize the cost. Moreover, if Congress fails to legislate, then the regulatory process also includes judicial review and years of delay, which I think hurts businesses tremendously because there are many, many investment decisions about what sorts of new power plants to be built that right now are on hold because businesses are waiting for the rules to be written. Will these rules come out of Congress? Will these rules come out of EPA? When will they come out? So I, for one, think a legislated solution is preferable. But you are right, greenhouse gases will be restricted either way.

Senator WHITEHOUSE. Madam Chair, thank you very much for this hearing. I thank the witnesses for their participation. I think we can all agree that businesses do appreciate certainty. Thank you very much.

Senator BOXER. Thank you so much. I think that is very, very important.

Let me just thank both of you. Mr. Fehrman, I am just going to put on the record that you operate in South Dakota, right?

Mr. FEHRMAN. We do.

Senator BOXER. OK. EPA calculates that the House-passed bill allocates to electric utilities in South Dakota a number of emissions allowances that greatly exceeds the amount of CO_2 emissions that utilities in that State emitted in 2008. In 2012, the free allocation is 150 percent of the utilities' emissions; in 2015, the free allocation is 144 percent. So MidAmerican customers in South Dakota will not need to buy emission allowances. In fact, they could receive an economic benefit through the utility rebates. Do you agree with that?

Mr. FEHRMAN. I have not seen the study, but our customer base in South Dakota electrically consists of an extremely small number of customers, so that portion of your study may actually be true. A very significant impact is on our Iowa customers, which we view as being in excess of a 20 percent rate increase. So that very well could be true in South Dakota. The fact is our population is very small there.

Senator BOXER. But your consumers will be kept whole. As a matter of fact, your consumers—I mean, there is a difference between your shareholders and your consumers, but your consumers, some of them will actually come away with $40 into the black a year. That is important also, that the study showed that the low quintile. So I think there is some confusion, I think, between your discussion about your consumers versus your shareholders.

You said something I just want to make sure I heard you right, Mr. Fehrman. I think you said that even if you get enough allowances to meet your cap, you have to keep buying more allowances. I don't think that is accurate.

Mr. FEHRMAN. No, what I said was there is a portion of cost which applies to meeting the compliance target, so if your actual emissions are above the cap in 2012, for instance, there is a cost to actually bring those emissions down to the cap, either through the purchase of allowances——

Senator BOXER. Or offsets.

Mr. FEHRMAN [continuing]. Or offsets, or investing in less carbon such as renewables. You also, however, have to buy allowances from your very first ton of carbon that you emit to get up to the total cap level.

So in this case, unlike the acid rain program, you have to buy allowances to not only come down to the limit, but come up to the limit as well, and that is a fundamental difference between this program and the acid rain program, which I think that this committee should really try to understand and study so that, as exceptionally working program as SO_2 is, this is not the SO_2 program.

Senator BOXER. OK. Well, I just want to say, Mr. Fehrman, I really understand your concern, but I just want you to think through this. You are either going to have to deal with the EPA in a command and control situation, where you have no ability to offset the costs that you are going to be hit with in order to protect our kids from pollution—I mean, that is just where it is at—or you can work with us on a bill that will soften the blow to everyone involved.

And I would just like to say that it is hard for me to understand. I know that the organization that you belong to, the Edison Electric Institute, does support Waxman-Markey. And I would put in the record the names of all the electric utilities and energy companies, manufacturing, corporate businesses, labor, farm and agriculture communities, civic, who all support the Waxman-Markey bill.

Now, we are working on it; we are looking at ways to make it better. We are looking at ways to make it more friendly to the consumer and soften the blow, and all the rest of it. We will do that and we will have our bill ready when we get back.

But I hope you will work with us, sir, rather than just stand out there and say no to everything, because I think, from your testimony, where I see you going is for the status quo. But the problem for you is the status quo is about to change. Once that endangerment finding comes into play, there won't be any choice but for us to say we have to protect our families and we won't have the flexibility.

We will try and we will do whatever we can, but this kind of a bill is going to give us the tools, and I think it is going to make your life far more predictable; your consumers will be kept whole. We want to work with you, and if you have any specific issues or problems, please come and talk to us about it, because I just don't see how you benefit—when I say you, I mean your company, your consumers, your shareholders—by just saying let's not do anything or just go to hard cap. You don't think that is going to help you?

Mr. FEHRMAN. Well, when you look at our testimony—and I very much appreciate your comments. When you look at our testimony, I think you will find that we have, No. 1, no opposition to reducing CO_2. So I want to make that crystal clear. We absolutely agree that we can reduce CO_2. In fact, we absolutely agree that we can reduce it in a manner similar to what is in Waxman-Markey.

Second, if you read my testimony, we have offered alternatives both on a hard cap, and second, on alternatives that would make the trading component work better and level the playing field and remove the inequities that are in the bill currently. That is our fundamental issue, is that the way the bill is currently set up, it severely penalizes Midwest utilities, and we are not alone in this concern.

Third, and again in my testimony, we want to work with you. We have said in our testimony we will come.

Senator BOXER. Good.

Mr. FEHRMAN. We would appreciate workshops. There are people out there we know have different views on this than we, but we fundamentally believe that we can arrive at a solution that takes Waxman-Markey and through the work of the Senate can actually deliver similar results at a lower cost to our consumers.

Senator BOXER. OK. Well, we are extremely interested in working with you on that and we will do so.

Mr. FEHRMAN. Excellent.

[The referenced document follows:]

ORGANIZATIONS EXPRESSING SUPPORT FOR HOUSE PASSAGE OF THE AMERICAN CLEAN ENERGY AND SECURITY ACT

[UPDATED 12/8/09]

Electric Utilities and Energy Companies

Duke Energy
Exelon
Shell Oil
American Electric Power
PG&E Corporation
FPL Group
Austin Energy
Entergy
National Grid
PNM Resources
Avista
NRG Energy Inc.
PSE+G
Edison Electric Institute
ConEdison
Constellation energy
Entergy
Austin Energy
Renewable Fuels Assn.
National Biodiesel Board
Constellation Energy
Ad Hoc Coalition of Small Business Refiners

Manufacturing, Industry and Corporate

GE
Dow Chemical
Dow Corning
DuPont
National Semiconductor
HP
Business Council on Sustainable Energy
Solar Power Industries
Alcoa
Rio Tinto
John Deere
Alstom Power
Johnson & Johnson
Siemens
Rio Tinto
BP Solar
Symantec
Applied Materials
eBay
Levi Strauss
Nike
Starbucks
Aspen/Snowmass
Seventh Generation
Clif Bar
Kleiner Perkins Caufield & Buyers
Calpine Corp.
Genpower
BluewaterWind

Labor

AFL-CIO
UAW
Steelworkers
Boilermakers
Communications Workers
Laborers International
Services Employees
Utilities Workers Union
Building and Construction Trades

Farm and Agriculture

National Farmers Union
American Farmland Trust
Growth Energy
American Corn Growers Association
National Association of wheat Growers
Renewable Fuels Association

Community, Civic, Faith and Environment

US Conference of Mayors
Environmental Defense Fund
League of Women Voters
Attorneys General of California, Arizona and New Jersey
National Association of Clean Air Agencies

National Parks Conservation Assn
Disciples Justice Action Network (Disciples of Christ)
The Episcopal Church
Evangelical Lutheran Church in America
Mennonite Central Committee U.S. Washington Office
National Council of Churches USA
Presbyterian Church (U.S.A.) Washington Office
Progressive National Baptist Convention
United Church of Christ, Justice and Witness Ministries
The United Methodist Church, General Board of Church and Society
National Wildlife Federation
National Resource Defense Council
The Wilderness Society
American Institute of Architects
World Resources Institute
Pew Center on Global Climate Change
The Nature Conservancy
Sierra Club
HipHop Caucus
Center for American Progress
Latino Coalition
Union of Concerned Scientists
National Congress of American Indians
World Wildlife Fund
American Public Health Association
Defenders of Wildlife
League of Conservation Voters
Pew Environment Group
National Audubon Society
Renewable Fuels Assn.
American Chemical Society
American Rivers
Clean Water Action
Earthjustice
Environment America
International Forum on Globalization
Oxfam Oceana
Physicians for Social Responsibility
Jewish Council for Public Affairs
Izaak Walton League of America
Baptist Pastors and Theologians
Woods Hole Research Center / 20 eminent scientists and leaders
United Nations Foundation
Catholic Relief Services
Evangelical Climate Initiative
National Assn of Clean Air Agencies
CARE
Trout Unlimited
Climate Communities / ICLEI-Local Governments for Sustainability USA

Senator BOXER. The last point I want to make is, to get back to Mr. Krupp, because I think he is seeing all over the country some of the pluses of moving forward. The other point I would make is what the status quo does is States are going to move out on their own. The western Governors, we have the mayors all involved, we have the Northeast RGGI. We have the EPA. So you are going to have everybody moving without certainty.

But I want to talk to you about my State—just put this in the record. We are all going through a horrible recession period, and my State was hit very hard by a housing downturn and is just starting to come back. In the last few years—and I am going to get this right—between 1998 and 2007, California's clean energy economy has been driven by significant investment. It attracted more than $6.5 billion in venture capital in the past 3 years alone. So we have $6.5 billion invested in the last 3 years alone, and it is a result of, they say, public policies and financial incentives for clean energy development and energy efficiencies to renewable portfolio energy efficient standards.

We also have a plan for California's green building, a goal for public buildings to be 20 percent more energy efficient by 2015. So that goal alone would save our State $100 million annually. We have seen 125,390 jobs created in this between 1998 and 2007; 10,209 new businesses formed in California by 2007 from 1998; and again, just the last 3 years, $6.5 billion in venture capital with the understanding from the venture capital community that they would invest more. The prediction is they would invest more in clean energy jobs in the future than they did in the high-tech communications revolution. So it is extraordinary. John Doerr has so stated.

We have seen, between 1999 and 2008, in California, 1401 new patents. So the unleashing of entrepreneurship is incredible, and it has happened because California moved forward and set some standards on this carbon, and I just think we can all prosper.

So I want to say to the two of you thank you very, very much. We shouldn't fear the future, because the future, if we do this right, as our President has said, if we do this reform right, we will see a whole new platform for economic growth going out into this century. We will go to Copenhagen, we will be a leader, and I think America is a place where entrepreneurship needs to be unleashed, and these financial incentives—that is just going to unleash it.

And I agree with—I think it was Senator Merkley who said some of these dates in the future that we are assuming we are going to meet, we are going to whiz by—in other words, we are going to get to where we need to go long before the 2030s and the 2050s because of this great entrepreneurship and the skills that we have in our country with our people and our workers.

So thank you both very, very much. Of course, this conversation continues on, and I look forward to working with both of you as we move forward. Thank you.

[Whereupon, at 12:29 p.m., the committee adjourned.]

[An additional statement submitted for the record follows:]

STATEMENT OF HON. MIKE CRAPO,
U.S. SENATOR FROM THE STATE OF IDAHO

Madam Chairman, thank you for the opportunity to share a few words. I would also like to thank the witnesses for being here with us today.

I have stated many times in this committee that Idaho is a leader in clean energy and that I am proud of Idaho's record in this area.

Nearly 50 percent of Idaho's electricity comes from hydroelectricity, and Idaho's energy plan aims for a total of 8 percent of non-hydro renewable electricity production by 2015, which is higher than the national average. Development of clean energy is important.

I am heartened to hear today about DOI's efforts to promote renewable energy, but I am concerned because Mr. Strickland's testimony today doesn't address the exploration and production of another very important clean energy source: natural gas.

Natural gas is clean burning and is domestically abundant.

The Colorado School of Mines and DOE estimate that U.S. future natural gas supply is over 2 quadrillion cubic feet, which at today's rate of consumption is enough to meet demand for more than 95 years.

Additionally, DOI's Minerals Management Service estimates that the Outer Continental Shelf alone holds 420 trillion cubic feet of natural gas that has yet to be discovered.

In fact, expanding exploration and production to U.S. offshore areas that were off limits until 2008 could result in more than a trillion dollars in Government profits and millions of new jobs. Oil and natural gas development in newly opened offshore areas is expected to generate $1.7 trillion in Federal tax revenues and almost $600 million in State and local taxes according to the American Energy Alliance.

Increased offshore energy production would support 1.2 million jobs annually.

Also, when we talk about clean energy, I would like to hear more about the potential for nuclear energy. I understand that Mr. Fehrman is knowledgeable in this field, and I hope to learn more about his experience and his thoughts on how to drive nuclear investment and jump-start the nuclear industry in the U.S.

I am also interested in hearing Mr. Fehrman's testimony regarding MidAmerican's alternate, State-driven proposal for emission reductions. After all, States often have the best gauge of their own potential and abilities.

Additionally, PacifiCorp, a subsidiary of MidAmerican Energy Holdings Company, provides power to my constituents in Southern Idaho, and I would be interested to know how this plan would benefit Idaho.

As we talk today, I hope to hear about all available means to unlock the tremendous clean energy potential of the United States of America.

Thank you.

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